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"TO STUDY IN REDUCE DELAY OF CONSTRUCTION PROJECT(S) DUE TO INADEQUACY OF PROJECT MANAGEMENT & CONTRACTS"

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Abstract— This Time is one of the major considerations throughout project management life cycle and can be regarded as one of the most important parameters of a project and the driving force of project success. Time delay is a very frequent phenomenon and is almost associated with nearly all constructing projects. However, little effort has been made to curtail the phenomenon, this research work attempts to identify, investigate, and rank factors perceived to affect delays in construction projects with respect to their relative importance so as to proffer possible ways of coping with this phenomenon. To achieve this objective, researcher invited practitioners and experts, comprising a statistically representative sample to participate in a structured questionnaire survey. Brain storming was taken into consideration, through which a number of delay factors were identified in construction projects. Totally, ninety-nine (99) factors were short-listed to be made part of the questionnaire survey and were identified and categorized into nine (9) major categories. The survey was conducted with experts and representatives from private, public, and local general construction firms. Delay in construction have been classified in different ways. Sample feedback form (Table 5.1) along with ranking criteria developed based upon linkert scale (Table no. 5.2) was also disseminated to various experience Project managers, engineers, Project Head etc. to record their responses over Probable Reasons/cause for Delay in Project Completion.

Many uncertainties can cause construction projects to be delayed, resulting in conflicts between the two parties to a construction contract. Using case study and content analysis methodologies, this study analyzed 79 litigation cases to identify the main causes of schedule delays in construction projects, which are "change orders," "changed scope of the work," "delayed site handover," and "weather." In this study, these causes are organized into a causation model to provide a reference for preventing schedule delay. The employed approach can be implemented for assessments of other regions, as schedule delays are common features in most construction projects.

The most important according to the key project participants; clients, consultants, and contractors. Thirty-two possible causes of delay were identified from the literature and semi-structured interviews of 15 key players in the implementation process. These delay factors were further categorised into nine major groups. The list of delay causes was subjected to a questionnaire survey for the identification of the most important causes of delay. The field survey included 130 respondents made up of 39 contractors, 37 clients and54 consultants. The relative importance of the individual causes and the groups were calculated and ranked by their relative importance index. The overall results of the study indicate that the respondents generally agree that financial group factors ranked highest among the major factors causing delay in construction projects. The financial group factors were delay in honouring payment certificates, difficulty in accessing credit and fluctuation in prices. Materials group factors are second followed by scheduling and controlling factors.

Contracting is an integral part of construction projects. Managing the contracts therefore is equally important for the success of any business process due to rapid increase in multiple contracts. The conventional method of managing contract involves risks and chaos which include inadequate information in contracts, inadequate delegation of authority and responsibility, fraud, theft, corruption, other unethical activities, communication gap, delayed financial decisions thus dampening the progress of the project, all due to manual intervention in managing contracts. This calls for a need of systematic and an effective method of contract management. This paper speaks about Intelligent Contract Management (automated contract management) which is an efficient, transparent and flawless concept of managing contracts. This technique will streamline the business process by reducing the time taken to create, review, execute and approve contracts, thus easing activities like tracking, central storage of contract documents, and reduction in disputes, minimize risks associated with manual data entry.

Contract management is an issue of strategic importance to both organization and to projects and through automated contract management technique; organizations can increase control, increase effectiveness, reduce cost and also provide strategic and competitive advantage. Key objective of automated contract management system is to ensure easy access to contract information to form flexible support for the contract workflow.

Keywords— (1) Late completion of project; (2) Increased cost; (3) Disruption of work; (4) Loss of productivity; (5) Third party claims; (6) Disputes; and (7) Abandonment or termination of contracts.

I. INTRODUCTION

In most countries, experience and the literature revealed that successful construction projects should be completed before project due dates and within budget. Therefore, causes of time delay are of critical importance to the profitability of most construction projects. Many researchers, in the literature, have identified these problems as factors that affect the delay in construction projects and will affect company's performance and overall economy of the country as well. The delay in construction projects by many factors is usually linked to the performance of time, cost, and quality. Meanwhile, identification and evaluating factors causing delay in construction projects have been carried out in the last decade; however, a deeper understanding is still needed to improve that. A construction project is commonly acknowledged as successful when it is completed on time, within budget, in accordance with specifications and to stakeholders' satisfaction

In construction industry, contractors tend to maximize their profit for market growth. To achieve this aim, it is crucial for contractors to carefully identify the factors that affect the success of project and estimate their impacts before bidding stage. Construction projects may differ in size, duration, objectives, uncertainty, complexity, pace, and some other dimensions. Delay means non-completion of project within the specified duration agreed upon in contract. It is widely accepted that construction project schedule plays a key role in project management due to its influence on project success. Delays are common in various construction projects and cause considerable losses to project parties.

Eight main Delay causes (Delay factors) in the Construction Project

Effects of Delay in Construction Projects

Therefore, delays in construction projects give rise to dissatisfaction to all involved parties. Most correspondents agreed that financial difficulties faced by the contractor and too many change orders by the owner are the leading causes of construction delay. Severe weather conditions and changes in government regulations and laws ranked among the least important causes.

