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Delay Analysis of Construction Project in Sikkim Using RII Method

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Abstract: ***Delays in construction are common in the sector of infrastructural development, including even Sikkim state, due to factors contributing to this like hard terrains, changed climatic trends, inapproachability, and inefficiency of bureaucracies. They not only contribute to escalating project costs but also disrupt planning, resource deployment, and co-ordination among interested parties. This research explores causes and extent of delay of Sikkim construction project through Relative Importance Index (RII) method to provide quantitative ranking of causes of delay as a function of involvement of stakeholders.***
Field data were gathered using a standardized, bilingual questionnaire from site managers, contractors, and workers of various project locations. Ground realities were comprehended during field visits along with gathering inputs through informal discussions with the respondents. RII was used to generate a ranking of the delay factors in terms of perceived effect on the project schedules and performance as per the responses.
The study concluded that among the main reasons for delays, they were late material delivery, insufficient skilled manpower, slow approval cycles, and distant-from-site locations. Landslides and inadequate infrastructure also made their contribution. This study suggests an imperative need to enhance project planning, effective supply chain coordination, and streamlined administrative procedures in order to reduce delays. The study provides policy recommendations, project management alternatives, and business counsel to achieve operating effectiveness and facilitate timely project completion in difficult areas such as Sikkim.
Keywords: Relative Importance Index (RII), Construction delay, Sikkim, contractor, labour.

I. INTRODUCTION

As in the rest of the world, construction activities in the infrastructure industry are one of the nation's prime economic growth and societal advancement stimuli. However, project delay is a nightmare phenomenon that leads to increased costs, ineffectiveness, and party-to-party disputes. Construction delay is far more prevalent in Sikkim, a mountainous region state with unseasonal climate and logistics challenges. These postponements have repercussions that go beyond project completion; they affect economic activity, regional jobs and put pressure on public and private investment.

These are several reasons for delays, which among others include poor project planning, unavailability of skilled labour, interruptions in material supply, adverse weather, cost constraints and bureaucracy. From outside, heavy rains, landslide, and poor access roads can be extremely harsh on project timelines. In addition, slow approval processes and regulatory problems are responsible for delays in the delivery of infrastructure and commercial projects in the region.

In order to examine, categorize, and rank in-depth the causes of construction delay in Sikkim, the present research employs the RII (Relative Importance Index) method. RII is a common statistical tool for ascertaining and ranking the severity of such delay factors by gathering and analysing data regarding major stakeholder (e.g. project manager, engineer, and contractor). This research tries to outline the most important delay causes on an organization based on positive attributes in an effort to develop some perceptions and information that can generate some solutions for construction anticipating environments and manufacturers. This is going to facilitate improved planning, better resource utilization and improved policy suggestions to avert holdup in construction activity in Sikkim. Proper management of labour and materializing adoption of emerging construction technologies with pre-emptive steps such as risk assessment would strengthen the productivity and enable timely completion of the projects. This research adds to the construction delay analysis body of literature and provides an outline for combating similar intricacies in future research and practice studies.

Need for study:Construction project delay analysis is a helpful study in determining delay causes, enhancing planning, and supporting legal proceedings. It aids in cost control, timely project completion, and enhancing project performance. Knowledge of delays facilitates better decision-making, reduces conflict, and can help in avoiding the same problems in subsequent projects.

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Objectives:

1) To determine the root causes of delay in construction projects by stakeholders like clients, contractors, and other external factors
2) To determine the impact of delay on project duration, cost, and quality.
3) To categorize types of delay (excusable, compensable, etc.) so that it can be understood and controlled easily.
4) To enable easier decision-making in project planning, scheduling, and resource planning.
5) To function as a guide book on resolving on conflicts through the use of delay blame and entitlement analysis.
6) To advice on prevention or reduction of delays on future projects.
7) To achieve ideal effectiveness of projects through additional control and management of delays.

II. METHODOLOGY

The research method applied is to ascertain the delay cause of Sikkim construction project using the Relative Importance Index (RII) method. The questionnaire was drawn from initial research and administered to two respondent groups who are the workers and the contractors are provided insight based on experience.

Besides determining the validity of information, some construction sites were visited and contractors, as well as workers, interviewed and informally discussed with. A map identifying visited sites has been included. The data, which was gathered, was further analysed based on the RII technique to determine the relative ranking of each one of the factors of delay. The findings of the research are presented in the form of a ranked table with the aid of graphical and pie chart representations for easy visual presentation and understanding.

