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The Need of Flood Forecasting in Bihar :A Conceptual Study on Natural Disasters

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Abstract: This paper has attempted to reiterate with emphasis that science and technology in contemporary India need to gradually own the additional burden of making it relevant to society and its problems. It is for the scientific community and technologists to gradually reorient their endeavour towards social issues that are significant for society and appropriate for solving their problems. Utilization of science and technology cannot be left for political leaders and bureaucrats alone. Scientist and technologist now need to be pro-active so that society is benefited by their valuable work to the optimum extent. In this sense, science and technology assumes an additional dimension of social movement.

I. INTRODUCTION

Natural disasters, which are sudden and many time massive misfortune of affected humane societies by the processes of natural environment have caused greater loss of men and materials since 1990's than the combined loss of two world wars. This fact has attracted the attention of scientists, governments and societies towards disasters globally. Indian sciences, governments and societies have also been recently aware of them and making infantile attempts to mitigate the harmful impact of disasters with added size caused by man –made disasters. As India grows rapidly in science and technology, economy, managements and population size in near future, the role of science, technology and management in politics and public policy has to be increased significantly in order to mitigate the impact of disasters. This in fact is making science (and also technology and management) a critical science which is related to society and its problems. The debate about the role of science in relation to society and its problems grew largely in 1970's

and a group of scientists agreed that a major part of science in the future should be 'critical science' that is a socially critical science which stresses the role of science in politics and public policy J.R.Ravetz's book Scientific Knowledge and its Social Problems (1971) is a typical case of scholars who believed in making major part of the future science a critical science. Contemporary Indian circumstances and facts call the greater need of making Indian science, technology and management critical, playing clear and determined role in Indian politics and public policy.

A. Types of Disaster

1) Tornadoes and Severe Storms
2) Hurricanes and Tropical Storms
3) Wildfires.
4) Earthquakes
5) Drought.
6) Floods

B. Meaning of Floods in India

In the words of Jules Renard "On earth there is no heaven but only the pieces of it." One of them is Nature. One touch of it can be your most beautiful experience or the worst. Nature has its own beauty but it is said that when it comes on taking revenge, it can get really deadly and terrifying. A natural disaster is the worst and deadliest kind of disaster.

C. Since Independence, India has seen some of the worst floods and here are some of them:

1) *Bihar flood, 1987*: In one of the worst floods in Bihar, 1,399 people and 5,302 animals lost their lives and nearly 29 million people were affected in 30 districts, 382 blocks, 6,112 panchayats, and 24,518 villages. The damage to crops were calculated to be 68 billion Indian rupees and damage to public property was at 68 million rupees.

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2) *Assam Floods, 2012:* The worst flood since the year 1998, took the lives of more than 120 people. The flood also affected 1,744 villages across nine districts and 70,000 hectares of crop land. It was reported that more than five million people were evacuated. Flooding significantly affected Kaziranga National Park, where about 540 animals died.

3) *Maharashtra Flood, 2005*: In the Maharashtra floods, approximately 1,094 people died. It occurred just one month after the June 2005 Gujarat floods. 52 local trains, 37,000 autos, 4,000 taxis, 900 BEST buses and 10,000 trucks were either damaged or spoiled. The financial cost was calculated to be 550 crore rupees.

4) *Uttarakhand Flood, 2013*: In the Uttarakhand foods, the destruction of bridges and roads left about 100,000 pilgrims and tourists trapped. The Indian Air Force, the Indian Army, and paramilitary troops evacuated more than 110,000 people from the flood hit areas. More than 5,000 people were presumed dead.

5) *Gujarat Floods, 2005:* Gujarat flood is considered to be the worst floods in the history of India. The floods accounted for a loss of more than 8,000 crore rupees. The floods also caused a great financial and economic loss to the nation. More than 123 deaths were recorded and total of 250,000 people were evacuated. The day is referred as a 'BLACK DAY' in Indian History.

