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Identifiction of Lean Wastes Causing Delay in Construction Operation

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Abstract:- Delay is considered as one of the most common issue faced by the construction industry which leads to increase in project time, cost and expenses. To overcome this, the delay factors had to be identified. The main objective of this paper is to identify, examine and evaluate the factors which affect delay in Indian construction projects with respect to relative importance. The data were analyzed through quantitative mode of research through structured questionnaire survey. The survey was conducted among 103 respondents from public, private and other construction firms. The questionnaire survey consists of 17 delay factors and 4 major categories. The study is carried out on Likert scale based on five ordinal measures. The data is analyzed and categorized using Relative Important Indices (RII), ranking and percentage. The paper concludes that client related factors are the most important causes of delay and suggested remedies.

Keywords: Project Efficiency, Delay in Construction, Time Overrun, Cost Overrun, Lean Waste.

1.   Introduction

Construction industry in India is one of the fastest growing industries and has a great contribution to country's growth and GDP. Increase in population leads to increase in human needs resulted in larger number of projects (Gann & Salter, 2000). Each construction projects are different based on their size, dimension, types of work. Over a certain period of years' construction industry is facing various challenges in both public and private sectors. Large number of parties are involved for the successful completion of project including, contractors, consultants, architects, stakeholders (Zou, Zhang, & Wang, 2007).

Delay in delivery of projects is one of the major challenges in construction industry (Aibinu & Jagboro, 2002). A large number of studies had been conducted, still required some corrections to improve it. Failure to complete the project according to the scheduled time is considered as construction delay. It is a common difficulty in building projects when a project deviates from its original schedule. (AlGheth & Sayuti, 2019) one of the primary factors contributing to project failure in emerging nations is schedule delays in building construction projects. Delay not only affect the construction sector but also affects the whole country's economic development (Teo & Loosemore, 2001).Delay is the slowing down of work without a complete stop to construction and can result in time overruns past the contract date or past the date that the parties have agreed upon for the delivery of the project (Joy & P, 2018). It is the loss of revenue for the owner due to a lack of manufacturing facilities and rentable space, or a reliance on current facilities. Due to longer workdays, greater material costs from inflation, and higher labor costs, delays can raise the contractor's overhead expenses. Delay occurs due to various reasons such as contractor related, client related, material related, equipment related and all these

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leads to delay in construction which resulted in increase in construction costs, time, resources (Wang, Dulaimi, & Aguria, 2004).These delays badly affect's contractor's final income. Increase in mental stress, loss of work, less interest in foreign investors are the major consequences (Onyeiwu, 2004). One of the important major cause is the changes in Government rules and weather conditions (Sweis, Sweis, Hammad, & Shboul, 2008) . Project Management helps to overcome these situations (Luu, Kim, Tuan, & Ogunlana, 2009). This research paper aims to identify the importance of various delay factors and their ranking on the basis of Relative Important Indices. Literature study helped to identify the different factors affecting delay in Indian Construction sites. The ability to recognize the obstacles to successful risk management, the application of the right risk management technique, proactive leadership to remove obstacles, the attitude of the workforce, sufficient resources, organizational culture, and top management's involvement are frequently key factors in project success (Dandage, Mantha, Rane, & Bhoola , 2018).

The first part of the paper describes the introduction of construction delays followed by an extensive relative review, which helps to identify the gaps in the literature. Third part of the paper describes about the objective of this study followed by methodology. Analysis is carried out through quantitative method and most crucial delay factors are identified. This paper concluded with recommendations and scope for the future study. Systematic Literature Review related to delay in Construction had been conducted and identified various factors which affect the construction projects. (Ogunlana, Promkuntong, & Jearkjirm, 1996) analyzed the factors causing time overrun and cost overrun for preconstruction projects in Thailand and suggested remedies. (Frimpong & Oluwoye, 2003) studied about the cost overrun reasons in the construction sector and causes of delay in Vietnam through questionnaire survey. Analysis was carried through exploratory factor analysis and regression analysis, identified financial issues are the major problems. Paper concludes with recommendations to improve the financial conditions. (Love & Irani, 2003) Prototype Project Management Quality Cost System to identify the quality cost in construction and the system implemented in two cases studies and identified the limitations and benefits. The study concluded that this PROMQACS helps to take proper actions in future management practises.