1) Preparation of Questionnaire Designed: The survey was professionally crafted following an extensive review of literature, consultancy from the construction industry, and real observation on site. The objective was to research and investigate several causes of delay in construction projects.

   The most significant factors to keep in mind were environmental (weather, electricity cut-offs, and water availability), human (communication failure, motivation, absenteeism, and narcotics abuse), site (safety, site planning, and material availability), and management (changes in shifts, technology introduction, and payment delay). All the question were designed with utmost care in such a way that they could relevant, specific, and readable, along with bilingual mode (Hindi and English) so that it can be readable by the technical staff and field staff. The survey tries to search for correct and accurate information about why construction is being delayed.
2) Field visit and Data collection: To ensure that the information was up-to-date and relevant, field visits were conducted to a few of the Sikkim locations. Field visits were arranged to observe an equal proportion of city and rural construction sites. Information was collected at each site by direct interaction with site workers and contractors. Working staff employees were asked to complete the pre-formatted questionnaire from their direct work experience at the workplace, whereas contractors conducted short interviews in attempts to solicit managerial causes of delays. Such street-level interaction acted as a point of reference for monitoring real working conditions and issues firsthand, thus providing more contextual validity of data obtained. A map of the locations visited on websites is provided in an effort to broaden the geographic scope of this research.