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6) *Jammu & Kashmir Floods, 2014*: Caused by torrential rainfall, in September 2014, the Kashmir region suffered disastrous floods across many of its districts. According to the Home Ministry of India, 2,600 villages were reported to be affected in Jammu and Kashmir, out of which 390 villages in Kashmir were completely submerged.

D. Why Role In Politics And Public Policy

Inclusive growth and development of any society is now an accepted belief for sustainability. Slums and civilization as well as massive rural poverty and urban affluence can not go together. In India, taking care of those living in slums and poor hinterlands of rural areas is a necessary prerequisite for development and progress, else their backwardness becomes a huge stress on progress decelerating its pace. Controlling crimes originating in large slums in Mumbai or Delhi is a huge stress on police administration which would otherwise contribute in maintaining law and order so conducive for progress. The problem in the 'Red Belt' of India, which is sometimes perceived bigger than the problem of terrorism, at least in part, is the result of ignoring inclusive growth- a growth that does not ignore those sections of society which are left behind or put on the margins mainly because of socio-political and economic order made by political decision and public policy . It is time to realize and believe that like the truth of social-Darwinism (Herbert Spencer), social- ecosystem also is a reality comprising mutually sustaining sections of society and none of them can be ignored for holistic socio-economic development. And if any one section is ignored, it is not without a price that society has to pay in different forms.

been paying in the recent past in the form of paralysis in decision-making and governance by a coalition government in Delhi. Cost accounting of this loss would run into billions of rupees and declined rates of growth. Neglected societies perceive regional parties and their leaders as their well- wishers loosing national perspective althrough. There are many more arguments for inclusive growth and science, technology and management disciplines therefore, can not afford to avoid playing a role that would focus on social relevance of their work.

science, technology and management has to move a step further to outline the social implications of their research. In fact they must identify the problems for their study which have direct bearing on contemporary socio-economic problems. Widespread poverty, unemployment, literacy and education , food security and malnutrition , unhygienic living condition, urban housing, gender issues, problems of marginalised sections of society, underdeveloped regions, environmental degradation and pollution, stagnating manufacturing, caste and religion related conflicts, over-population, increasing disparities in incomes, widespread corruption , emerging dangers of armed conflict, boarder issues, stability and consolidation of India democracy, pathetic condition of civil rights may, for example, be some of the socio-economic problems needing attraction of the attention of scholars working in the disciplines of science, technology and management. All of them have scope for contributing towards solving these national problems of contemporary India.

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There already exists an element of critical science, technology and management in India but that element is insignificant and nascent to be sufficient to meet the contemporary needs. There are examples of natural and social sciences adressing contemporary problems. Appropriate technology meeting the needs of Indian problems are not totally absent. Social Responsibility in corporate management has started being talked about and occasionally being given importance. However, there are seriously emerging conflicts between aggressive industrialization-urbanisation and peasants in the countryside as in case of Singur, (W. Bengal) ; between mining giants and native tribal societies as in Bokaro (Chhatisgarh) ; between Birhor tribes and a steel and power plant receiving coal from their native area; between the deprived tribal-landless labourers- peasants and the establishment in Red Belt in the mid-eastern poverty belt across India running north-south; religion- caste-based conflict as in Muzaffarnagar and adjoining districts; between Indian union and its provinces and between centripetal and centrifugal forces operating within the Union of India.
These are a few examples of conflict and disharmony in the Indian social ecosystem threatening the age-old harmonious social fabric of India. But these problems are left to their own fate and to be made use of for partisan and selfish narrow motives by some ill-meaning political leaders and uninformed confused masses. Very little comes from the world of science, technology and management to enable masses to choose an informed path for resolving such conflicts. Critical science has to take up this responsibility with high priority and accord it as high place as research itself. Critical science has to evolve methods of taking relevant science, technology and management to the masses for enabling and strengthening them for resolving problems so grave in nature .
most of their time in earning a bread for them and family with very little leisure for contemplation and exchanging information, have a feudalistic mind-set where reason plays little role and influential persons in society cleverly mould public opinion and behavior, blind faith overpowers scepticism, masses still have medieval belief systems and readily reject the logic and reason so basal for scientific temperament of the people. However, with a serious emphasis and beginning, methods and system would eventually evolve to tackle apparently colossal problems of enriching masses with scientific information and scientific temper. This in turn must evolve in them logical perspective replacing emotional one and also respect for reasoning and accommodation of disagreement. These characteristics make the foundation of modern democracy. India needs strengthening and consolidation of her democracy by enriching masses with the power of science, technology and management skills.
Already exiting methods and systems of popularization of science and extension must be brought in focus by academicians. Education and its content and methods need be integrated at basic, secondary and tertiary levels, breaking their isolation. The content and its communication needs to be simple for understanding and burden of learning and testing could be reduced. As science could reach to masses by spoken words as compared to printed words in contempory India, it should travel by spoken media and not so much with print media. Print medium is confined to microscopic part of population. Electronic media is the strongest one, having access to the people of every part of the country. Radio and television systems may be promoted to play the role of carrying science and information by spoken word to the masses. The role may be brought into focus by regulations and policy formulation.
communicating has to be information contained in entertainment. No matter how small is the beginning; it has to be effective and self-promoting, increasing the interest of people in science and technology. This mission should be equally important constituent of academic persuits and research. It should percolate to all parts of society. In this, critical science becomes a movement apart from what it is at present.

