

Assessment of Factors Causing Delay in Construction Projects

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Abstract - Construction industry is the backbone for development of any country across the globe. In all the countries, the most common problem in construction industry is deviation from a planned time schedule. The most common problem at construction sites is delays, i.e. time overrun to complete the project. There are various factors at construction sites which affect systematic flow of work resulting in time overruns. Delays may be site dependent and vary in severity for different project activities. However, one can find out ways to minimize such delay by identifying the causes and effects of delays. This paper focuses on finding out the most important factors causing delays in construction project by conducting a questionnaire survey with the various contractors, clients and consultants. By random sampling technique the questionnaire survey concluded that there are 38 major causes of delay and 6 effects of delays are prominent. Out of which the top 10 causes of delays have been shortlisted with respect to Mumbai construction industry and to avoid delays in construction projects certain remedies are suggested. The second objective of the paper is to specifically study the causes of delays on site and its effects on the project using MSP i.e. Microsoft Project, delays of sub activities are measured. The assigning of resources educate about the project in terms of cost. Furthermore the rank of each delay factor is assigned through the questionnaire survey and the actual data collected on site through pergola task. The spearman rank correlation has been used to compare the parameters to find out whether the delay factors are dependent or independent of each other.

Key Words: *Causes of Delay, Effects of Delays, Mumbai, and Construction Projects, MSP.*

I. Introduction:

Construction activities have been initiated ever since the dawn of civilization. Construction projects are the backbone for development of any country; it is the second largest industry after agriculture in India. It is different from manufacturing because it does not typically take place at a particular location or for a known client. The most important factor for the success of construction project is finishing the project on time. However, the problem of delay in construction projects is a global phenomenon. Delay could be defined as prolonging the time duration in completion of the project.

One of the most important aspects of construction projects is project management which includes proper scheduling, controlling and implementing the activities. There should be proper arrangement of activities and a proper plan for good construction projects. The plan plays a vital role in specifying the budget of the project.

Azhar and Farouqui (2008) observed that delays in construction projects are a global phenomenon in which the time and cost overrun are common and particularly severe in developing countries". Delays of the project are the most common problem in the construction industry. However the impact of the delay may vary depending on the nature, time of construction and importance of the project etc. Generally when the project gets delayed it results in extending the delivery of the project, so in that case the owner/client has to suffer from arbitration, litigation, and penalties, etc. The delay of project may also result in acceleration of the progress of the project in order to deliver it on time, which results in additional cost and also a compromised quality of work. (Dinesh Kumar 2016)

Timely completion of a project is a key indicator of its success. It is essential to finish the project on time to prevent loss of money. The delay in project may impair the project cost which has to be compensated by the contractor in the form of liquidated damages. Delay can be caused by the employer, the contractor or the third party. In order to keep the project on schedule it is very important to use sound strategies, good practices and careful judgments.

Alade (2016) have classified delays are:

- A. Excusable Delays** – These are those types of delays that are not attributable to the contractor's actions. The contractor may be given some time extension in such delays.
- B. Non Excusable Delays** – Such delay presents no entitlement to a time extension for the contractor if the delay can be proved to have affected the whole project. However the owner may have to bear the losses.
- C. Compensable Delays** – In such types of delays the contractor will receive payment due to additional cost of delay and may also receive a time extension for proper performance.
- D. Concurrent Delays** – These delays are when two or more delays happen at the same point of time.

The paper will focus on giving a perception into the causes of delays. The main centre of interest in this paper is to improve the performance in construction industry and find out new ways and methods in minimizing the causes and effects of delays. A survey is done for various construction sites in Mumbai region to find the causes of delays. Then a Scientific analysis is done to rank the delays in construction. Also the pergola activity is studied in detail with respect to various starting and finishing time of its sub activities. The strongest factor for the delay is identified with on site observation.

II. Literature Review:

The construction industry plays a vital role to improve the human lifestyle and sustainability. Last past decades many researcher has investigated the area of delay, as each site has unique reasons of delay. Delays are nothing but prolonging the time duration of the project that results into compromising the profit by client. Sometime project doesn't start with adequate planning that turns the project to delay, else sometime due to uncertain events or unexpected things that turn the project into delay. Various Researchers has studied the area of causes and effects of delays they are described below.

Gunduz (2009) identified delay factor and scrutinized those delay factor. In Turkish construction project 83 different delays were identified and visualized in Ishikawa diagram. The RII method was used and ranking of the factors were done as per their level of delay.

Kazaz *et al.* (2012) focused on 34 factors causing delays. A questionnaire survey was applied to 71 construction companies in Turkey, and the outcomes were evaluated.

Pourroostam and Ismail (2012); focused on the causes and effects of construction in Iranian Projects. They have identified 10 significant causes of delay ; delay of payment , rework by client during execution, low capability of managing site , lack of decision making , poor finance status of contractor , delay in approving design document by client , Issues with sub contractor , uncertain planning of project by contractor , bad weather. There are certain effects that has observed in this study, such as Time overrun, cost overrun, Disputes, Total abandonment, arbitration, litigation.

