



## Detailed Study on Critical Delay Factors Affecting the Construction Industry

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**ABSTRACT:** The Construction industry of India is an important indicator of the growth as it generates investment opportunities across various related sectors. Delay in construction projects is considered one of the most common problems causing a multitude of negative effects on the construction projects. Construction delays can be defined as the late completion of work compared to the planned schedule or contract schedule. Construction delays can be minimized only when their cause are identified. The objective of this study was to identify the major causes of construction delays. In this context the management of the delay may influence the financial performance of the project, since the overall value of contractual penalties may exceed ten percentage or more than that of the project budget.

This study was carried out based on literature review and a questionnaire survey. The data for this study will be gathering through a detailed questionnaire survey. The questionnaire consists of total factors of seventeen group were contributed to the causes of construction delay based on literature review. In that seventeen groups have been consist of total 50 factors for delay. The questionnaire form is forwarded to various construction industries through email and in personal. The objectives of the study were successfully achieved. The top five most important factors that contributed to the causes of delays were Delay in financial support by owner to the contractor (Stage by stage payment), Design errors made by designers due to unfamiliarity with local conditions & environment, Equipment allocation problem, Poor site management & Inaccurate site investigation, Fluctuation of prices. To minimize delay in construction projects it has been identified that the top three effective methods of minimizing construction delays includes: site management and supervision, effective strategic planning, and clear information and communication channels.

**Keywords:** Construction delay, Delay causes, Mean score value, Quantification, Questionnaire survey, Ranking.

### 1. Introduction

Delays are one of the biggest problems in construction firm's face. Delay can lead to many negative effects such as lawsuits between owners and contractors, increased costs, loss of productivity and revenue, and contract termination. According to the World Bank (2007), for many projects completed worldwide between 1999 - 2005, the overrun varied between 50% - 80%.

The construction companies in many countries around the world experience significant delay. In the past few years, the number of claims submitted to the American Arbitration Association (AAA) reached almost 25% of the 1.7 million claims submitted over the past 74 years. In the United Kingdom (U.K), a 2001 report by the National Audit Office, entitled "Modernizing Construction", revealed that 70% of the project undertaken by Government department and agencies were delivered late, and a recent research by Building Cost Information Service (BCIS) found that nearly 40% of all studied project had overrun the contract period.

In India, a study conducted by the infrastructure and Project Monitoring Division of the Ministry of Statistics and Programmed Implementation in 2004 reported that out of 646 central sector projects costing about 2500Cr, approximately 40% are behind schedule, with delay ranging from 1-252 months. In the United Arab Emirates (UAE), where construction contributes 14% to the gross domestic product (GDP).

Delay could be defined as the time over run either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects.

Delay in construction project is considered one of the most common problems causing a multitude a negative effect on the project and its participating parties. Therefore, it is essential to identify the actual causes of delay in order to minimize and avoid the delays and their corresponding expenses.

Delays in construction can cause a number of changes in a project such as late completion, lost productivity, acceleration, increased costs, and contract termination. The party experiencing damages and the parties responsible for them in order to recover time and cost.

## 2. Literature Review

Wail Menesi (2007) identified two reason for causing of waste, i) Not listening and ii) Not speaking. Lack of proper communication leads to waste. These causes of wastes are due to poor communication between the client and the contractor. Not asking includes fear of asking top level managers for clarifications on how exactly the work is to be done [1].

Megha Desai & Rajiv Bhatt (2013) carried out a study to identify the main causes of delay in construction projects in Egypt from the point of view, in that financing by contractor during construction, delays in contractor's payment by owner, design changes by owner or his agent during construction, partial payments during construction, and non-utilization of professional construction/contractual management are the major causes of delay [2].

Frank D.K. Fugar (2010) has done a study on delays in building construction projects in Ghana. 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 [3].

Aibinu et.al (2002) studied effects of delay in Nigerian construction sector and concluded time and cost overrun to be most frequent causes of delay, one of the primary causes of delay has been attributed to contractors [4].

Tommy Y. Lo et al (2006), revealed that Natural ground conditions, poor Communication, Manpower problem, Insufficient knowledge on work are lead the delay in construction project in Hong Kong region [5].

## 3. Aim and Objectives of the Study

Construction is a dynamic, competitive, ever changing and challenging industry. This research was aimed at identifying the major causes of delay, effect of delay and methods of minimizing delays in construction. To achieve the aims, objectives have been identified as following:

- a) To identify the main reasons of construction delay.
- b) To identify the effect of construction delay.
- c) To identify the methods of minimizing construction delay.