E. Natural Disaster Management

As the natural disaster management is still quite young in India, the 9th foundation day of NDMA-National Disaster Management Authority falling in October 2013, it is time to shape disaster management methods and skills in India. The people of India will hopefully learn to minimize the disaster impact, as science becomes part of their lives with the argued need of critical science.
One of the major jobs of Geography and Environmental Science has been to investigate the changing nature of man-environment relationship. The wisest conclusions of such studies, which are identical with conclusion from other fields of science, hold that for happy and sustainable human existence, man should sense the feelings of the 'Mother Earth' and should respect them while acting for his living. What was realized as 'Dharati Mata' in oriental wisdom and as Gaia (nurturing mother figure in Greek mythology from whom all sustenance on the earth was derived), has been of late realized by one of the most original British environmental scientist of our time, geochemist James Lovelock (1979) who is creator of the concept of Gaia and now widely known as Gaianismin environmental sciences. Lovelock found that life upon mother earth is manipulated by living organisms which through their naturally coordinated interaction helps smooth out disturbances in the atmosphere, lithosphere and hydrosphere so that a complicated life-sustaining state is maintained on the earth's surface (Dikshit, 1999). So the mother earth is the best guide for man and he must understand her.

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The best part of disaster management would be to live on the earth in such a way that disaster-impact is avoided. Even traditional wisdom with limited science and technology avoided natural disasters. If there is perceived compulsion of siting Kedarnath temple (Uttarakhand) on a stream-side, then its foundation and structure has to be made to bear thrust of landslip-loaded flood water. If Japanese have the compulsion of living on frequent earthquake shaken islands, they have to construct earthquake-resistent structures. Such traditional wisdom must be worth emulating and sharpened with more science and technology at modern generation's disposal. Identifying and mapping of natural disaster prone areas in India already exist and can further be made precise. All probable threats many be estimated and popularised among the concerned inhabitants. In recent Kedarnath disaster enough scientific reasons and explanations came forward post- disaster, but none was available before the disaster with probability of the event. In the zones of disaster, areas of human habitation may be studied for the probability of natural disaster. Identification of high probability spots and probable future disaster studies may be hired from scientific community.

studies of probability and intensity should be authoritative so that authentic word may be said in prediction and masses believe in such prediction due to the truth that is observed at the occurrence of a natural disaster. As the impact of a natural disaster is the outcome of multidisciplinary factors, the predictions should come from a team comprising of meteorologists, oceanographers, geomorphologists, geologists, engineers, medical professionals and so on depending on the disaster-inducing factors.