Therefore, the objective of this research is to identify and rank the relative importance of factors perceived by owners, consultants, managers, engineers, and contractors to cause delay in construction projects. The outcomes can be used by not only local, but also international industry practitioners, who may be further interested in venturing into potential mega scale projects, but possess no prior practical knowledge of the construction industry. The outcomes can help all practitioners to develop wider and deeper perspective of factors causing delay in construction projects and provide

guidance to projects and construction managers for efficient solutions. The literature has identified several factors causing delay in construction projects that the researcher has explored in this study. This research ranks the factors causing delay in construction projects and explores them by using statistical methods.

II. OBJECTIVE

The objectives was to identify the various types of delays and the examine the reasons for project delays. The evaluation of the existing methods for delay mitigation and demonstration of the ability to prevent delays and solve problems. The reason responsible for causing delays are tackled by utilizing the knowledge gained in the various modules and applying them through a scientifically acceptable research methodology.

1) Delay due to late decisions like late nominations by client and Unreasonable project scope & inadequate early planning.
2) Understand the delay due to lack of task clarity and assessment and monitoring tools like key performance indicators(K.P.I's)
3) Calculate the delay due to lack of resources, productivity and overambitious estimates.
4) Define the delay due to inadequate contractor /subcontractor experience.
5) Develop mitigation methods by knowledge management and project learning.
6) Mitigation by lessons learnt feedback.
7) Elimination of delays by acceleration
8) Prevention of delays by planning /analyzing and mapping.
9) Prevention of delay by identifying risks, estimating, allocating and modularizing work.
10) Types of Project Delays :
    a) Critical delays and Non critical delays
    b) Non Excusable (Contractor Caused) Delays & Excusable Delays.
    c) Compensable (Owner Caused) Delay & Non-Compensable Delays.
    d) Concurrent delay & Non concurrent delay
11) Dispute Resolution

The Spectrum of Conflict Resolution

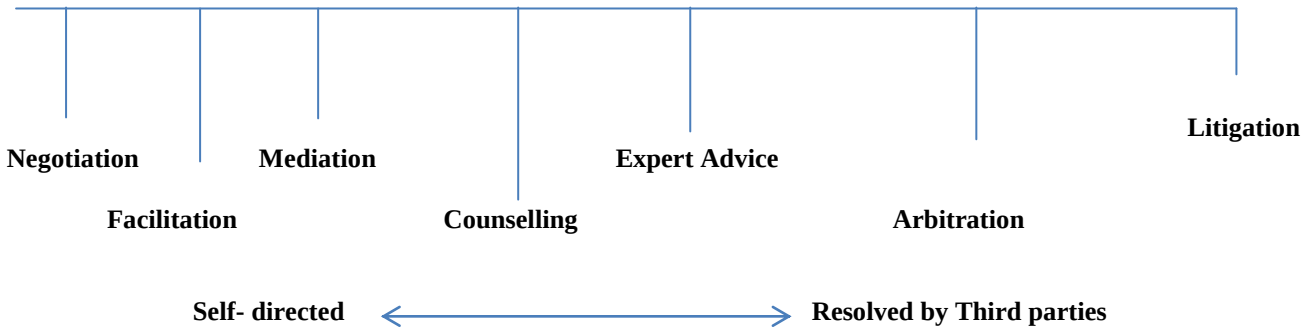


Fig.1 Method of conflict resolution range from self-determination by the participants to decision made unilaterally by a judge or arbitrator

III. METHODOLOGY

The construction projects have become so vast and complex that the application of information technology has become inevitable. Companies started developing software for project management such as Primavera P6, Microsoft Project, etc. This study involves Earned value analysis of the project using Primavera P6, Microsoft Project. The progress at the site must be incorporated in the Microsoft Project schedule and updated. These updates need to be thoroughly monitored using Microsoft Project. The WBS for the project is created and several activities are identified.

The methodology of step procedure to find out the problem and resolved the matter for delay of project is as follows:

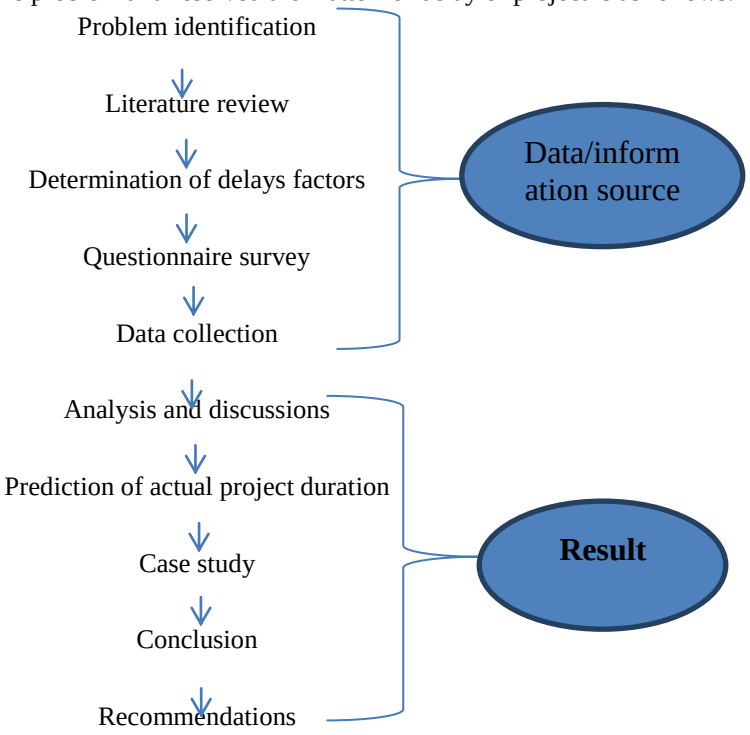


Table 1 Recommended steps for the successful implementation of earned value analysis:

1	Create Project
2	Define WBS
3	Creating Calendars
4	Define Activities
5	Appoint Activity Durations
6	Assign Logic Links
7	Perform Scheduling
8	Allocating Resources/budgeting
9	Creating Baselines
10	Updating Schedule
11	Earned value analysis

PROBABLE REASONS/CAUSE OF DELAY IN PROJECT COMPLETION

Delay in construction have been classified in different ways. Sample feedback form (Table 2) along with ranking criteria developed based upon linkert scale (Table no. 3 & 4) was also disseminated to various experience Project managers, engineers, Project Head etc. to record their responses over Probable Reasons/cause for Delay in Project Completion.

Table 2 One respondent Sample Feedback sheet.

Sl. No.	Probable Reasons/cause for Delay in Project Completion	Kindly give 1 – 5 ranking to each reason responsible for Delay in Project Completion	Based on your experiences and fine sense of judgement kindly rank the occurrence of each cause/reason on scale of 1 - 5
		Probability level of risk occurrences(α) Rating scale by likert	Degree of impact if the risk occurs(β) Rating scale by likert
1	**Poor Investigation :** In terms of site condition	2	1
2	Mode of financing and payment for completed work	3	4
3	Long period between design and time of bidding/tendering	3	3
4	Inappropriate contractual procedure	4	2
5	Bureaucracy in bidding/tendering method	4	5

6	Selecting inappropriate contractors	5	4
7	Change in design by consultant/Design changes	4	3
8	Time consume in taking approval for time extension, extra item, additional item, variation escalation etc.	5	5
9	Client initiated variations	4	3
10	The scope of work for the contractor is not well defined	3	2
11	The objective of the project is not well defined	4	3
12	Conflicts between project documents	3	3
13	Lack of coordination between Client, Consultant and Contractor	4	3
14	Undue intervention of Other organisations	2	3
15	Errors and omissions in design	2	3
16	Inadequate Planning	4	3
17	Local Residents	3	2
18	Technology Change	3	4
19	Safety Considerations	2	3
20	Shortage of Materials	4	5
21	Unavailability of skills (Shortage of skilled manpower)	4	5
22	Defective workmanship	3	2
23	Unrealistic Contract durations imposed by Client	4	3
24	The Contractors Financial difficulties	3	4
25	Non availability of required tools, equipment, Machineries, operator etc.	4	5
26	Workmanship or material not meet requirement of specifications	4	3
27	Expending the funds available on other project by Contractor instead of project under consideration	3	4
28	Weather conditions	4	4
29	Changes in Government regulations in the project zone during execution	4	5
30	Political Pressure/issues to initiate/revive/stop the project	5	4
31	Natural Disasters	3	3
32	Poor performance of Sub Contractors	4	3
33	Delay in administrative, designing, Architectural etc. approval	4	4
34	Consultant's lack of judgement and experience	4	4
35	Scope of Replacement of material and/ or procedure as per tender	4	5
36	Change in economic Conditions of Client/Contractor/Market in project zone	4	5
37	Shortage of Materials	5	4
38	Complexity of project (project type, project scale, project planning, designing etc.)	5	5
39	Inadequate definition of virtual/substantial and actual completion	4	4
40	Ineffective delay penalties	3	4
41	Legal disputes between agencies involved and client	4	3
42	Unfavorable contract clauses	3	4

The Rank Criteria for feedback was also circulated along with feedback form. Sample rank factor are as under:

Table 3 Ranking Criteria for Occurrence and Impact

Sl. No.	**Probable Reasons/cause for Delay in Project Completion (for 1 to 42)**	**Ranking Criteria for Occurrence**		**Ranking criteria for Impact**	
1		Division	Rank	Division	Rank
		Very Large (i.e. 9 in 10 Projects)	V	**Severe**	V
		Large (i.e. 7 in 10 Projects)	IV	**Moderate**	IV
		Medium (i.e. 5 in 10 Projects)	III	**Medium**	III
		Small (i.e. 2 in 10 Projects)	II	**Normal**	II
		Very Small (i.e. None/Once in 10 Projects)	I	**Ignorable**	I

Table 4 Matrix for the calculation of the Delay significance index (DSI)

