iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4130

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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 IV, April 2018- Available at www.ijraset.com

Risk Assessment for PPP based Road Infrastructure Projects

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Abstract: ***Infrastructure has been an inspiring strength for economic growth and development in India. However, the Infrastructure in India is still in the developing phase. In context of the PPP based Road infrastructure projects, it is generally observed that such projects cannot meet the target and requirements as the Indian companies lack scientific management Technology to challenge the risks. Much of the risk of a PPP projects comes from the complexity of financing, taxation, law regulatory, acquired technical documentation and construction process involved in a major infrastructure venture. Main risks, their analysis and management on road infrastructure projects are explained in this paper. After risk analyse, Risk management framework are presented for managing risks on PPP based road projects in India. In view of the findings it is suggested to set up Regulator to the PPP Road projects which could oversee the fast changing overall socio economic environment and suggest measures to lessen risk and create win-win situation to all stakeholders.***
Key words: Risks, Risk management, Risk factors, PPP, Frequency, Severity

I. INTRODUCTION

Public Private Partnerships (PPP) are increasingly common model for delivering infrastructure projects globally. PPP are based on concession agreement between government authority and private sector for delivering services. Public Private Partnership (PPP) brings private and public sectors together in long-term contracts to produce a required infrastructure like roads, airports, water systems, hospitals etc. In PPP a private entity, usually a consortium responsible for financing, design, construction, operation and maintenance of the facility for agreed duration known as concession period and at the end of the period transfers the ownership of the operational facility to the government at no cost. In return, the private entity generates revenue either from the levying of tariffs on users or the receipt of periodic service payments from the government over the life of the agreement

Risk can be defined as probability of occurrence of an event which can hamper project objectives negatively. Risk management is the process in which risks are primarily detected and measures to mitigate or transfer are determined and adopted. Risk management Road construction projects are considered as very complex projects, as uncertainty lies at various stages. For a road project, risk management can be done by identifying the sources of risk in every stage of project from feasibility to maintenance as these projects have long life cycle. Every road project is different and is exposed to various risks depending on location and geography.

Risk assessment for PPP Based road construction project is done to prevent adverse impact at the design or planning stage, prioritize hazards and control measures, to maintain cost and quality of the project and for scheduled completion of the project. This study involves risk identification, risk classification, risk analysis or evaluation and ranking of risks using Importance Index (IMPI).

II. NEED OF STUDY

More construction companies are starting to become aware of Risk Management Program (RMP), but are still not using models & technologies for managing risks. Risks differ between projects due to fact that every project is unique, especially construction projects. After having awareness of risks and their results some organizations do not approached to establish Risk Management methods. However, there are still many practitioners that have not realized the importance of including risk management in the process of delivering the project. Also, for delivery of public infrastructure services there is a huge fund is required therefore there is a burden on government. PPP allows to delivering that public services in budget funding with quality. Due to PPP government can utilize the skills of the persons of private firm for infrastructure development. There are many risks in the construction of any infrastructure project. Neglecting those risks may cause much hazardous effect on the project. Ignoring the risks may lead the construction project towards the huge economic losses. Ignoring the risks sometimes may lead the project towards failure.

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III. OBJECTIVES

A. The objectives of this study are listed below:

1) To find out risks associated with various risk categories in Indian context.
2) To analyse and find out most vulnerable risks in PPP roadway project.
3) To Develop the Risk Assessment Model Using Most Critical Factors for the PPP roadway projects

IV. METHODOLOGY

The study begins with understanding the process of risk management. After that literature review was carried out. Major risk categories as well as the other risks associated with the Road business were identified. Questionnaire was designed based on the risk identified from the literature review. The main purpose of the questionnaire was to identify the likelihood of occurrence and impact of each risks associated with the PPP roadway project. Subsequently, Pilot survey was carried out to validate the questionnaire. In pilot survey Technical interviews are done with experts who have experience more than 20 years in relevant field. Risk category and risk factors identified through literature review and pilot survey are described in fig.1 the data was collected from various registered Civil engineers, Consultants, Road Developer/Builders, site engineers and structural engineers. The collected Data has been analysed to assess the general and overall rankings in order to give an overall picture of the risks in Indian PPP roadway construction industry. The data collected through questionnaire survey was analysed by using quantitative method of importance Index (IMPI) on a excel sheet. The FI & SI is computed using the following equations.