F. Flood Forecasting

Flooding is caused by the inadequate capacity within the banks of the rivers to contain the high flow brought down from the upper catchments due to heavy rainfall. It is also caused by accumulation of water resulting from heavy spells of rainfall over areas, which have got poor drainage characteristics.

Flooding is accentuated by erosion and silting leading to meandering of the rivers in plains and reduction in carrying capacity of the river channel. It is also aggravated by earthquakes and land slides, leading to changes in river course and obstructions to flow. Synchronization of floods in the main rivers and tributaries and retardation of flow due to tidal effects lead to major floods. Cyclones bring in their wake considerable loss of life and property.

The flood forecasting and warning system is used for alerting the likely damage centers well in advance of the actual arrival of floods, to enable the people to move and also to remove the moveable property to safer places or to raised platforms specially constructed for the purpose.

A beginning in scientific flood forecasting was made in November, 1958 by Central Water Commission (then known as Central Water & Power Commission) when a Flood Forecasting Centre was set up at its Headquarters, at Delhi, for 21 giving timely Forecasts and Warnings of the incoming floods to the villages located in the river areas around the National Capital, Delhi. The network has been expanding and by now the Flood Forecasting Network of the Central Water Commission(CWC) covers all the major flood prone inter-State river basins in the country.

G. Forecasting stations river-wise break up-

At present there are 166 flood forecasting stations on various rivers in the country which includes 134 level forecasting and 32 inflow forecasting stations, river-wise break up of which is as under-

Sl. No	Name of River Systems	No. of Flood Forecasting Stations		
		Level Inflow Total	Level Inflow Total	Level Inflow Total
1	Ganga & Tributaries	77	10	87
2	Brahmaputra & Tributaries	27	0	27
3	Barak-System	5	0	5
4	Eastern-Rivers	8	1	9
5	Mahanadi	3	1	4
6	Godavari	14	4	18
7	Krishna	3	6	9
8	West Flow Rivers	9	6	15
9	Pannar	01	00	1
	Total	147	28	175

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The Flood Forecasting Network covers the 14 States and one Union Territory in addition to NCT of Delhi. State-wise number of flood forecasting centres are as under-

Sl. No.	State / Union territory	No. of Flood Forecasting Stations		
		Level	Inflow Total	Level Inflow Total
1	Andhra Pradesh	9	7	16
2	Assam	24	0	24
3	Bihar	33	0	33
4	Chhattishgarh	01	0	1
5	Gujarat	6	4	10
6	Haryana	0	1	1
7	Jharkhand	0	4	4
8	Karnataka	1	3	4
9	Madhya Pradesh	2	01	3
10	Maharashtra	7	2	9
11	Orissa	11	1	12
12	Uttaranchal	01	2	3
13	Uttar Pradesh	31	4	35
14	West Bengal	11	3	14
15	Dadra & Nagar Haveli	01	01	2
16	N.C.T. of Delhi	2	0	2
17	Tirpura	2	0	2
	All India total	140	35	175

Site wise "Forecast Performance" of flood forecasting sites of CWS in Food Season, 2011

Sl. No.	Details of sites within different range of permissible limit of accuracy (±15cm, ±20% cumec)	Flood Season 2011	
		No. of Sites	% age
01	Sites with performance accuracy between 0.0% to 25.0%	0	0%
02	Sites with performance accuracy between 25.1% to 50.0%	1	0.78%
03	Sites with performance accuracy between 50.1% to 75.0%	3	2.36%
04	Sites with performance accuracy between 75.1% to 99.99%	30	23.62%
05	Sites with 100% performance accuracy i.e. where all forecasts issued were within permissible limit of accuracy.	93	73.24%
06	Totals sites where forecasts were issued.	127	100%