α \ β				**Degree of impact**					
					Rating scale by Likert				
					Very low-1	**Low-2**	**Neutral- 3**	**High-4**	**Very High-5**
					Numerical Scale				
					0.2	**0.4**	**0.6**	**0.8**	**1.0**
Probability	**Rating scale by Likert**	**Very large-5**	**Numerical scale**	**1.0**	0.20	0.40	0.60	0.80	1.00
		Large-4		**0.8**	0.16	0.32	0.48	0.64	0.80
		Neutral- 3		**0.6**	0.12	0.24	0.36	0.48	0.60
		Small-2		**0.4**	0.08	0.16	0.24	0.32	0.40
		Very small-1		**0.2**	0.40	0.08	0.12	0.16	0.20

- Further, Delay significance Index of all ten respondents are determined thereafter based on Delay Significance Index of all ten respondents, averaging scores i.e. Delay Index Score is determined by using risk index score formula. Calculation is shown in Table 5
- Based on Delay Index Score, ranking of risk factors is rearranged from extreme risk to low risk. It is shown in Table 6
- Draw a bar chart based on ranking of risk as shown in Table 7

Table : 5 Delay index Calculation sheet

Sl. No.	Probable Reasons/cause of Delay Factor/Respondents	1	2	3	4	5	6	7	8	9	10	Total	Delay Index Score (Mean)
1	**Poor Investigation :** In terms of site condition	0.08	0.24	0.40	0.08	0.40	0.08	0.40	0.08	0.16	0.40	2.32	0.232
2	Mode of financing and payment for completed work	0.48	0.08	0.48	0.24	0.32	0.24	0.16	0.08	0.08	0.08	2.24	0.224
3	Long period between design and time of bidding/tendering	0.36	0.24	0.24	0.02	0.48	0.36	0.24	0.12	0.08	0.24	2.38	0.238
4	Inappropriate contractual procedure	0.32	0.24	0.08	0.16	0.08	0.24	0.24	0.16	0.40	0.08	2.00	0.200
5	Bureaucracy in bidding/tendering method	0.80	0.48	0.12	0.24	0.24	0.16	0.08	0.08	0.48	0.08	2.76	0.276
6	Selecting inappropriate contractors	0.80	0.64	0.48	0.48	0.48	0.02	0.24	0.16	0.24	0.08	3.62	0.362
7	Change in design by consultant/Design changes	0.48	0.48	0.60	0.80	0.80	0.80	0.64	0.80	0.48	0.48	6.36	0.636
8	Time consume in taking approval for time extension, extra item, additional item, variation escalation etc.	1.00	0.80	0.80	0.80	0.24	0.24	0.80	1.00	1.00	0.80	7.48	0.748
9	Client initiated variations	0.48	0.48	0.24	0.36	0.64	0.48	0.24	0.32	0.24	0.16	3.64	0.364
10	The scope of work for the contractor is not well defined	0.24	0.48	0.24	0.24	0.08	0.08	0.08	0.40	0.40	0.08	2.32	0.232
11	The objective of the project is not well defined	0.48	0.80	0.08	0.08	0.12	0.08	0.08	0.40	0.08	0.40	2.60	0.260
12	Conflicts between project documents	0.36	0.48	0.40	0.08	0.40	0.08	0.12	0.40	0.08	0.08	2.48	0.248

13	Lack of coordination between Client, Consultant and Contractor	0.48	0.24	0.24	0.24	0.60	0.24	0.24	0.08	0.24	0.24	2.84	0.284
14	Undue intervention of Other organisations	0.24	0.08	0.40	0.08	0.32	0.24	0.08	0.40	0.40	0.08	2.32	0.232
15	Errors and omissions in design	0.24	0.16	0.24	0.48	0.12	0.48	0.80	0.36	0.64	0.24	3.76	0.376
16	Inadequate Planning	0.48	0.48	1.00	1.00	0.32	0.48	0.60	0.48	0.80	1.00	6.64	0.664
17	Local Residents	0.24	0.24	0.16	0.08	0.08	0.08	0.16	0.08	0.08	0.08	1.28	0.128
18	Technology Change	0.48	0.36	0.40	0.16	0.08	0.24	0.36	0.24	0.08	0.40	2.80	0.280
19	Safety Considerations	0.24	0.32	0.48	0.48	0.12	0.24	0.16	0.08	0.08	0.16	2.36	0.236
20	Shortage of Materials	0.80	0.48	0.08	0.08	0.60	0.80	0.32	0.24	0.48	0.24	4.12	0.412
21	Unavailability of skills (Shortage of skilled manpower)	0.80	0.80	0.48	0.02	0.32	0.48	0.48	0.80	0.80	0.64	5.62	0.562
22	Defective workmanship	0.24	0.16	0.60	0.48	0.32	0.24	0.48	0.08	0.48	0.48	3.56	0.356
23	Unrealistic Contract durations imposed by Client	0.48	0.24	0.80	0.60	0.60	0.48	0.48	0.48	0.24	0.64	5.04	0.504
24	The Contractors Financial difficulties	0.48	0.64	0.24	0.48	0.60	0.24	0.24	0.08	0.24	0.16	3.40	0.340
25	Non availability of required tools, equipment, Machineries, operator etc.	0.80	0.80	0.08	0.36	0.12	0.24	0.48	0.24	0.48	0.48	4.08	0.408
26	Workmanship or material not meet requirement of specifications	0.48	0.48	0.48	0.32	0.32	0.24	0.24	0.08	0.64	0.24	3.52	0.352
27	Expending the funds available on other project by Contractor instead of project under consideration	0.48	0.48	0.64	0.48	0.48	0.24	0.08	0.16	0.24	0.40	3.68	0.368
28	Weather conditions	0.64	0.24	0.60	0.60	0.32	0.16	0.08	0.08	0.16	0.08	2.96	0.296