(Trigunarsyah, 2004) conducted a study in Indonesian construction industry and identified that 47% of the projects are completed within time and 38% are completed after the expected time and 15% of projects are completed before the expected time. (Koushki, Al-Rashid, & Kartam, 2005) analysed problems faced by low, middle-income developers in self build housing projects and questionnaire survey was conducted to identify the causes. The analysis was carried out through t- test, reliability test and mean test and suggested recommendations for future study. (Sambasivan & soon, 2007) identified the major causes of construction delays in Malaysia, conducted a study among 150 respondents (owners, consultant and contractors) and identified major 10 factors of delay and its effect in construction sector and created an empirical relationship. Poor site management, lack of financial in clients, lack of experienced workers, material shortage, labor shortage, lack of communication between parties are the major reasons identified in this case. (Hoai, Lee, & Lee, 2008) analyzed the problem in Vietnam by interviewing 87

construction experts, 21 causes of delay were analyzed. Factor analysis is carried out and helps to find out better understanding of problems influencing budget and time. (Luu, Kim, Tuan, & Ogunlana, 2009) conducted a study on how profitability can be increased in developing countries. Bayesian Belief Network (BBN) is used and the data were collected through questionnaire survey among 166 professionals. The concluded that BBN is one of the most advanced methods to improve the profitability. (Khoshgoftar, Baker, & Osman, 2010) conducted a study on Iranian building projects and delays had been the subject of investigation. According to the research, the main factors for delays in Iranian construction projects are a lack of effective planning, poor site management, poor contract management, and a communication gap between the parties involved.

(Shebob, Dawood, Shah, & Xu, 2012) conducted a comparison of the delays that affect the Libyan and UK construction industries. The findings showed that the variables that because delays differ across the two countries, with construction projects in Libya experiencing more delays than those in the UK. By using a case study technique and examining the most important delay reasons, it was discovered that a construction project may be delayed in Libya by 41 to 46 days and in the UK by 34 to 38 days. (Yang & Kao, 2012) conducted window-based delay analysis method (EDAM) method

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and various factors of delay were analyzed, hypothesis tested and concluded EDAM is an appropriate tool to schedule the delays. (Kikwasi, 2013) conducted a study to identify the delay causes in Tanzania.

The data collection was carried out through questionnaire survey and identified that changes in plan and delayed payments are the major reasons. (Mahamid, 2013) conducted a study on 74 road construction cost deviation over these years from 2007-2010. Data analysis was carried out through questionnaire survey and identified cost deviation varies from 20.33% to 56.01%. (Aziz & Hafez, 2013) conducted a study on Lean based tools to reduce project delays in Egypt. This study briefly explained the application, principles and methods in implementing Lean Principles in reducing time, wastages etc.

(Amoatey, Ameyau, Adaku, & Famiyeh, 2015) studied the reasons and effects of delays in the construction of state housing in Ghana. According to the study, factors that cause construction projects to take longer to complete include: delays in paying contractors, price fluctuation or inflation, increases in the cost of materials, a lack of adequate funding from project sponsors, variation orders, and the absence of a healthy financial or capital market. The main effects of delays are litigation, cost and time overruns, client continuity, and adjudication.

(Afram, Dery, Eghan, & Kwofie, 2015) analysed causes of delay in Middle- and High-income Self Build Housing Projects (SBHPS) and collected data and reliability test analysis is carried out and recommended suggestions. (Emam, Farrell, & Abdelaa, 2015) conducted a study in Qatar and identified lack of skilled labor and change in scope are the major factors affecting delays. (Hammadi & Nawab, 2016) conducted a study in Saudi Arabia to identify the factors of delay. The study was carried out through literature study and questionnaire survey and identified seven delay factors and recommended suggestions. (Gebrehiwet & Luo, 2017) conducted a study on Ethiopian construction projects through questionnaire survey with 52 causes and collected response from 77 respondents. The responds were classified according to RII Indices and suggested recommendations.

(Mai & Wang, 2017) researched on quality risk of EPC hydropower projects of Vietnam and evaluated the risk, investment and quality and ensuring the benefits to contractors, investors etc. The delay was common in medium and large projects, but it was also seen in small enterprises. There are numerous factors that contribute to delays, including the involvement of the owner and the contractor. Financial issues, as well as the project's early planning and design, are major issues. Numerous studies on construction-related projects, especially those in developing nations, state that in the majority of situations, the final cost of the project exceeds the projected cost by over 30%. A study in risk factors in Saudi Arabia is carried out through literature review and identified the top causes of delays (Alfraidi, 2018). (Joy & P, 2018) conducted a study on different causes of delay factors and data were analyzed and recommended certain suggestions. (Thakkar & Shah, 2021) studied barriers in implementation of lean principles in construction industry and its effect on construction sector and identified improper implementation of lean caused delay in different areas such as time, cost, material is one of the major problems.