H. Name of the rivers in Bihar State –

1) Ganga river
2) Koshi river
3) Punpun river
4) Bagmati river
5) MahaNadi
6) Son Nadi
7) Gandak river
8) SaruNadi
9) KamlaNadi
10) KaramnashaNadi
11) FalguNadi
12) Ajay Nadi

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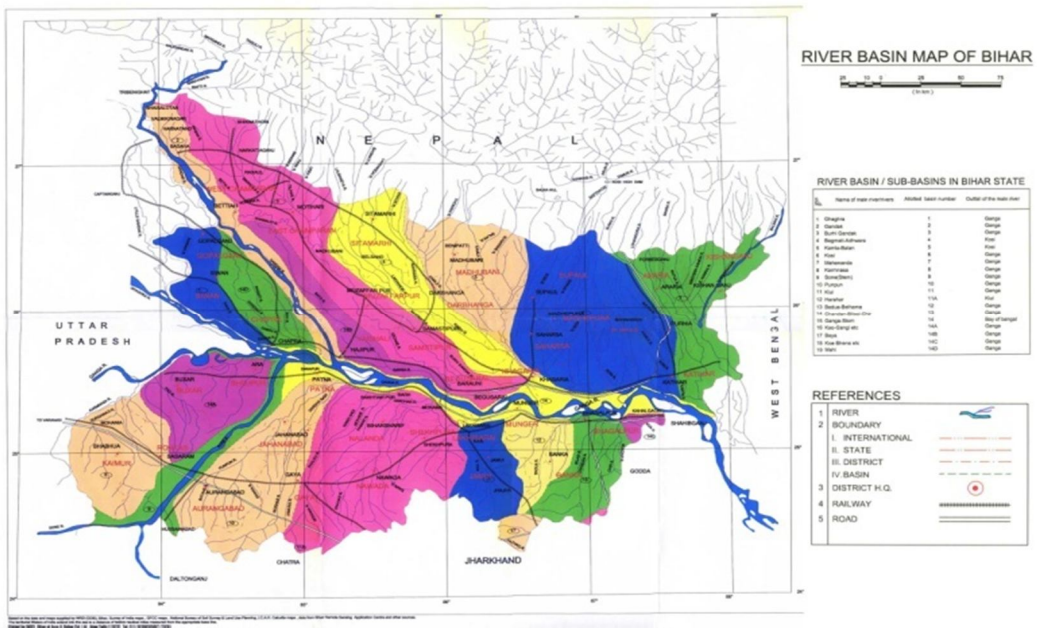

I. Issues relating to maintenance of Dams-

An Expert Committee conducted (December 2015) a safety review of two Dams (Chandan Dam under Irrigation Division, Baunsi and Badua Dam at Irrigation Division, Bijukhorwa) for suggesting remedial measures. Defects and deficiencies observed in the dams during inspection were, however, not rectified as Department had not provided any funds for the same. Due to siltation, water storage capacity of the Badua Dam was found to be reduced.

II. CONCLUSION

A. Siltation and water quality of Koelwar and Gandhi Ghat, Patna FFS was not ascertained and laboratory instruments were lying idle due to non-availability of Research Assistant. Boats were used on hire basis due to non-availability of Boatman for the departmental boat.

B. Thus, in the nine major river systems in the country where "Flood Forecasting & Warning Network" of the Central Water Commission exists, and floods are being monitored, the accuracy of the forecasting performance during 2011 season varies from a maximum of 100% for Barak and Meghan Rivers Basin and its tributaries to a minimum of 93.16% for the Krishna 34 basin. The overall accuracy performance was of the order of 98.55% for the country as a whole.

C. Description of need to correlate forecast level with extent of inundation of flood plain areas, suggesting ways and means to improve warning time by, say, using modern advanced techniques viz. installing telemetric stations for data transmission and collection, setting up computer compatible rainfall radar for more accurate and quicker assessment of aerial rainfall, utilization of weather forecast of the super computer of the IMD at Delhi etc. Need for additional base stations, forecast stations, inflow and outflow forecast stations etc. in the river system to qualitatively improve the forecast and enhance the efficacy of the flood forecasting system as a whole.