Figure 1: map showing location of visited construction site of Sikkim

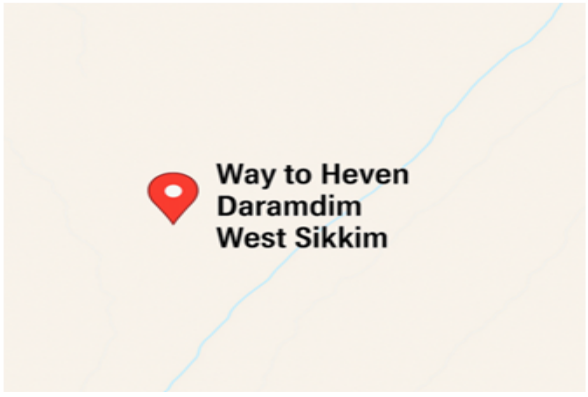


Figure 1(a): showing west Sikkim

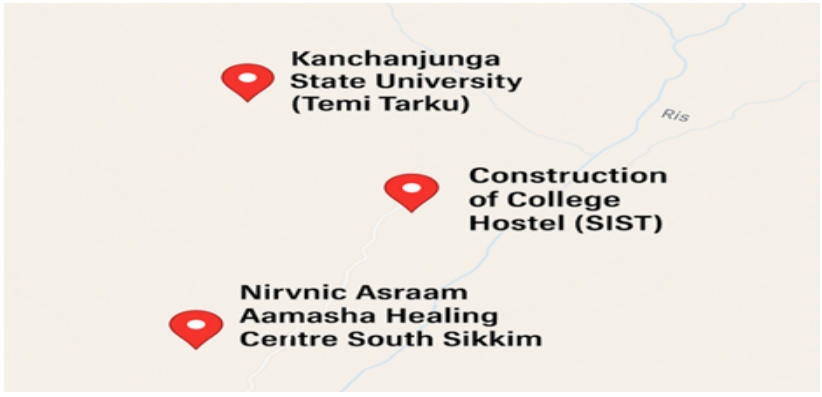


Figure 2(b): showing south Sikkim



Figure 1(c): showing east Sikkim

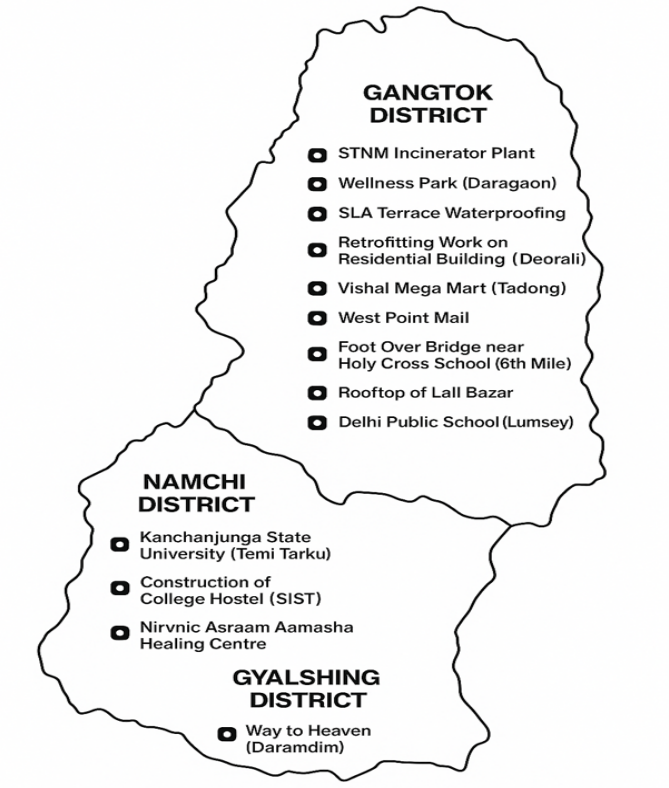


Figure 1(d): showing combined diagram

3) Application of RII method: We have utilized the Relative Importance Index (RII) method here in this research to examine and rank the delay causes of construction projects on perceptions alone from two most important stakeholder groups: workers and contractors.

The research was done with a view to assessing the gravity of most of the top-ranked delay causes from the point of view of these ground-level stakeholders who are also the direct participants in the actual hands-on implementation of construction work.

Even though the causes for the delays are very diverse from management to external issues, and material supply to labour, the contractor and the labour representative were interrogated individually. This is because it ensures that the production is founded on verifiable evidence on the implementation side of the construction.

There were 26 delay causes in the questionnaire: 7 contractors and 19 labours. The respondents were requested to score each factors impact on a five-point Likert scale, marked as follows:

To put the responses into numerical form, we computed the Relative Importance Index (RII) for every factor using the formula below:

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

Where,

W = the weight assigned to each response

A = highest Likert scale

N = No. of respondents

RII values within 0 to 1 are constructed, the greater the value of the more important or critical is deemed. The index gives a clear quantitative estimate and comparison of causes of delay from experience on individual sites.

Upon calculation of RII, 26 factors were ranked in descending order to determine the root causes of delay for the contractors and workers point of view. The ranks give a real context further improving the project performance and resource management.

They are listed in two different tables. Table 1 is made up of labour factors and Table 2 is made up of contractor factors. Question number, factor description, RII value, and ranking are completed in the rows of each of the tables.

Table 1: RII calculation for delay factor of labour showing each factor along with its RII value and corresponding RII ranking

Sl.no	Factors	Weightage					Total Number	∑W	R.I.I	Rank
		1	2	3	4	5				
1.	Does Intermittent water supply cause delay in construction?	4	32	29	28	37	167	452	0.585	12
2.	Does bad weather impact your work progress?	13	9	20	93	32	167	623	0.746	8
3.	Do equipment breakdown delay your task?	19	27	76	17	28	167	509	0.60	11
4.	Do communication gaps between management and workers cause delays?	15	81	64	2	5	167	402	0.481	15
5.	Are safety concerns a reason for work stoppage or delays?	20	67	70	10	0	167	407	0.483	14
6.	Does disagreements among workers impact progress on site?	4	63	66	25	9	167	473	0.566	13
7.	Does shortage of labour cause delay in construction?	4	2	8	149	4	167	648	0.776	6
8.	Are workers regularly absent, causing delay in teamwork?	2	10	22	116	17	167	637	0.762	7
9.	Does shortage of skilled workers cause delay in construction?	1	0	0	78	98	167	803	0.913	3
10.	Does shortage of material cause delay in construction?	6	7	34	65	55	167	657	0.786	5
11.	Does presence of substance consuming workers in site cause delay in construction?	131	5	12	8	11	167	142	0.2	19
12.	Does language difference between workers impact in construction projects?	9	21	37	60	40	167	601	0.72	9
13.	Does site condition affect in construction?	29	24	55	33	26	167	504	0.603	10
14.	Does reuse of materials plays a strong role in delays?	0	0	11	42	114	167	771	0.923	1
15.	Does frequent power shutdown in particular area impact the work progress?	31	54	82	0	0	167	385	0.461	17
16.	Does using of traditional tools cause delay in construction projects?	0	0	0	69	98	167	766	0.917	2
17.	Does price fluctuation of materials impact in construction work?	0	6	49	60	52	167	797	0.335	18
18.	Are wages paid on time and does a late payment affect your motivation?	53	43	71	0	0	167	352	0.421	16
19.	Does using of natural shuttering instead of steel shuttering cause delay in construction?	0	0	2	80	85	167	748	0.895	4