2. Objectives

The major objective of this study is to figure out causes of delays in construction projects in India. This study outlines the major reasons of delays, which are divided into seventeen categories: client- related, contractor-related, material-related, equipment-related issues. From the perspective of the primary stakeholders involved in the construction activity, this project work identifies the reasons for the delays.

- To review and classify the literature related to delay in construction projects.

- To identify the major delay factors in Indian Construction Industry.

- To categorize the delay factors based on Relative Important Indices (RII) and Rankings.

- To identify the most contributing factors leads to delay.

- To recommend suggestions and future scope of the study.

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3.   Methods

An extensive literature review related to delay was carried out to find the gaps in the literature. The current study is based on past research in the field of delay analysis, as well as the causes and effects of delays on projects. Structured questionnaire survey was conducted among construction professionals in India to identify the major causes of delays. The study considers the importance of causes and their effects on projects and suggesting necessary steps that may be implemented throughout the execution phase to reduce or eliminate delay impacts. This study includes a literature evaluation, questionnaire design, identification of parties involved, survey and data collection, and data analysis. Quantitative mode of research was used in this study. (Doloi, Sawhney, Iyer, & Rentala, 2012) Relative Important Indices (RII) method had been used as an analytical method in this study. Engineers representing clients, consultants, and contractors are the participants in the survey. The data was analyzed, and recommendations were made for reducing building project delays.

Design of Questionnaire

Identification of critical attributes for the study and preparation of questionnaire is a crucial step for the success of the research. Significant amount of work has already been done on causes of construction delay and there is a well-documented and peer-reviewed set of delay attributes available in the literature. For this research, the questionnaire has been prepared by incorporating the key delay attributes reported in the literature. A total of 17 delay attributes were identified under four broad categories namely client related, contractor related, material related, equipment related issues. To reflect the cross-section of the already available delay attributes in the Indian context, personal interviews with Indian construction experts were also conducted. The final questionnaire survey was on design based on these two inputs. The attributes are listed in Table 1.

Table 1. Likert scale rankings

Factor	Weightage
Neutral	1
Disagree	2
Strongly Disagree	3
Agree	4
Strongly Agree	5

A five-point Likert scale (1 very low, 2 low, 3 average, 4 high, 5 very high) was adopted where respondents were asked to rank the importance and impact of a particular attribute on delay in one of their selected projects (Allen & Seaman, 2007). D. The research was designed to be used with Anova and Descriptive Statistics. In addition, descriptive analysis was also performed on the attributes using the raw data collected in the survey. Descriptive analysis is an important measure for ranking the attributes in terms of their criticality as perceived by the respondents. This is similar to the analysis of the basic statistics on collected samples to investigate the trends of perceptions of certain industry practices based on first hand experiences of the practitioners. As such analysis does not provide any meaningful outcomes in terms of understanding the clustering effects of the similar attributes and the predictive capacity, further analysis is required using advanced statistical methods. Descriptive statistics namely Relative Importance Index (RII) has been used to highlight the relative importance of attributes as perceived by the respondents The results form a firm basis for identifying the criticality of attributes on construction impact.

However, the analysis is unable to depict the underlying relationship. An attempt to achieve this Anova is considered a most suitable method to derive the relationship between the attributes. With these research design issues in mind a survey of Indian construction professionals was conducted. Various methods such as email, online, mail, and telephone

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discussions were used to collect the information from experts.

Respondent's profile

Respondents are selected from a wide range of professionals engaged in the Indian construction sector (contractors, clients and engineers). All the respondents identified had experience in relatively large engineering construction projects in the Indian context. The sample consisted of owners, architects, structural engineers, service engineers, project managers, contract administrators, design managers and construction managers.

Table 2. Experience of Respondents in construction sector.

Experience in construction sector	Total No's of respondents
>1-≤5	3
>5-≤10	1
>10-≤15	2
>15-≤20	9
>20-≤25	21
>25-≤30	67

Table 2 shows a brief description of respondents' profile in terms of professional role and experience who participated in the study. As seen, the mix of disciplines was well proportioned in the sample. In order to get the best possible response commensurate by the experience and expertise, introductory conversations and email contacts were made with each respondent to explain and make the objectives of the research clear. A total of 110 questionnaires were mailed both by hard copy and via email, out of which 103 valid responses were obtained.