A. Frequency index

A formula is used to rank risk event based on frequency of occurrence as identified by the participants.

Frequency Index (F.I.) (%) = Σ a (n/N) * 100/4
Where,
a = constant expressing weighting given to each response (ranges from 1 for rarely up to 4 for always),
n = frequency of the responses,
N = total number of responses.

B. Severity index

A formula is used to rank risk event based on severity as indicated by the participants.

Severity Index (S.I.) (%) = Σ a (n/N) * 100/4
Where,
a = constant expressing weighting given to each response (ranges from 1 for little up to 4 for severe),
n = frequency of the responses,
N = total number of responses.

C. Importance index

The importance index of each event is calculated as a function of both frequency and severity indices, as follows:
Importance Index (IMP.I.)(%) = [F.I. (%)* S.I. (%)]/100
The various risks categorized under different categories were calculated and ranked. The higher values of IMPI represent significant risks affecting construction of PPP Based Roadway project. Total 9 numbers of risk categories are identified which are technical, political, operational, financial, resource management, legal, marketing, strategic and statutory clearance. Total 58 risk factors are derived from risk identification process. Various risk factors are classified into various risk categories.

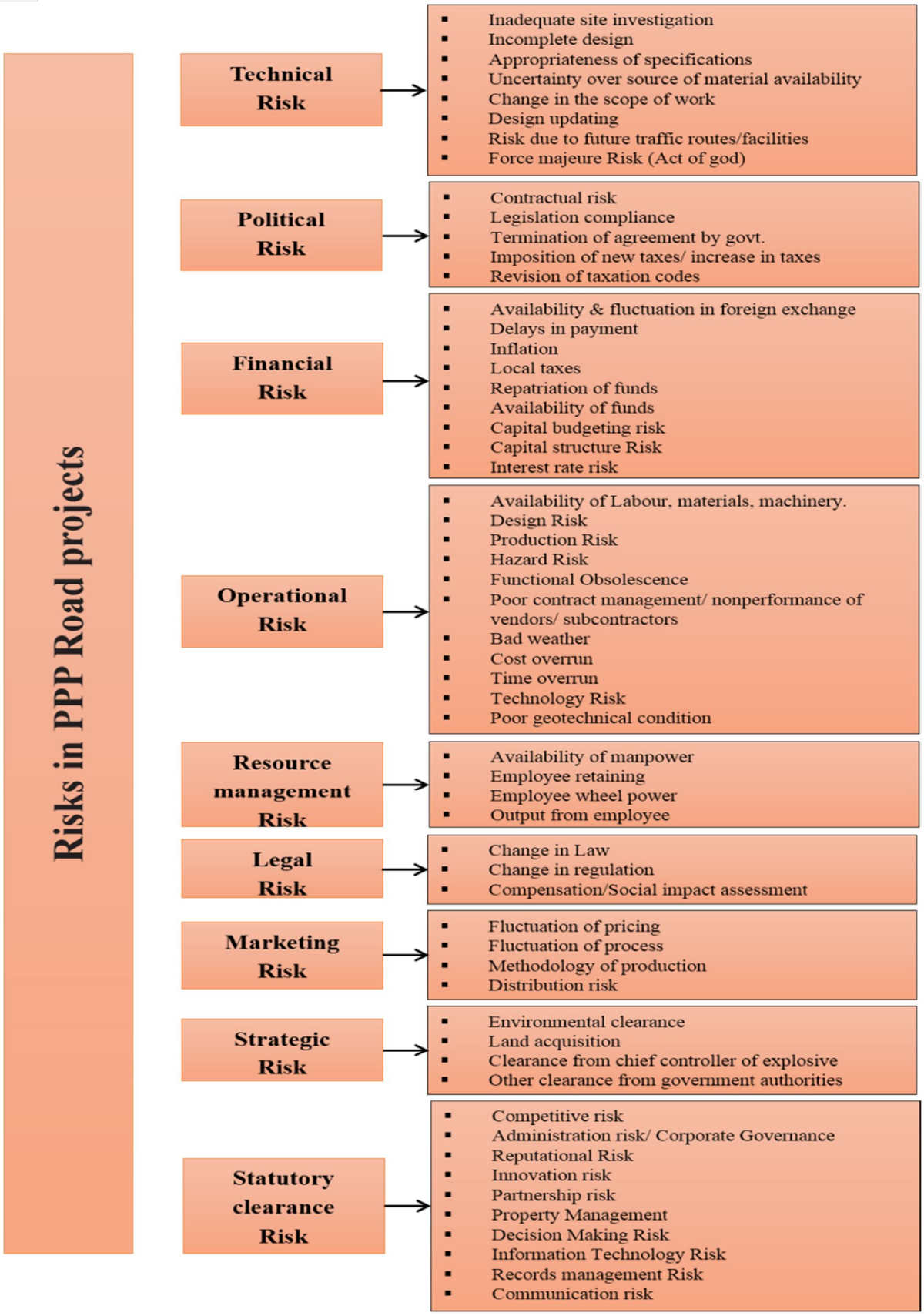

Fig 1: Risk category and Risk identified through literature review and pilot survey

V. DATA COLLECTION & ANALYSIS

Questionnaire distribution and collection has been done by hand-to-hand method, by direct visit or after taking prior appointment with the respondent in personal. Data has been collected in the form of questionnaire survey as a personal opinion of the internal/key stakeholders of construction project within scope of study

TABLE 1: PERCENTAGE OF RESPONSE RECEIVED.

Respondent	Questionnaire Distributed	Questionnaire Received	Response (%)
Civil Eng.	40	36	90%
Developer/ Builder	30	24	80%
Site Eng.	40	33	82.5%
Construction contractor	40	38	95%
Structural Eng.	15	10	66.66%
Total	165	141	85.45%

The statistics of questionnaire survey based on numbers of projects worked on & years of experience of the respondents is as shown in table 2.

TABLE 2: RESPONDENT DETAILS BASED ON EXPERIENCE & NO. OF PROJECTS WORKED