FIGURE 2(a):

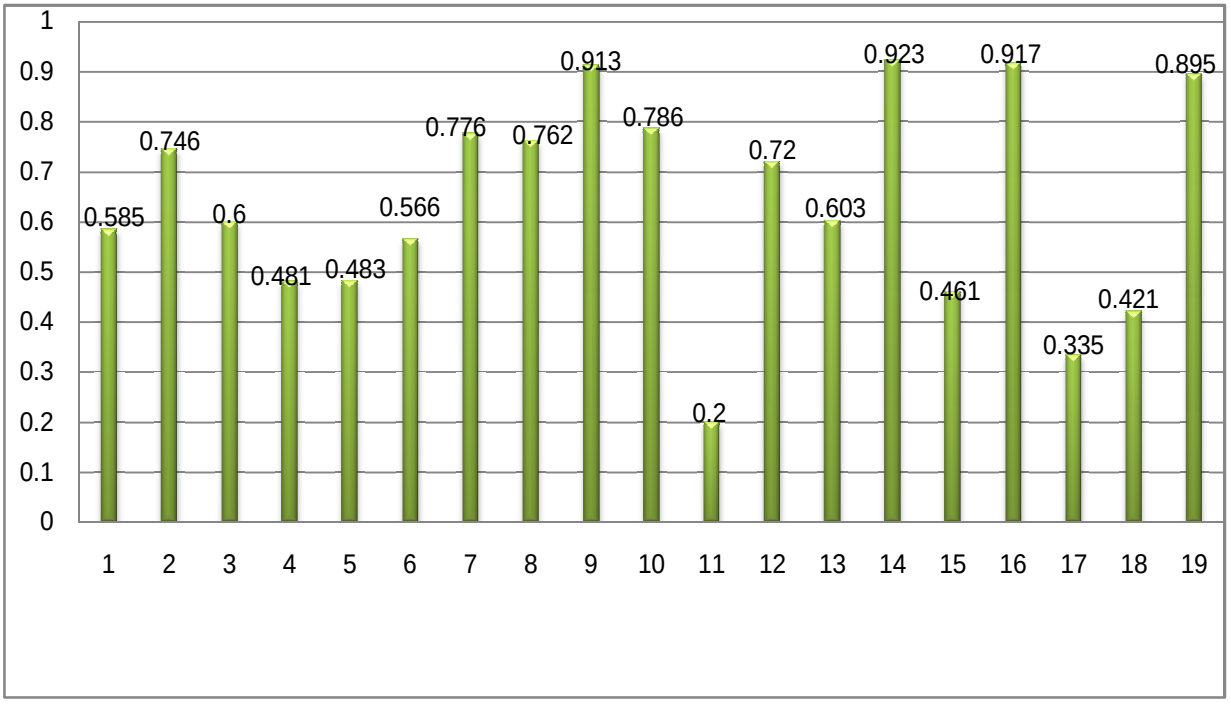


Figure 2(a): Bar-graph showing RII values of labour -related delay factors
X-axis – Delay factors, Y-axis – RII value

Table 2: RII calculation for delay factor of contractor showing each factor along with its RII value and corresponding RII ranking.

SL. NO	Factors	Weightage					Total number	∑w	R.I.I	Rank
		1	2	3	4	5				
1.	Do you face delays due to unfortunate natural or man-made disaster/Hazard?	0	0	4	4	5	13	53	0.815	2
2.	Due to the presence of different religions participating in their events during the construction work, does it lead to delay to work?	1	4	5	3	0	13	36	0.55	5
3.	Have delays occurred in the construction projects due to approvals, permits, or regulatory requirements?	0	1	2	4	6	13	24	0.83	1
4.	Have coordination problems between the contractor, subcontractor, site in-charge, and workers caused delays?	5	4	2	2	0	13	27	0.415	7
5.	Have changes in design or project scope caused major delays?	0	2	4	5	2	13	46	0.707	3
6.	Does delay occur due to shortage of material supply?	1	3	4	3	2	13	41	0.630	4
7.	Does lack of labour cause delay in construction project?	3	4	2	2	2	13	35	0.538	6