Ranking of attributes

Many researchers are of the opinion that mean and standard deviation of each individual attribute is not a suitable measure to assess overall rankings as they do not reflect any relationship between them and hence used RII which can be calculated using the following equation: RII Relative Importance Index = $\Sigma w / AxN$, "W" Weight given to each attribute by respondent, "A" Highest weight, "N" Total number of respondents. The attributes are arranged in ascending order of ranks, attribute with highest RII or rank 1 indicates that it has the maximum impact on the delay while the attribute with lowest rank indicates that it has the least impact on delay duration. However, RII doesn't talk about the relationship between the various attributes.

Discussion of the extracted factors

Client Related Factors

Due to the client's inability to finance and pay for finished work, the client's delivery of the site to the contractor to begin work has been delayed (Koushki, Al-Rashid, & Kartam, 2005). Delay caused by client orders changing during the execution process. Delay caused by the client's/delayed owner's decision-making process, as well as delays caused by the owner's poor communication and coordination with the other parties involved.

Contractor Related Factors

Delay caused by the contractor's financial instability and management, delay caused by the project's improper planning and scheduling, delay caused by conflict between the contractors and other parties involved, delay caused by the contractors' improper construction methods and poor site management, delay caused by the contractors' technical staff's

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lack of qualification. To prevent unfavorable events that could harm the project and its stakeholders, the reasons behind the contractor's insolvency should be found (Patel, Trivedi, Pandit, & Patel, 2022).

Consultant Related Factors

Consultants' delays in doing inspection and testing, their delays in reviewing and approving design papers, and their delays owing to insufficient experience (Odeh & Battaineh, 2002).

Materials Related Factors

A scarcity of construction materials caused a delay during the execution phase. Delays resulting from changes in building material types, as well as delays resulting from late material procurement on site and poor material quality (Chan & Kumaraswamy, 1997).

External Factors

Delays in acquiring permissions from relevant government agencies, delays caused by weather effects on construction activities, delays caused by pricing increases, and so on. These are followed by questions about the impact of project delays caused by the aforementioned factors, such as time overruns, cost overruns, disputes, and conflicts (Assaf & Al-Hejji, 2006). Apart from the foregoing, the parties are asked to highlight the most important recommendations/suggestions in order to reduce construction delays via an open-ended inquiry.

Calculation and Analysis:

The data for questionnaire is calculated on a five- point scale. The questionnaire contains 5 major delay factors and 18 subdivided categories. Total sample size is 103 respondents among which 57 males and 46 females. Data was collected among construction professionals of different age group and experience. Each data had given its own weightage. The data for the questionnaire is collected on a five-point scale, which is subsequently translated into Relative Important Indices. (RII) (Fashina, Omar, Sheikh, & Fakunle, 2021).

RII= $\sum W/AXN$, Where W is the respondents reply for each of the factors, A is the highest reply of the same factor and N is the no. of respondents (103 respondents). Figure 1 gives a detailed calculation using SPSS Anova.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
CLIENTRELATED	Between Groups	2022.649	41	49.333	8.347	.000
	Within Groups	372.342	63	5.910		
	Total	2394.990	104			
CONTRACTORRELATED	Between Groups	2980.714	41	72.700	10.931	.000
	Within Groups	419.000	63	6.651		
	Total	3399.714	104			
MATERIALRELATED	Between Groups	702.220	41	17.127	3.497	.000
	Within Groups	308.542	63	4.897		
	Total	1010.762	104			
EQUIPMENTRELATED	Between Groups	729.990	41	17.805	3.190	.000
	Within Groups	351.667	63	5.582		
	Total	1081.657	104			

Figure 1. Caluculation of Respondents response using Anova

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Table: 3 Percentage of respondents for delay factors