29	Changes in Government regulations in the project zone during execution	0.80	0.08	0.24	0.48	0.24	0.16	0.08	0.08	0.40	0.08	2.64	0.264
30	Political Pressure/issues to initiate/revive/stop the project	0.80	0.24	0.36	0.08	0.48	0.08	0.16	0.16	0.08	0.40	2.84	0.284
31	Natural Disasters	0.36	0.08	0.40	0.08	0.20	0.12	0.08	0.08	0.40	0.16	1.96	0.196
32	Poor performance of Sub Contractors	0.48	0.80	0.80	0.48	0.24	0.24	0.08	0.08	0.08	0.40	3.68	0.368
33	Delay in administrative, designing, Architectural etc. approval	0.64	0.24	0.80	0.24	0.32	0.48	0.48	0.48	0.64	0.48	4.80	0.480
34	Consultant's lack of judgement and experience	0.64	0.08	0.48	0.24	0.64	0.48	0.48	0.48	0.24	0.40	4.16	0.416
35	Scope of Replacement of material and/ or procedure as per tender	0.80	0.08	0.40	0.40	0.40	0.32	0.24	0.24	0.24	0.08	3.20	0.320
36	Change in economic Conditions of Client/Contractor/Market in project zone	0.80	0.24	0.24	0.24	0.40	0.24	0.16	0.08	0.24	0.36	3.00	0.300
37	Shortage of Materials	0.80	0.48	0.24	0.12	0.48	0.36	0.16	0.48	0.24	0.48	3.84	0.384
38	Complexity of project (project type, project scale, project planning, designing etc.)	1.00	0.48	0.24	0.80	0.48	0.64	0.48	0.64	0.80	1.00	6.56	0.656
39	Inadequate definition of virtual/substantial and actual completion	0.64	0.24	0.48	0.48	0.64	0.80	0.36	0.48	0.24	0.36	4.72	0.472
40	Ineffective delay penalties	0.48	0.24	0.32	0.24	0.12	0.24	0.08	0.32	0.08	0.48	2.60	0.260
41	Legal disputes between agencies involved and client	0.48	0.48	0.08	0.16	0.40	0.24	0.08	0.16	0.08	0.24	2.40	0.240
42	Unfavorable contract clauses	0.48	0.24	0.40	0.24	0.60	0.48	0.24	0.12	0.24	0.24	3.28	0.328

Table 5.6 Ranking of Delay Sheet

Sl. No.	Probable Reasons/cause of Delay Factor/Respondents	Delay Index Score (Mean)	Rank
1	Time consume in taking approval for time extension, extra item, additional item, variation escalation etc.	0.748	1
2	Inadequate Planning	0.664	2
3	Complexity of project (project type, project scale, project planning, designing etc.)	0.656	3
4	Change in design by consultant/Design changes	0.636	4
5	Unavailability of skills (Shortage of skilled manpower)	0.562	5
6	Unrealistic Contract durations imposed by Client	0.504	6
7	Delay in administrative, designing, Architectural etc. approval	0.480	7
8	Inadequate definition of virtual/substantial and actual completion	0.472	8
9	Consultant's lack of judgement and experience	0.416	9
10	Shortage of Materials	0.412	10
11	Non availability of required tools, equipment, Machineries, operator etc.	0.408	11
12	Shortage of Materials	0.384	12
13	Errors and omissions in design	0.376	13
14	Expending the funds available on other project by Contractor instead of project under consideration	0.368	14
15	Poor performance of Sub Contractors	0.368	14
16	Client initiated variations	0.364	15
17	Selecting inappropriate contractors	0.362	16
18	Defective workmanship	0.356	17
19	Workmanship or material not meet requirement of specifications	0.352	18
20	The Contractors Financial difficulties	0.340	19
21	Scope of Replacement of material and/ or procedure as per tender	0.320	20
22	Change in economic Conditions of Client/Contractor/Market in project zone	0.300	21
23	Weather conditions	0.296	22
24	Lack of coordination between Client, Consultant and Contractor	0.284	23
25	Political Pressure/issues to initiate/revive/stop the project	0.284	23
26	Technology Change	0.280	24
27	Bureaucracy in bidding/tendering method	0.276	25
28	Changes in Government regulations in the project zone during execution	0.264	26