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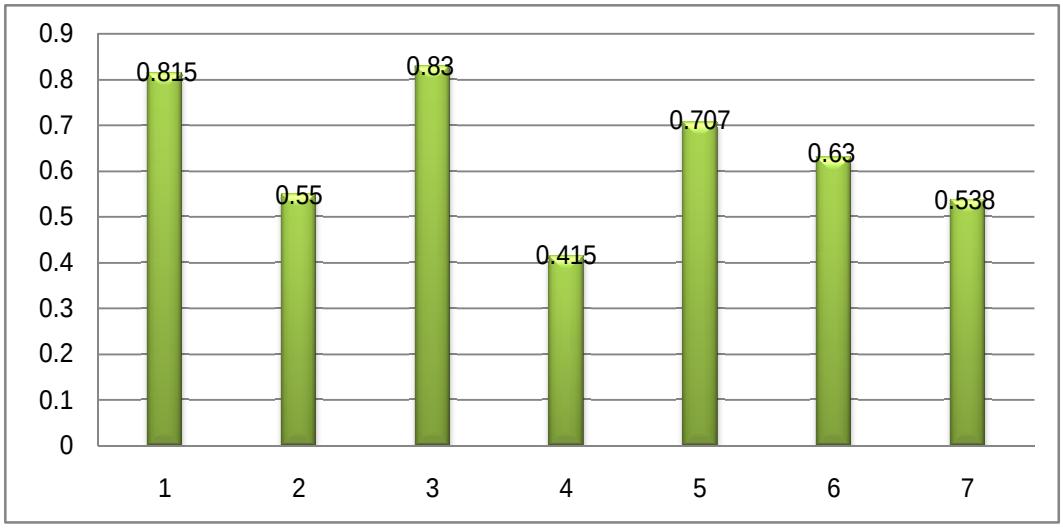


Figure 2(b): Bar-graph showing RII values of contractor-related delay factors
X-axis – Delay factors, Y-axis – RII value

III. RESULT AND INTERPRETATION

Following successful completion of a systematic survey of 167 interviewees, i.e. labourers and contractors, using the Relative Importance Index (RII) method, the main delay causes of construction projects were found. This helped rank the cause of delays using field experience and field staff information and provided data-based insight into delay trends within the studied scenario.

Among the labour-related responses, seven were identified as the most significant cause of delay with extremely high Relative Importance Index (RII) values. As seen in Figure 3, most impactful factor was reuse of materials (RII = 0.923) and reflects a strong perception that material recycling procedures have an important impact on construction durations. This was closely followed by the use of traditional tools (RII = 0.917), which reflected the influence of outdated machinery on inefficiencies in projects. Inadequate skilled human resources came as the third main factor (RII = 0.913), reflecting the need to improve training for the workforce. Another key driver was the use of natural shuttering instead of steel shuttering (RII = 0.895) to reflect work methods and the use of raw material on sites effect on productivity. Some drivers were shortages of materials (RII = 0.786), shortages in labour at large (RII = 0.776), and personnel absenteeism in workdays (RII = 0.762), reflecting associated issues with the availability of manpower and the site discipline responsible for slowing up projects.

The contractors have given some major reasons behind the delays of construction projects as per Figure 4. One of the foremost reasons in their opinion was ranked at the first place by approval, permit, and regulatory requirement delays (RII = 0.830). Delayed because of unforeseen man-made or natural disaster risks ranked at second place (RII = 0.815). The third substantial reason was design or project scope changes, which often generate rework and revisions to the schedule and, in turn, affect project duration as a whole (RII = 0.707). The findings are based on the feedback from 13 contractor participants and pinpoint areas of critical concern where action can be taken early on to avoid delaying the project.