DETAILS OF RII AND RANKS OF CAUSES BY ALL RESPONDENTS							
CAUSES OF DELAY	PERCENTAGEOF RESPONDENTS					RII	Total RII
	1	2	3	4	5		
CLIENT RELATED FACTORS							
Late in reviewing and approval of the design document	17%	22%	21%	22%	16%	0.43	2.44
Finance and payment of completed works	18%	0	16%	24%	30%	0.40	
Delay in delivery of site to contractor	23%	29%	28%	18%	12%	0.54	
Change of order by clients during the execution phase	23%	23%	12%	20%	18%	0.48	
Poor communication and coordination	18%	26%	23%	16%	24%	0.59	
CONTRACTOR RELATED FACTORS							
Financial instability of contractor	14%	12%	12%	19%	20%	0.41	
Delay due to lack of submittals by consultants	22%	15%	6%	19%	10%	0.40	2.96
Improper planning and scheduling of the project	14%	18%	16%	14%	26%	0.57	
Conflict between contractor and other parties	17%	16%	14%	19%	11%	0.40	
Poor qualification of technical staff	16%	27%	29%	10%	18%	0.74	
Dispute between main contractor and subcontractor	18%	11%	22%	18%	14%	0.44	
MATERIAL RELATED FACTORS							
Non availability of construction materials	26%	30%	56%	32%	38%	0.45	
Changes in construction material types	41%	34%	28%	35%	22%	0.41	1.31
Changes in construction material rate	33%	36%	17%	32%	40%	0.45	
EQUIPMENT RELATED FACTORS							
Equipment breakdown	36%	46%	44%	29%	26%	0.52	
Shortage of equipment's	29%	35%	50%	34%	28%	0.43	1.34
Climatic conditions	36%	19%	6%	37%	47%	0.40	

Table 4: Total RII value of each factor

Causes of delay	Client related Factors	Contractor related factor	Material related factor	Equipment related factor
Total RII	2.44	2.96	1.31	1.34

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Table 3 represents different delay factors and the percentage of respondents and identified poor qualification of technical staff is the main reason for delay. Table 4 shows Relative Important Indices (RII) of each delay factors. RII factor for client related factors 2.44, Contractor related factor as 2.96, Material related factor 1.31, Equipment related factor as 1.34.

Table: 5 RII Ranking of delay factors.

Sl.No	Delay Factors	RII Ranking
1.	Late in reviewing and approval of the design document	11
2.	Finance and payment of completed work	17
3.	Delay in delivery of site to contractor	4
4.	Change of order by clients during the execution phase	6
5.	Poor communication and coordination	2
6.	Financial instability of contractor	12
7.	Delay due to lack of submittals by consultants	16
8.	Improper planning and scheduling of the project	3
9.	Conflict between contractor and other parties	15
10.	Poor qualification of technical staff	1
11.	Dispute between main contractor and subcontractor	9
12.	Non availability of construction materials	7
13.	Changes in construction material types	13
14.	Changes in construction material rate	8
15.	Equipment breakdown	5
16.	Shortage of equipment's	10
17.	Climatic conditions	14

Table 5 represents the RII rankings of delay factors and identified poor qualification of technical staff is the major reasons for delay which resulted in inefficient construction, reworking, wastageof manpower, resources, costs, time etc.

Analysis of delay factors related to client.

Table 6: Client Related Factors.

Client Related Factors	1	2	3	4	5	RII	RII Ranking	Level of Contribution
Late in reviewing and approvalof the design document	17%	22%	21%	22%	16%	0.43	11	High

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Delay in Finance and payment of completed works	18%	0	16%	24%	30%	0.40	17	High
Delay in delivery of site tocontractor by client	23%	29%	28%	18%	12%	0.54	4	High
Change of order of work by clients during the executionphase	23%	23%	12%	20%	18%	0.48	6	High
Poor communication andcoordination	18%	26%	23%	16%	24%	0.59	2	Very High

Table 6 represents the contractor related factor with higher (RII= 0.59) for poor communication and coordination among workers, delay in finance and payment of completed works represents (RII = 0.54) second in this category, and change of order of work by clients during the execution phase (RII = 0.48) represents third. Delay in finance and payment of completed works and late inreviewing and approval of the design document are the least significant factors with (RII= 0.40 &RII = 0.43).

Analysis of delay factors related to contractors

Table 7: Contractor related factors

Contractor RelatedFactors	1	2	3	4	5	RII	RII Ranking	Level of Contribution
Financial instability ofcontractor	14%	12%	12%	19%	20%	0.41	12	High
Delay due to lack of submittals byconsultants	22%	15%	6%	19%	10%	0.40	6	High
Improper planning and scheduling of the project	14%	18%	16%	14%	26%	0.57	3	High
Conflict between contractor and other parties	17%	16%	14%	19%	11%	0.40	15	High
Poor qualification oftechnical staff	16%	27%	29%	10%	18%	0.74	1	Very High
Dispute between maincontractor and subcontractors	18%	11%	22%	18%	14%	0.44	9	High