29	The objective of the project is not well defined	0.260	27
30	Ineffective delay penalties	0.260	27
31	Conflicts between project documents	0.248	28
32	Legal disputes between agencies involved and client	0.240	29
33	Long period between design and time of bidding/tendering	0.238	30
34	Safety Considerations	0.236	31
35	**Poor Investigation :** In terms of site condition	0.232	31
36	The scope of work for the contractor is not well defined	0.232	31
37	Undue intervention of Other organisations	0.232	31
38	Mode of financing and payment for completed work	0.224	32
39	Inappropriate contractual procedure	0.200	33
40	Natural Disasters	0.196	34
41	Local Residents	0.128	35

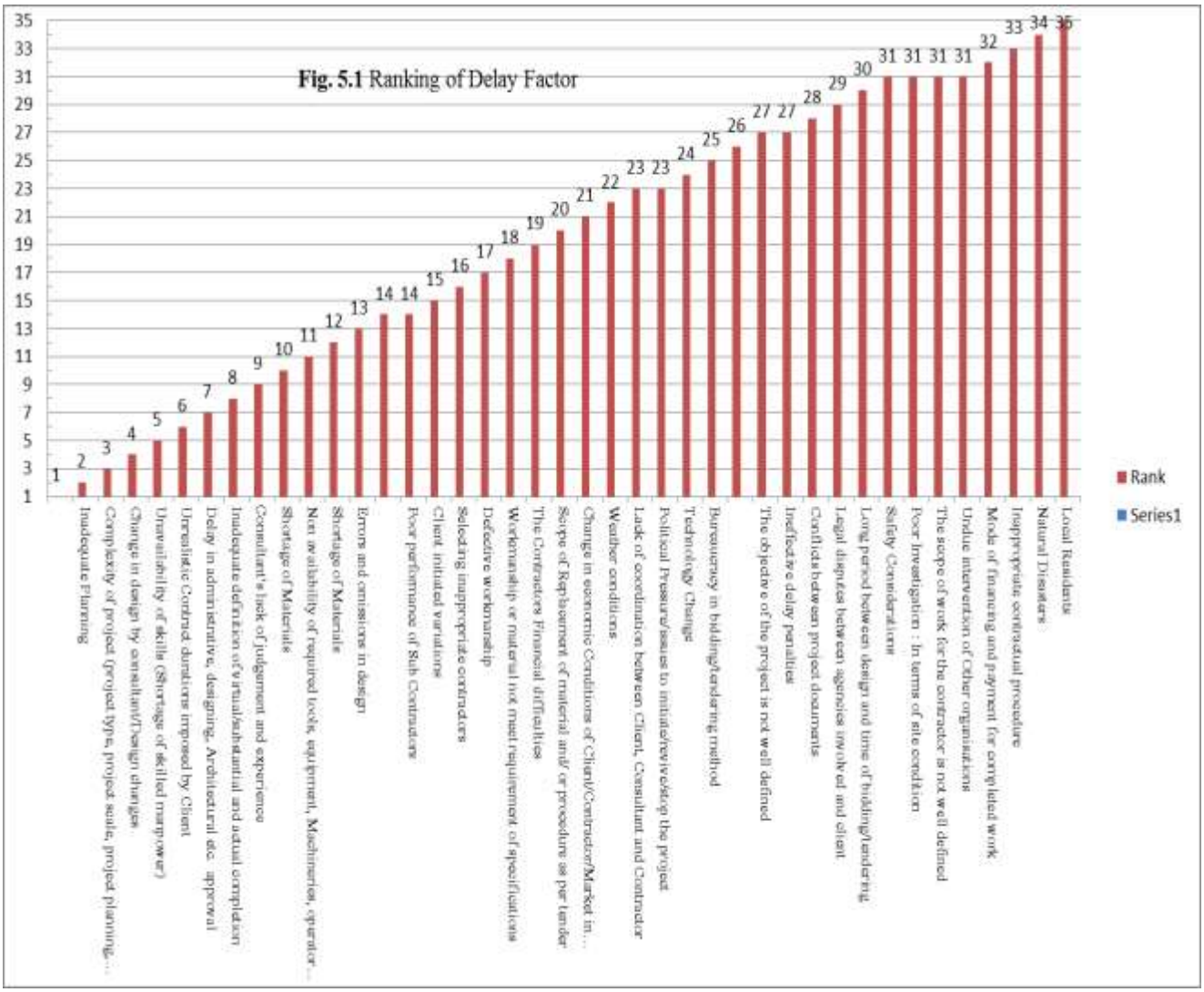
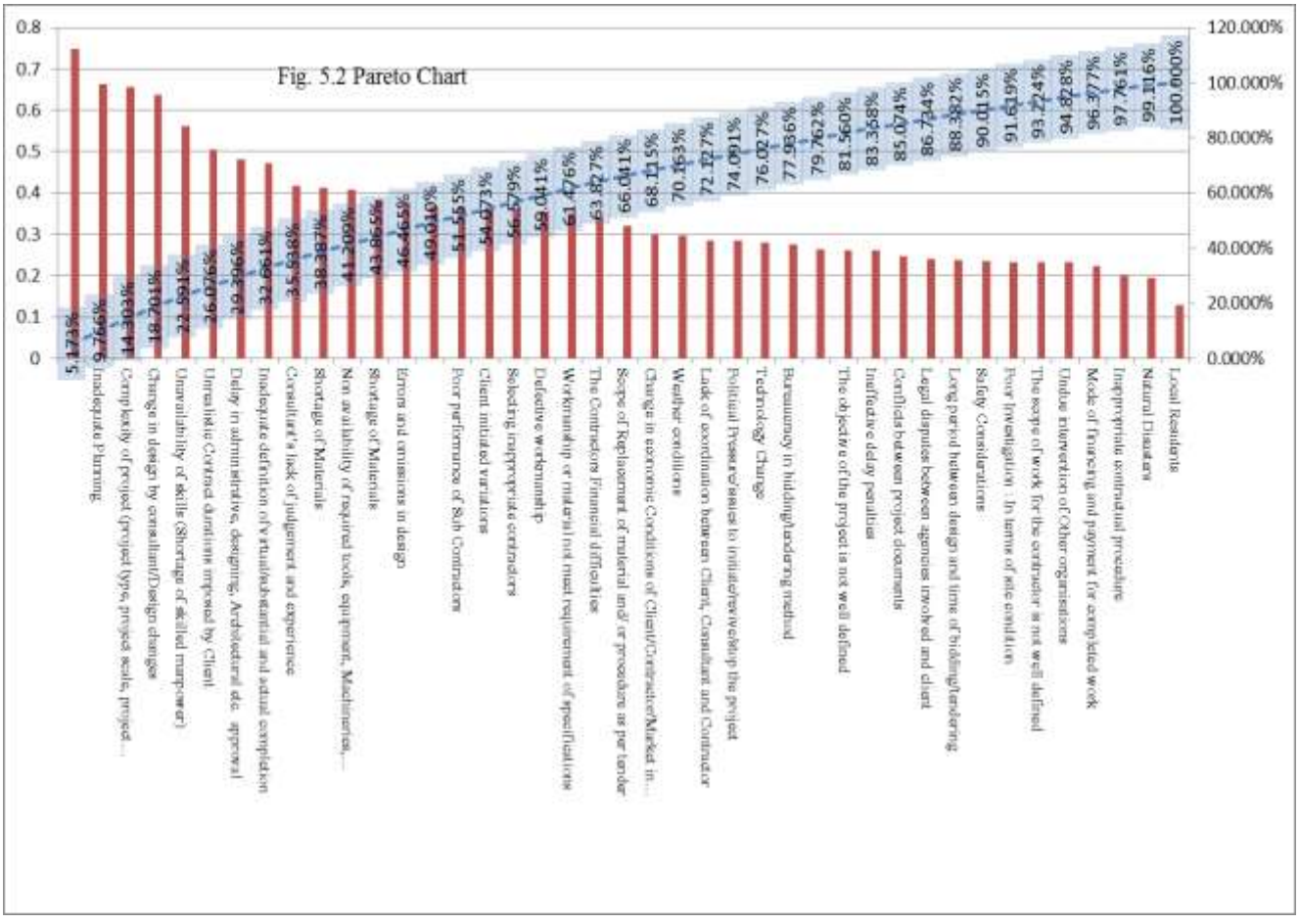