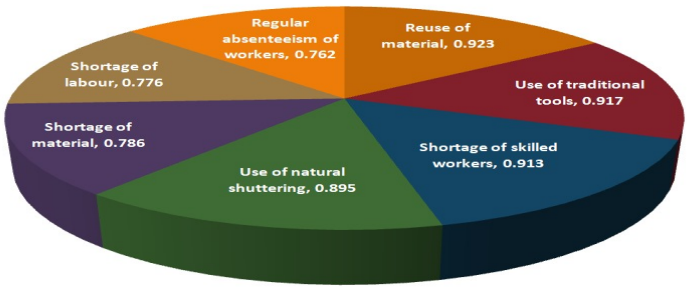


Figure 3: pie chart showing RII values of labour- related delay factor

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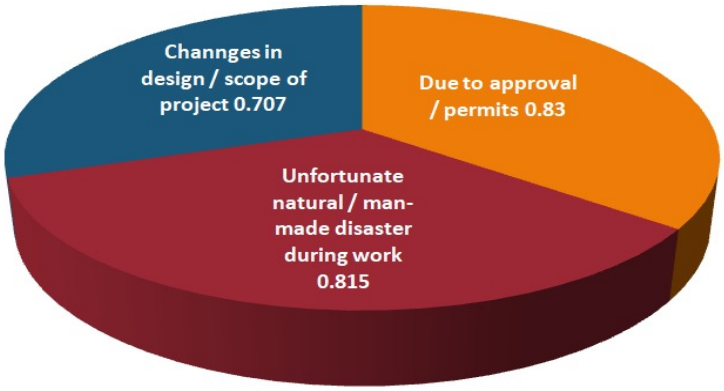


Figure 4: pie chart showing RII value of contractor-related delay factor

To paint the whole picture, the most common delay drivers for both respondent groups are summarised in Figure 5, a single pie chart. Aggregation allows the recognition of priority areas – balancing site-level problems (e.g., labour and tools) with more macro-level managerial and procedural issues (e.g., design changes and approvals).

These results confirm that both administrative and technical inefficiencies are, collectively, contributing to construction delays. Labour-type issues are virtually all operation in nature, while contractor-specified issues are virtually all management, external threat, approval in nature. Contractor identification issues, which can be addressed, include placing greater emphasis on the above-mentioned areas. This will enable us to determine better time overrun reduction strategies and making the project more efficient.

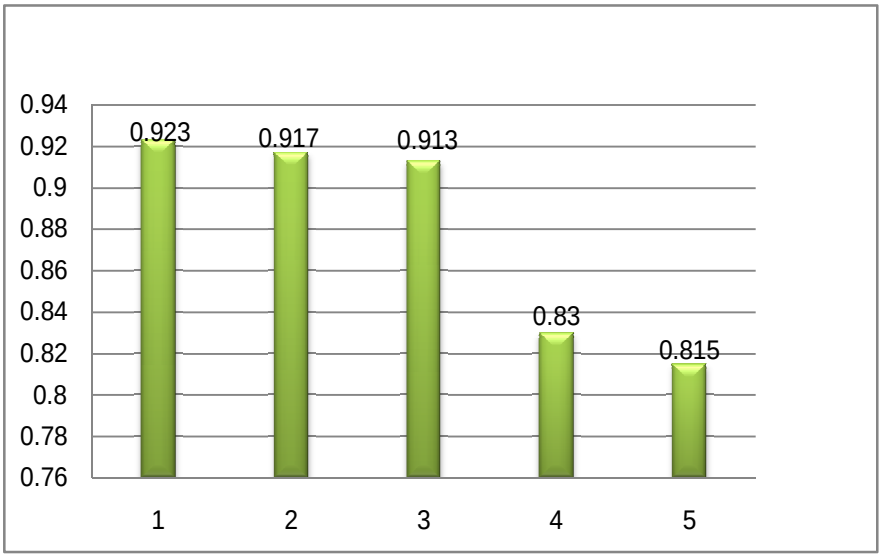


Figure 3: collective key delay factors (labour and contractor) as evident through RII value

IV. CONCLUSION

The preset study analysed the major reasons for construction project delay through a systematic questionnaire of 167 workers and 13 contractors with Relative Importance Index (RII) analysis. The findings revealed that labour delays are primarily operational, and reuse of materials (RII = 0.923), use of traditional tools (RII = 0.917), and insufficient skilled manpower (RII = 0.913) were identified as the most significant factors. Reliance on natural shuttering, material shortages, general absence of labour, and also workers absenteeism all contributed significantly.