SR NO	Respondent	Years of experience		No. Of projects	
		Years	Respondents	Nos.	Respondents
1	Civil Engineer	< 5	9	< 5	9
		5-10	10	5-10	5
		10-15	3	10-15	6
		15-20	2	15-20	3
		>20	12	>20	13
		Total	**36**	**Total**	**36**
2	Developers / Builders	< 5	1	< 5	0
		5-10	4	5-10	5
		10-15	8	10-15	8
		15-20	2	15-20	2
		>20	9	>20	9
		Total	**24**	**Total**	**24**
3	Site Engineer	< 5	11	< 5	13
		5-10	11	5-10	5
		10-15	5	10-15	8
		15-20	5	15-20	3
		>20	1	>20	4
		Total	**33**	**Total**	**33**
4	Construction Contractor	< 5	2	< 5	4
		5-10	7	5-10	10
		10-15	5	10-15	2
		15-20	3	15-20	3
		>20	21	>20	19
		Total	**38**	**Total**	**38**
5	Structural Engineer	< 5	4	< 5	2
		5-10	0	5-10	2
		10-15	2	10-15	2
		15-20	3	15-20	3
		>20	1	>20	1
		Total	**10**	**Total**	**10**

The Importance index (IMPI) for the risk priority is calculated based on all responses for each risk. The priority of each risk is given by the Importance index (IMPI) value which is according to the Frequency and severity of each risk. The risks are prioritizing according their ranks. The priority helps to identify the most significant risks. In this analysis, the most significant risks from each category were short listed out with their value of FI, SI & IMPI in Table. 1.

Table 3: Risk category wise top 2 factors as per importance index (IMPI)

NO	Risk Category	FACTORS AFFECTING RISK	FI	SI	IMPI
1	Technical Risk	Inadequate site investigation	90.957	93.972	85.474
2		Incomplete design	71.099	75.355	53.577
3	Political Risk	Contractual risk	81.560	75.355	61.459
4		Legislation Compliance	72.340	70.922	51.305
5	Financial Risk	Delays in payment	82.447	87.589	72.214
6		Availability of funds	79.610	85.638	68.177
7	Operational Risk	Availability of Labour/Material/ Machinery	78.014	86.170	67.225
8		Time overrun	76.596	84.574	64.780
9	Resource Management Risk	Employee wheel power	65.603	70.745	46.411
10		Employee retaining	64.894	70.567	45.794
11	Legal Risk	Change in regulation	52.305	54.610	28.564
12		Change in law	49.645	47.695	23.678
13	Marketing Risk	Fluctuation of pricing	50.887	51.950	26.436
14		Distribution risk	49.823	51.241	25.530
15	Statutory Clearance Risk	Environmental clearance	68.262	80.319	54.828
16		Clearance from government authorities	69.681	78.014	54.361
17	Strategic Risk	Competitive risk	61.170	58.688	35.900
18		Decision making risk	55.319	63.652	35.212