Table 7 Pareto analysis calculation sheet

Sl. No.	Probable Reasons/cause of Delay Factor/Respondents	Delay Index Score (Mean)	Cumulative Index Score	Cumulative %
1	Time consume in taking approval for time extension, extra item, additional item, variation escalation etc.	0.748	0.748	5.173%
2	Inadequate Planning	0.664	1.412	9.766%
3	Complexity of project (project type, project scale, project planning, designing etc.)	0.656	2.068	14.303%
4	Change in design by consultant/Design changes	0.636	2.704	18.701%
5	Unavailability of skills (Shortage of skilled manpower)	0.562	3.266	22.591%
6	Unrealistic Contract durations imposed by Client	0.504	3.770	26.076%
7	Delay in administrative, designing, Architectural etc. approval	0.480	4.250	29.396%
8	Inadequate definition of virtual/substantial and actual completion	0.472	4.722	32.661%
9	Consultant's lack of judgement and experience	0.416	5.138	35.538%
10	Shortage of Materials	0.412	5.550	38.387%
11	Non availability of required tools, equipment, Machineries, operator etc.	0.408	5.958	41.209%
12	Shortage of Materials	0.384	6.342	43.865%
13	Errors and omissions in design	0.376	6.718	46.465%
14	Expending the funds available on other project by Contractor instead of project under consideration	0.368	7.086	49.010%
15	Poor performance of Sub Contractors	0.368	7.454	51.555%
16	Client initiated variations	0.364	7.818	54.073%
17	Selecting inappropriate contractors	0.362	8.181	56.579%
18	Defective workmanship	0.356	8.537	59.041%
19	Workmanship or material not meet requirement of specifications	0.352	8.889	61.476%
20	The Contractors Financial difficulties	0.340	9.229	63.827%
21	Scope of Replacement of material and/ or procedure as per tender	0.320	9.549	66.041%
22	Change in economic Conditions of Client/Contractor/Market in project zone	0.300	9.849	68.115%
23	Weather conditions	0.296	10.145	70.163%
24	Lack of coordination between Client, Consultant and Contractor	0.284	10.429	72.127%
25	Political Pressure/issues to initiate/revive/stop the project	0.284	10.713	74.091%
26	Technology Change	0.280	10.993	76.027%
27	Bureaucracy in bidding/tendering method	0.276	11.269	77.936%
28	Changes in Government regulations in the project zone during execution	0.264	11.533	79.762%