## 4. Effects of Delay

The effects of construction delays on project delivery will cause the following effects. The six effects of delay identified were:

- a) Time overrun
- b) Cost overrun
- c) Dispute
- d) Arbitration
- e) Total abandonment
- f) Litigation

## 5. Questionnaire Design

A questionnaire survey was designed based on the objectives of the study, which are causes of construction delays. A questionnaire survey was developed to get the opinion and understanding from the experienced respondents regarding to the construction delays problem. The questionnaires are all classified into 3 sections:

- a) SECTION A: Company and respondent profile
- b) SECTION B: Construction delay factor
- c) SECTION B: Construction delay factor construction

## 6. Questionnaire Preparation

Based on the literatures and factors considered, a Questionnaire was designed as a measurement tool for delay in construction. The above mentioned seventeen factors were adapted to measure delay on construction project. The Questionnaire consists of 50 questions relating factors influencing delay. Also, the respondents were asked to rate their level of argument according to 5 point scale. To protect privacy, respondents were guaranteed with confidentiality and nondisclosure of their responses.

## 7. Mode of Data Collection

The questionnaire has been collected on following two modes

- Direct Interviews
- Through Online

In that online data collection method jotform website has been used for questionnaire survey. The following link was created by using the jotform to send the questionnaire through online for various construction companies around India.

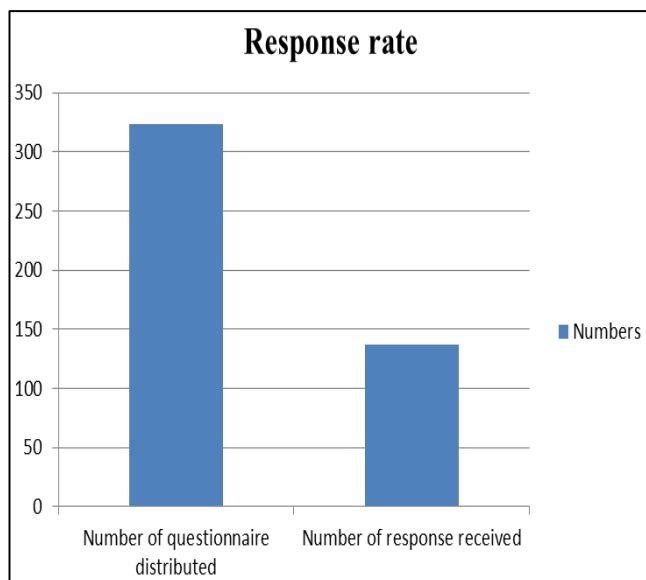
## 8. Response Rate

In this survey there are 324 questionnaires were distributed to various construction companies to the targeted respondent in order to identify the most important factors that cause delay. The questionnaire was completed by

experienced directors, project managers, projects engineers, site managers. In those 137 responses has been received. The response rate of this survey was 42.8%. The response rate will be explained in following table 1 and chart.

**Table.1** Response Rate

Description	Numbers
Number of questionnaire distributed	324
Number of response received	137
Response rate (%)	42.28



## 9. Analysis of Results

The objective of conducting the analysis for this section is to establish the factors under the groups of causes identified from the literature review and the ranking according to their significant influence towards construction project delays. This analysis is used for identifying the major factors that contributing the construction delay and improved efficiency of project management is shown in Table 2.

## 10. Demographic Profile of the Respondent

**Table.2** Demographic Profile of the Respondent

S. No	Demographic profile variable	Category	No. of Respondent	Percentage
1	Age	Less than 29 years	38	27.7

		30-39 years	52	38.0
		40-49 years	36	26.3
		Above 50 years	11	8.0
2	Experience in construction field	Less than 2years	2	1.5
		2-5 years	35	25.5
		6-10 years	44	32.1
		11-15 years	23	16.8
		Above 15 years	33	24.1
3	Year of establishment of organization	Less than 5 years	4	2.9
		5-10 years	22	16.1
		11-15 years	81	59.1
		Above 15 years	30	21.9
4	Type of project undertaken	Housing Project	77	56.2
		Public utility Project	23	16.8
		Industrial project	32	23.4
		Others	5	3.6
5	Company annual work volume	Above Rs100 crores	36	26.3
		Above Rs100 crores	48	35.0
		Above Rs100 crores	37	27.0
		Above Rs100 crores	16	11.7

## 11. Reliability Analysis

Reliability is concerned with the extent to which any measuring procedure yields the same results on repeated trials. Cronbach's alpha is designed as a measure of internal consistency. A rule of thumb that applies to most situation is alpha greater than 0.7. The Cronbach's alpha for this research is **0.848**, where number of Cases = 137 and number of Items = 50. So, the research is an acceptable one., reliability statistics is shown in Table 3.