VI. CONCLUSION

This study concluded that an effective risk assessment is determination of quantitative estimate of risks as risks are involved at every stage of Road construction project. This study provides a good understanding of the risk assessment procedure to assist in assessing the risks involved during construction. Risk assessment is an effective tool for supporting decision-making and corrective actions in construction. This assessment of risk factors will help in risk planning and risk management of any roadway construction project. Further, this will help in improving the performance of any PPP based road construction projects, i.e., to maintain cost and quality of the project and for scheduled completion of the project. From analysis and results top ten risk factors for PPP based roadway construction project are described in bar chart in fig 2. These were the significant risks which mainly cause the delay of the project. As time and cost of the project are related, hence as the time of the project overruns the cost also overruns and impose high risk on Roadway construction project.

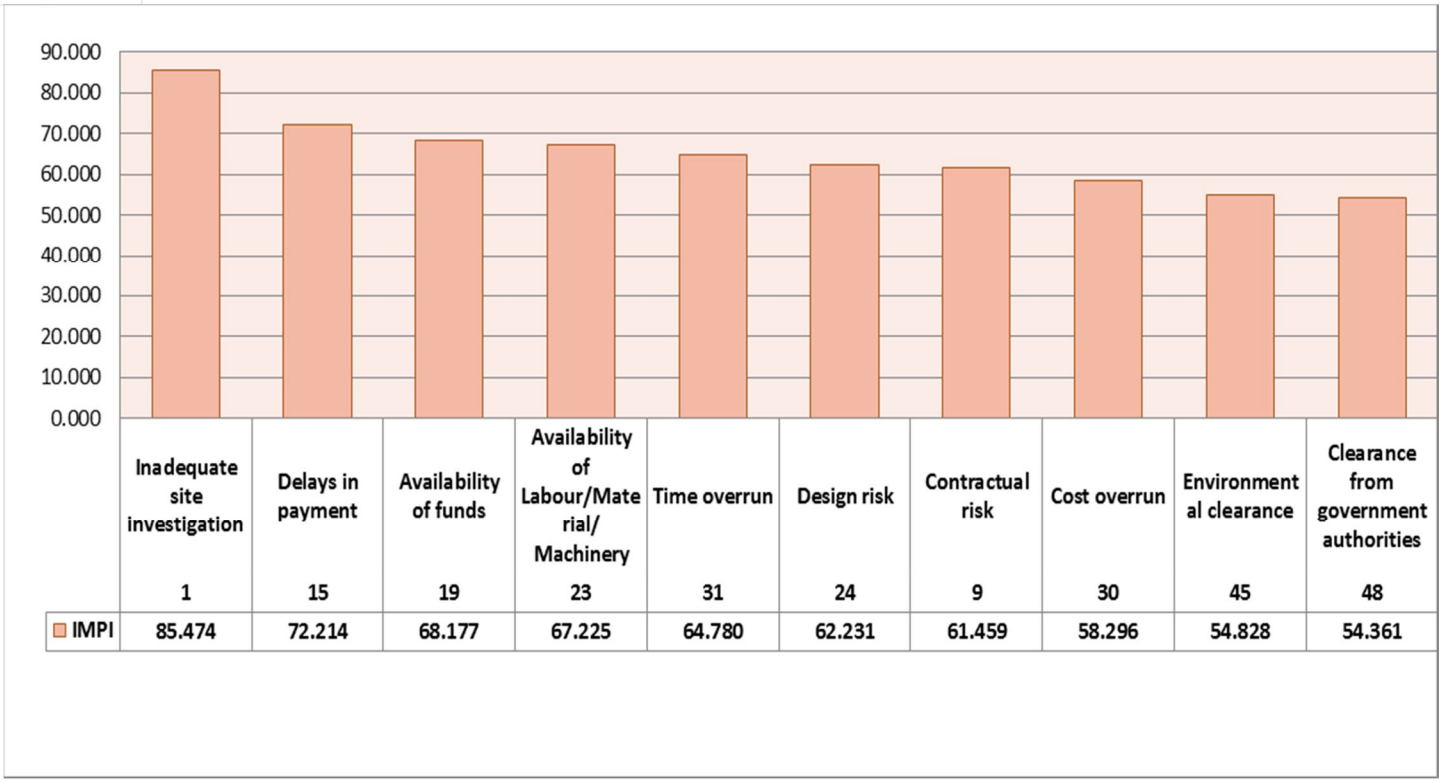

Fig. 2: Bar chart analysis of overall top ten risks.