Table 7 represents the contractor related factors with higher RII = 0.74 ranked first for poor qualification of technical staff, Improper planning and scheduling of the project (RII = 0.57) represents second, Dispute between main contractor and subcontractor (RII = 0.44) represents third. Financial instability of contractor (RII = 0.41), delay due to lack of submittals by consultants(RII = 0.40), conflict between contractor and other parties (RII = 0.41) are the least significant contractor related factors which affect delay

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Analysis of delay factors related to materials

Table 8: material related factor

Material related factors	1	2	3	4	5	RII	RII Ranking	Level of contribution
Non availability ofconstruction materials	26%	30%	56%	32%	38%	0.45	7	Very High
Changes in construction material types	41%	34%	28%	35%	22%	0.41	13	High
Changes in construction material	33%	36%	17%	32%	40%	0.45	8	Very High

Table 8 represents the material related factor with RII = 0.45 very high for changes in constructionmaterial rate and non-availability of materials. Changes in construction material types with RII = 0.41 represents the least significant factor for delays.

Analysis of delay factors related to equipment.

Equipment relatedfactor	1	2	3	4	5	RII	RII Ranking	Level of Contribution
Equipmentbreakdown	36%	46%	44%	29%	26%	0.52	5	Very High
Shortage of equipment's	29%	35%	50%	34%	28%	0.43	10	High
Bad Climatic conditions	36%	19%	6%	37%	47%	0.40	14	High

Table 9: Equipment related factor

Table 9 represents equipment related factors which affect delay with RII = 0.52 having higherlevel of contribution, shortage of equipment's and bad climatic conditions (RII = 0.43 & RII =0.40) having less significance.

4.   Results

The data collected by the questionnaire survey is analyzed and are summarized. According to thestudy conducted, the RII calculation clearly describes the causes and effects of project delays. Experience of respondents are shown in Table 1; Table 2 represents the weightage of delay factors.According to Table 3 & Table 4 shows the ranking and RII of delay factors. Contractor related factors with RII = 2.96 is the highest. According to Table 3, **Client related factors (RII = 2.44)** include "Late in reviewing and approval of the design document (RII = 0.43)", "delay in finance and payment of completed works (RII = 0.40)", "Delay in delivery of site to contractor (RII = 0.54)", "Change of order by clients during the execution phase (RII = 0.48)", "Poor communication and coordination (RII = 0.59)", As per Table 3, **Contractor related factors (RII = 2.96)** ranked among the first. These includes "Financial instability of contractor (RII = 0.41)", "Delay due to lack of submittals by consultants (RII = 0.59)", "Improper planning and schedulingof the project (RII =

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0.57)", "Conflict between contractor and other parties (RII = 0.40)", "Poor qualification of technical staff (RII = 0.74)", "Dispute between main contractor and subcontractor(RII = 0.44)", Third category includes, **Material related factors (RII = 1.31)** includes "Non availability of construction materials (RII = 0.45)", "Changes in construction material types (RII = 0.41)", "Changes in construction material rate (RII = 0.45)", Fourth category includes, **Equipment related factors (RII = 1.34),** "Equipment breakdown (RII = 0.52)", "Shortage of equipment's (RII = 0.43)", "Climatic conditions (RII = 0.40)",.

5.   Limitations and Future Scope

The survey is conducted among civil engineering experts from Delhi and Kerala. The feedback was obtained from only 103 respondents which was a smaller population. This study identified thegaps in project delays in Indian Construction Industry. Future researchers can have done survey among larger population was challenging and may results in more accurate findings. The study can be conducted among other parts of India or other countries and can validate the findings usingthe useful outcome of this study.

6.   Conclusion and Recommendations

This research had identified various delay factors based on RII and rankings. Contractor related factor are identified as the major factor followed by client related, equipment related and materialrelated. Poor qualification of the technical staff are the major reasons for contractor related delays,resulted in poor quality building, large amount of use of material, time etc. Contractor related factor can be improved by giving right payment to contractor at right time by clients. Proper project management, increased contractor's managerial skills, proper communication among contractors,clients, and workers helps to control the project extension time to a certain limit. As per the above discussions, the following recommendations can be used to control delays such as: Worker selection should be done in a proper way, Poor qualification of workers leads to increase in accidents and low-quality works. Contractor's experience is an important factor. Contractor should have done proper planning and scheduling of the project. While redesigning a project the contractor should make sure it doesn't cross the critical path. Site management and supervision should be done in a proper manner. Availability of equipment's should be make sure to avoid unexpected delays.

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