**Table.3** Reliability Statistics

Cronbach's Alpha	No of Items
.848	50

## 12. Mean and Rank

The identified delay factors were ranked based on the mean value of the respondent opinion. Table 4 will give the complete detail about mean and ranking of delay factors in construction industry.

**Table.4** Mean and Rank

Delay Factors	Mean	Rank
Delay in financial support by owner to the contractor (Stage by stage payment)	4.64	1
Design errors made by designers due to unfamiliarity with local conditions & environment	4.63	2
Equipment allocation problem	4.62	3
Poor site management & Inaccurate site investigation	4.61	4
Fluctuation of prices	4.58	5
Rework due to errors	4.53	6
Complexity of project design	4.46	7
Legal disputes	4.46	7
Slowness in decision making	4.31	9
Obsolete technology	4.23	10
Geological problems on site	4.18	11
Non availability of bank loan	4.18	11
Insufficient data collection and survey before design	4.10	13
Changes in government regulations and laws	4.10	13

Strike	4.06	15
Personal conflicts among workers	4.01	16
Lack of data base in estimating activity duration and resources	4.01	16
Lack of communication between parties	3.99	18
Project complexity	3.99	18
Accidents during construction	3.97	20
Design changes by owner or his agent during construction	3.91	21
Preparation and approval of shop drawings	3.88	22
Shortages of materials on site or market	3.87	23
Equipment failure or breakdown	3.86	24
Improper project feasibility study	3.80	25
Lack of incentives for contractor to finish ahead of schedule	3.80	25
Unskilled equipment operators	3.75	27
Late delivery of material	3.74	28
High waiting time for availability of work teams	3.72	29
Lack of experience of consultant in construction projects	3.69	30
Receiving materials that do not fulfill project requirements	3.63	31
Lack of experience of owner in construction projects	3.58	32
Lack of coordination among project-teams	3.48	33
Application of safety aspect	3.45	34
Underestimation of time of completion	3.43	35
Inaccurate bills of quantities	3.42	36
Shortage of unskilled & skilled labour	3.28	37
Wrong selection of type /capacity of equipment	3.27	38
Inadequate modern equipment	3.26	39
Discrepancy between design specification and building code	3.21	40
Application of quality control based	3.12	41

on foreign specification		
Unclear and inadequate details in drawings	3.09	42
Defective materials provided by client	3.08	43
Imbalance in the risk allocation	3.00	44
Bad weather conditions /Natural disasters (flood, earthquake)	2.96	45
Choice of wrong construction method	2.95	46
Delays in obtaining approval from municipality	2.92	47
Lack of program on works	2.72	48
Delay in performing final inspection & certification by a third party	2.56	49
Poor material procurement planning	2.55	50

### 13. Factor Analysis

**Table.5** Kmo and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.775
Bartlett's Test of Sphericity	Approx. Chi-Square	3.989E3
	df	1225
	Sig.	.000

The generated score of KMO is 0.775, reasonably supporting the appropriateness of using factor analysis. As per Kaiser Level, 0.775 is middling, almost meritorious. Table 5 displays the Kmo and Bartlett's test.

### 14. Principal components method

The factor analysis is carried out through principal components method with varimax rotation.

**Table .6** Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.143	22.286	22.286	11.143	22.286	22.286	9.376	18.75	18.753
2	4.540	9.081	31.367	4.540	9.081	31.367	3.286	6.573	25.325
3	3.030	6.060	37.426	3.030	6.060	37.426	3.106	6.213	31.538
4	2.372	4.745	42.171	2.372	4.745	42.171	2.996	5.992	37.530
5	2.232	4.465	46.635	2.232	4.465	46.635	2.814	5.629	43.159
6	1.919	3.838	50.474	1.919	3.838	50.474	2.457	4.913	48.072
7	1.747	3.493	53.967	1.747	3.493	53.967	1.836	3.672	51.744
8	1.541	3.082	57.048	1.541	3.082	57.048	1.642	3.283	55.027
9	1.526	3.053	60.101	1.526	3.053	60.101	1.627	3.254	58.281
10	1.365	2.730	62.831	1.365	2.730	62.831	1.492	2.983	61.264
11	1.261	2.521	65.352	1.261	2.521	65.352	1.437	2.874	64.139
12	1.157	2.315	67.667	1.157	2.315	67.667	1.386	2.772	66.910
13	1.110	2.220	69.886	1.110	2.220	69.886	1.260	2.520	69.431
14	1.024	2.049	71.935	1.024	2.049	71.935	1.252	2.505	71.935
15	.948	1.896	73.832	-	-	-	-	-	-