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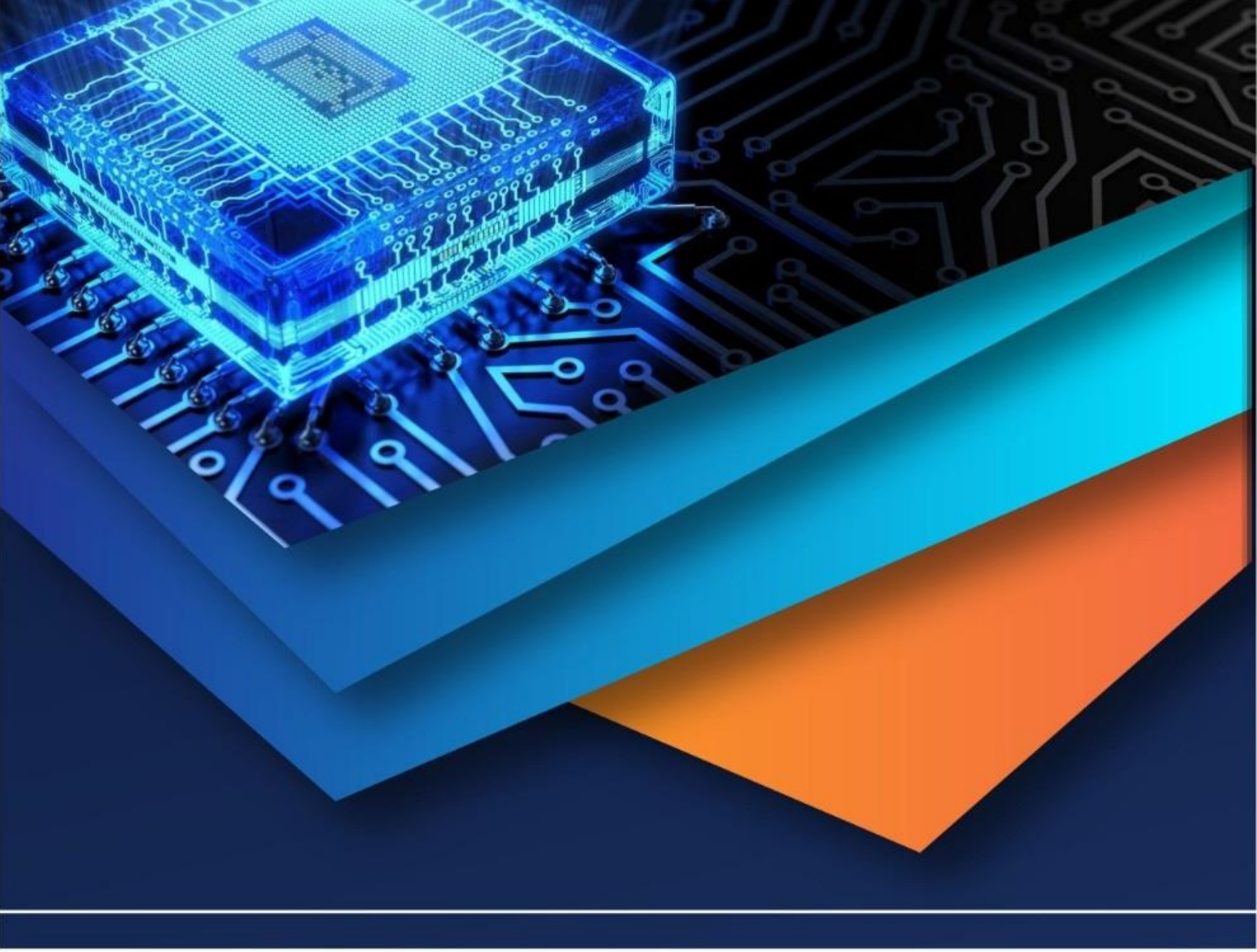

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IMPACT FACTOR: 7.129

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