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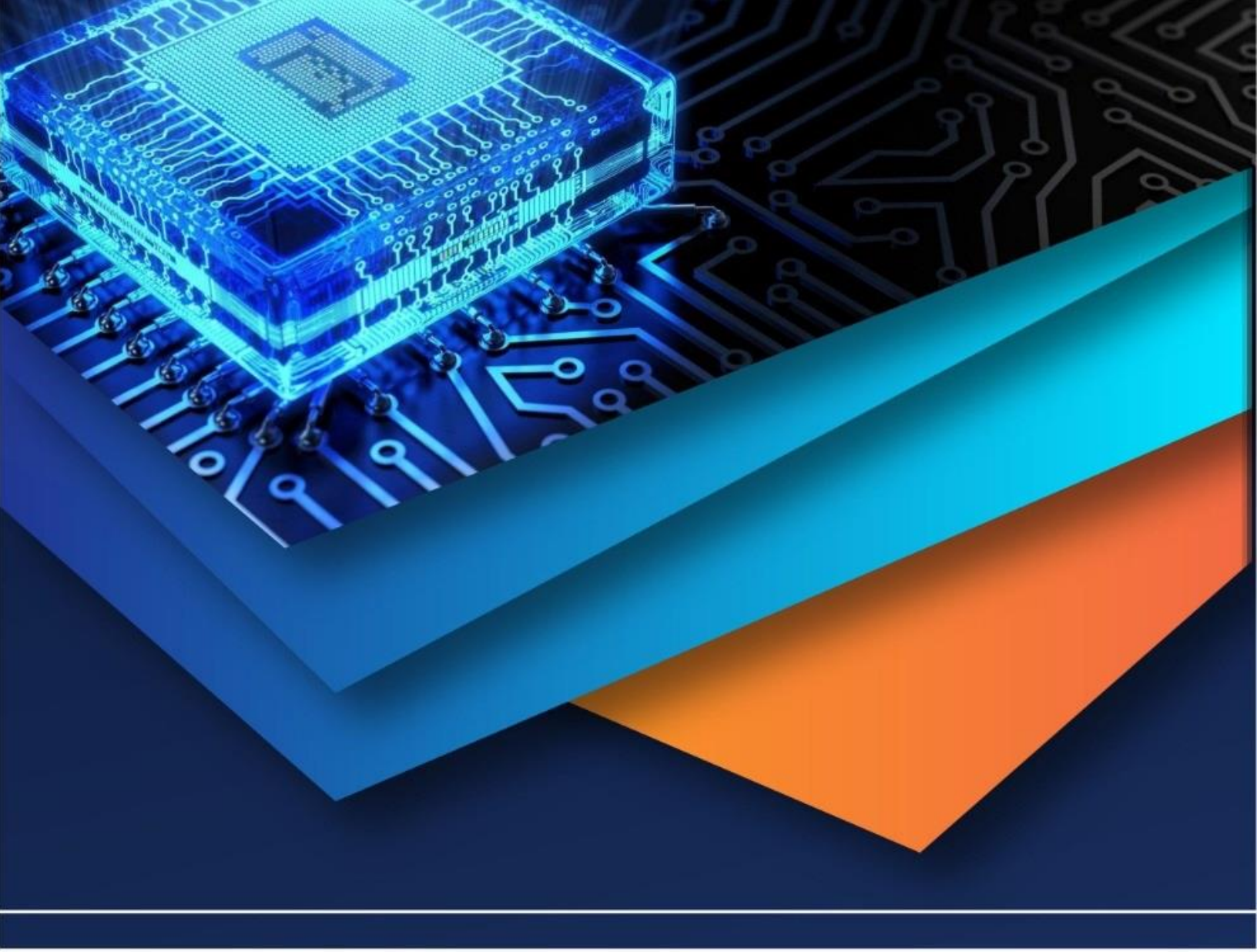

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