16	.929	1.858	75.690	-	-	-	-	-	-
17	.818	1.637	77.327	-	-	-	-	-	-
18	.802	1.605	78.932	-	-	-	-	-	-
19	.768	1.537	80.468	-	-	-	-	-	-
20	.702	1.404	81.873	-	-	-	-	-	-
21	.666	1.332	83.205	-	-	-	-	-	-
22	.642	1.284	84.489	-	-	-	-	-	-
23	.584	1.167	85.656	-	-	-	-	-	-
24	.554	1.109	86.765	-	-	-	-	-	-
25	.533	1.067	87.832	-	-	-	-	-	-
26	.506	1.011	88.843	-	-	-	-	-	-
27	.485	.970	89.813	-	-	-	-	-	-
28	.444	.888	90.701	-	-	-	-	-	-
29	.413	.826	91.527	-	-	-	-	-	-
30	.397	.795	92.321	-	-	-	-	-	-
31	.358	.717	93.038	-	-	-	-	-	-
32	.332	.664	93.702	-	-	-	-	-	-
33	.314	.628	94.330	-	-	-	-	-	-
34	.282	.563	94.893	-	-	-	-	-	-
35	.257	.513	95.406	-	-	-	-	-	-
36	.247	.495	95.901	-	-	-	-	-	-
37	.237	.473	96.374	-	-	-	-	-	-
38	.218	.437	96.811	-	-	-	-	-	-
39	.207	.414	97.225	-	-	-	-	-	-
40	.201	.402	97.627	-	-	-	-	-	-
41	.185	.371	97.998	-	-	-	-	-	-
42	.173	.347	98.345	-	-	-	-	-	-
43	.148	.297	98.642	-	-	-	-	-	-
44	.136	.273	98.915	-	-	-	-	-	-
45	.126	.252	99.166	-	-	-	-	-	-
46	.117	.235	99.401	-	-	-	-	-	-
47	.092	.183	99.584	-	-	-	-	-	-
48	.081	.163	99.747	-	-	-	-	-	-
49	.072	.144	99.891	-	-	-	-	-	-
50	.055	.109	100.000	-	-	-	-	-	-



It can be concluded that these 14 factors are extracted from the 50 variables explaining about 71.935% of variance.

### Labeling of Factors

Based on the factor analysis the causes of delay in construction industry have been grouped into fourteen factors as follows.

#### Factor-1 (Problem)

In the first factor can be labeled as “Problem” which consists of fourteen causes of delay in construction industry.

1. Changes in government regulations and laws
2. Strike
3. Personal conflicts among workers
4. Unskilled equipment operators
5. Equipment failure or breakdown
6. High waiting time for availability of work teams
7. Shortages of materials on site or market
8. Obsolete technology
9. Lack of communication between parties
10. Legal disputes
11. Wrong selection of type / capacity of equipment
12. Accidents during construction
13. Lack of data base in estimating activity duration and resources
14. Lack of coordination among project-teams

#### Factor-2 (Wrong decision)

In the second factor can be labeled as “Wrong decision” which consists of four causes of delay in construction industry.

1. Imbalance in the risk allocation
2. Defective materials provided by client
3. Choice of wrong construction method
4. Application of quality control based on foreign specification

#### Factor-3 (Shortage)

In the third factor can be labeled as “Shortage” which consists of five causes of delay in construction industry.

1. Underestimation of time of completion
2. Inadequate modern equipment
3. Delay in obtaining approval from municipality

4. Discrepancy between design specification and building code
5. Shortage of unskilled & skilled labour

#### Factor-4 (Quality and Quantity)

In the fourth factor can be labeled as “Quality and Quantity” which consists of four causes of delay in construction industry.

1. Lack of experience of owner in construction projects
2. Lack of experience of consultant in construction projects
3. Late delivery of material
4. Receiving materials that do not fulfill project requirements

#### Factor-5 (Lag of technology)

In the fifth factor can be labeled as “Lag of technology” which consists of three causes of delay in construction industry.