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On the contractor's side, managerial and regulatory problems were the primary reasons for delays, i.e. delays in permits and approvals (RII = 0.830), unforeseen risks (RII = 0.815), and alternations in project scope or design (RII = 0.707). Joint analysis emphasized addressing both site-level inefficiencies as well as higher-level administrative bottlenecks.

The study reinforces the significance of enhanced mechanization, training among workers, and forward-looking regulation planning. As a focus is placed on these elements, parties involved in projects are more likely to avoid delays in time and optimize overall productivity in construction.

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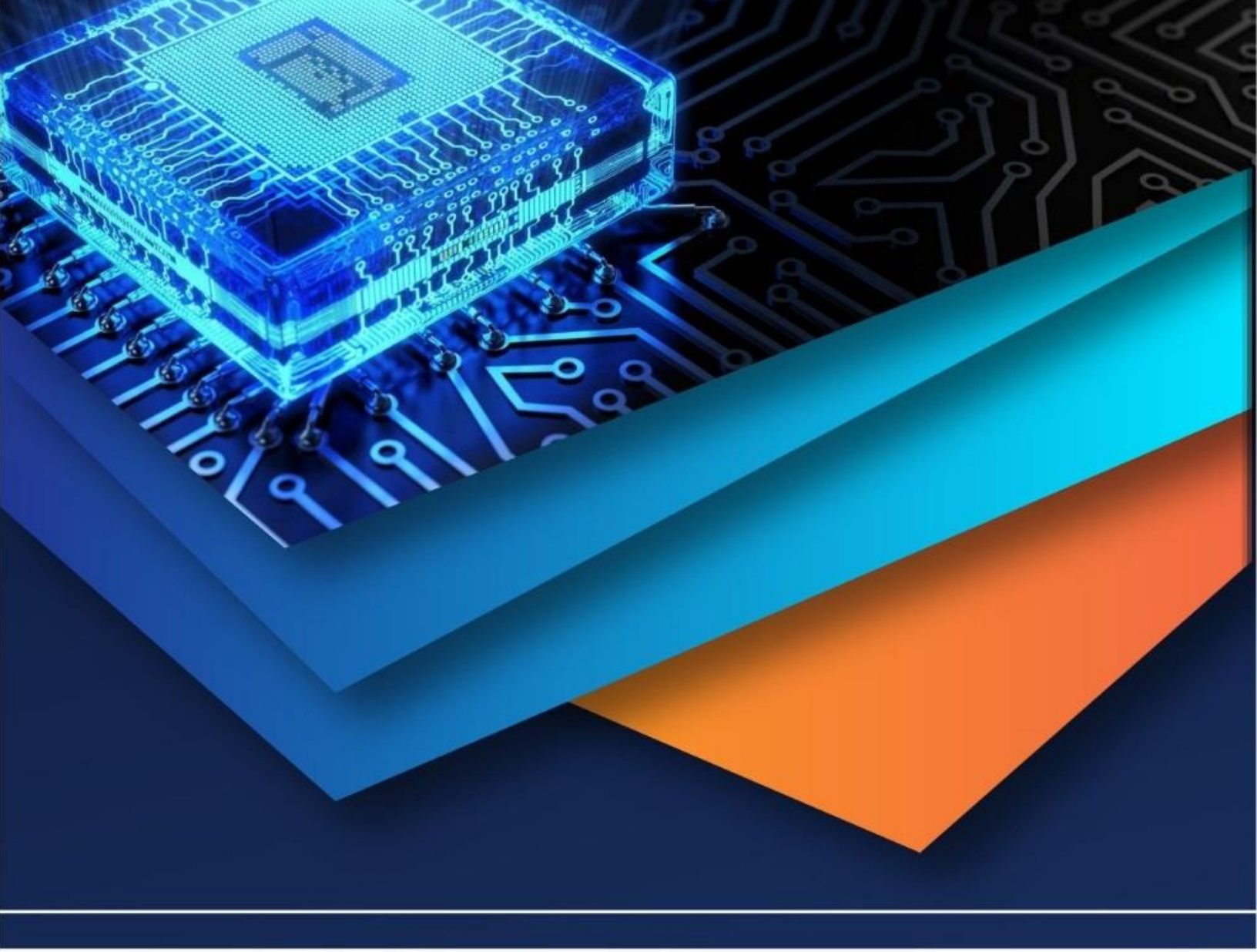
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