29	The objective of the project is not well defined	0.260	11.793	81.560%
30	Ineffective delay penalties	0.260	12.053	83.358%
31	Conflicts between project documents	0.248	12.301	85.074%
32	Legal disputes between agencies involved and client	0.240	12.541	86.734%
33	Long period between design and time of bidding/tendering	0.238	12.779	88.382%
34	Safety Considerations	0.236	13.015	90.015%
35	**Poor Investigation :** In terms of site condition	0.232	13.247	91.619%
36	The scope of work for the contractor is not well defined	0.232	13.479	93.224%
37	Undue intervention of Other organisations	0.232	13.711	94.828%
38	Mode of financing and payment for completed work	0.224	13.935	96.377%
39	Inappropriate contractual procedure	0.200	14.135	97.761%
40	Natural Disasters	0.196	14.331	99.116%
41	Local Residents	0.128	14.459	100.000%
	Total	**14.459**		

- Draw the Pareto chart in which Risk index score are taken on primary vertical axis shown by vertical bars in descending order and cumulative percentage of relative index are taken on secondary vertical axis as shown by line graph in ascending order. It is shown in fig. 5.2.



IV. CONCLUSIONS

According to above-mentioned findings, following points can be recommended in order to minimize and control delays in construction projects:

(1)Time consume in taking approval for time extension, extra item, additional item, variation escalation and planning etc. Owner must pay progress payments as fast as possible on time periods in order not to delay the completeness of project work; (2) It is forbidden to pay any kind of bribes for any beneficiary; (3) Contractors should not be awarded the job in which they lack in sufficient expertise. They should gain necessary experience before bidding stage. Inadequate experience of contractor has the most importance on delay. Contractors with inadequate experience cannot plan and manage projects properly, and this may result in bad consequences; (4) Contractors should also pay more attention to prepare effective planning and scheduling. During construction, planning and scheduling may be revised, if necessary conditions occur. Only a well-planned and scheduled project can be well executed; (5) Site management and supervision should be made in a proper manner. Administrative staff should be assigned to make necessary arrangements to complete the project within specified time while satisfying required quality and estimated cost; (6) Owner may demand some design changes during construction, but to a limit having no adverse effect on the activities on the critical path; (7) Delivery of the construction equipment and materials on site should not be late in order to execute work in the planned order; (8) Generally in large projects, there may be many subcontractors working under main contractors. If the subcontractor is capable and reliable, the project can be completed on time as planned. If the subcontractor under performs because of inadequate experience or capability, project may face delay. High degree of sub-constructing may lead to high risk of delays; (9) Performing inspection and testing by consultant is an important activity during construction since lower inspection may result in lower quality of work; (10) The quality and experience of labor supply may have major impact on projects. Unqualified labor may lead to inefficient work and may cause accidents during construction; (11) Change order is work added to or deleted from the original scope of work of a contract, which may alter the original contract amount or completion date. Change orders often lead to claims and disruption of work due to inadequate analysis of the project in its initial stages. Also, contract conditions, corresponding to change orders, should be carefully understood; (12) Delay in site delivery, approving design documents, and progress payments are delay factors caused by owner. Site should be delivered as soon as possible after project is awarded. Approval of design documents should not be delayed, since it could delay the progress of work. Progress payments should be made on time to contractor in order to finance the work; (13) Owner should be as fast as possible indecision making in order not to hinder the work to complete the project on time; (14) Since there are many parties involved in a project, communication and coordination with other parties are a very crucial factors to achieve the project on time. Effective communication can alleviate most of delay factors. Proper communication and coordination channels between various parties should be established during each phase of construction. Any problem with communication may result in severe misunderstanding and therefore delays in execution of the project.

Project Management

To improve delay control in construction projects, the influence of the main factors affecting it must be identified and recognized. This research has identified and, based on the quantified relative importance indices, determined the influence ranks of ninety-nine (99) factors causing delay in construction projects.

The explored factors were classified under the following nine (9) primary classifications:

(1) Consultant related delay factors; (2) Contractor related delay factors; (3) Design related delay factors; (4) Equipment related delay factors; (5) External related delay factors; (6) Labor related delay factors; (7) Material related delay factors; (8)Owner related delay factors; and (9) Project related delay factors.

To study the effect of participants' experience on the obtained results, the results were grouped under experience based groups of the participants and professional cadre of respondents. The results were compared by studying all participants to scope with all factors causing delay in construction projects. The paper then quantified relative importance indices of delay factors and demonstrated the ranking of the factors and groups according to their importance level on delay.

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