1. Design errors made by designers due to unfamiliarity with local conditions & environment
2. Poor site management & Inaccurate site investigation
3. Fluctuation of prices

#### Factor-6 (Design)

In the sixth factor can be labeled as “Design” which consists of three causes of delay in construction industry.

1. Complexity of project design
2. Design changes by owner or his agent during construction
3. Insufficient data collection and survey before design

#### Factor-7 (Delay)

In the seventh factor can be labeled as “Delay” which consists of three causes of delay in construction industry.

1. Rework due to errors
2. Slowness in decision making
3. Delay in financial support by owner to the contractor

**Factor-8 (Improper focus)**

In the eighth factor can be labeled as “Improper focus” which consists of three causes of delay in construction industry.

1. Improper project feasibility study
2. Lack of incentives for contractor to finish ahead of schedule
3. Geological problems on site

**Factor-9 (Huge work)**

In the ninth factor can be labeled as “Huge work” which consists of two causes of delay in construction industry.

1. Project complexity
2. Inaccurate bills of quantities

**Factor-10 (Technology)**

In the tenth factor can be labeled as “Technology” which consists of two causes of delay in construction industry.

1. Application of safety aspect
2. Equipment allocation problem

**Factor-11 (Third party)**

In the eleventh factor can be labeled as “Third party” which consists of two causes of delay in construction industry.

1. Bad weather conditions /Natural disasters (flood, earthquake)
2. Preparation and approval of shop drawings

**Factor-12 (Inadequate)**

In the twelfth factor can be labeled as “Inadequate” which consists of two causes of delay in construction industry.

1. Non availability of bank loan
2. Unclear and inadequate details in drawings

**Factor-13 (Lagging)**

In the thirteenth factor can be labeled as “Lagging” which consists of one causes of delay in construction industry.

1. Lack of program on work

**Factor-14 (Poor management skill)**

In the fourteenth factor can be labeled as “Poor management skill” which consists of two causes of delay in construction industry.

1. Poor material procurement planning
2. Delay in performing final inspection & certification by a third party

**16. Conclusion and Recommendation**

Delays occur in every construction project and the magnitude of these delays varies considerably from project to project. Some projects are only a few days behind the schedule; some are delayed over a year. So it is essential to define the actual causes of delay in order to minimize and avoid the delays in any construction project.

There are three objectives of this study which have been achieved. The first objective was to identify the major causes of delays, the effects of delays, and the methods of minimizing delays in construction projects.

**Major Causes of Delays**

The first objective of the study has been successfully identified. A total of fifty factors that causes delay were identified. Some of these factors were the top ten most important factors that contributed to the causes of delays include: Delay in financial support by owner to the contractor (Stage by stage payment), Design errors made by designers due to unfamiliarity with local conditions & environment, Equipment allocation problem, Poor site management & Inaccurate site investigation, Fluctuation of prices, Rework due to errors, Complexity of project design, Legal disputes, Slowness in decision making, Obsolete technology.

**Common Effects of Delays**

The second objective of this research was to identify the common effects of delays in construction projects. This objective has been success fully achieved. There are six factors that affect delays in construction project which includes: time overruns, cost overrun, dispute, total abandonment, arbitration, and litigation. In that time overrun and cost overrun were two most common effects of delays in construction project.

**Methods of Minimizing Construction Delays**

The third objective of this study was to identify the effective methods of minimizing delays in construction



project has been successfully achieved. The most effective methods of minimizing delays includes: site management and supervision; effective strategic planning; clear information and communication channels; collaborative working in construction; proper project planning and scheduling; frequent coordination between the parties involved; complete and proper design at the right time; use appropriate construction methods; accurate initial cost estimates; proper material procurement; and proper emphasis on past experience.

### Recommendation

From this study, some recommendations are given as follows:

1. A construction delay occurs mostly during the construction phase. This is mostly caused by the poor labor's skill, supervisor not able to coordinate the project very well and also low quality of material used in the construction projects. Therefore, contractor need to give awareness on these three factors stated above in order to minimize the construction delays' problems.
2. Low technical and managerial skills of contractors are the problems that faced by contractors which might cause construction delays. Therefore, contractors should organize some training programs for their workers in order to update their knowledge and improve their management skill.
3. Due to the dynamic nature of project environments, it is inevitable that conflicts among the project team will arise. All project participants should recognize that conflict are inevitable and actually can be beneficial if resolved in an appropriate manner. Therefore, the conflict management is a need to produce a good working environment.

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