Braimah (2013); remarked that delays are the main reason of conflict between the participant parties. This researcher investigated on various delay analysis technique, the idea of this technique is very useful in construction project. As each project has its own reason for delay, as per the suitable technique for delay it can be overcome by applying any delay analysis technique which is suitable for particular project.

Heravi *et al.* (2014) investigated the execution phase on the construction project. Most of time execution phase has a negative effect on project, which is accompanied by disputes, claims or conflicts. The quest of this work is to build a framework for foresee the changes in project by studying the implementation process.

Larsen *et al.* (2015) studied the factors which construction project manager face in practical experience. As a result 26 factors of delays were identified and later those factors were ranked using RII and tested for significance difference using Friedman test.

Islam *et al.* (2015) studied the construction delays in Bangladesh. In this study the owner, consultant and the contractor were asked to find the most important causes of delay. 79 factors were discovered out of which the most common ones include lack of experience construction manager, lowest bidder selection, fund shortage by owner, project site constraints, improper planning and scheduling, contractor's excessive workload, lack of proper management by both owner and contractor especially poor site management by contractor, lack of skilled workers, site constraints, contractor's cash flow problem during construction, escalation of resources price, contractor's excessive workload etc

Alade *et al.* (2016) identified various causes and effects of delay in construction projects. Through this study top 30 causes of delays were identified with the help of questionnaire survey.

Bagaya *et al.* (2016), focused on the severity and frequency of the causes of delays on construction site. The research was conducted on various construction sites by conducting a questionnaire survey to get the causes of schedule delay by 140 experts from Burkina faso construction project.

Pawar and Prof. Dange (2017) investigated the delay analysis in construction, it also explained how interruption of time affects the project, as time got affected simultaneously it affects the cost of the project.

Zakaria *et al.* (2017); investigated the CPM /PERT method in which it said; CPM/PERT is an efficient method which can be used in construction project, it aid to give the answer to the main question, like how many days will be required to complete the project. And what are the causes of delay, how many days are require completing each activity.

Mohammadsorouh Tafazzoli *et al.* (2017) studied the most common factor for causing delays through literature review, then, a questionnaire was distributed through which various causes of delays were found with the help of relative importance index.

Serdar Durdyev *et al.* (2017); remarked about certain factors which cause delays, Such as; Shortage of material on site, unrealistic project scheduling, late delivery of material, shortage of skilled labor, complexity of project, labor absenteeism, rain effect on construction activity, design changes, delay by subcontractor, accident due to poor site safety. The Questionnaire were distributed to many construction parties, many respondents ranked the shortage of material on site and late delivery of material as the first and third most influential causes of delay on construction project.

III. Methodology

For this study the collection of data was done in two stages. The initial stage was collection of primary data which was done through a questionnaire survey. The questionnaire was focused at some contractors Clients and consultant in construction projects. The second stage was the collection of secondary data that was obtained from the practical experience from pergola activity. From the above approach some of the causes and effects of delays that are generally encountered in a construction project were acknowledged. A questionnaire was then made to go through the clients view, simultaneously taking consultants, and contractors point of view and using relative importance index method (RII), causes and effects of delay in the construction industry were

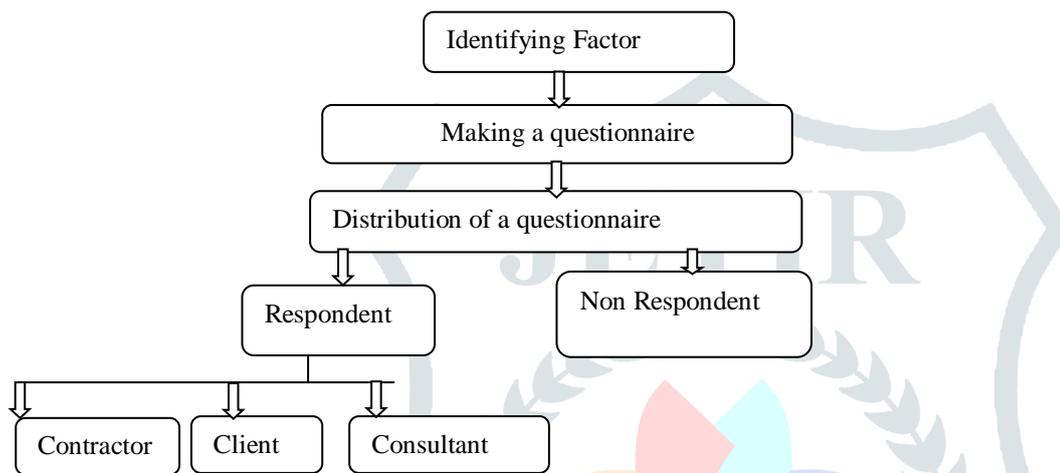
identified. The questionnaire and the activity of pergola is combined, with the help of spearman rank co relation both the cases are merged and the value of co-relation between them is obtained. Table 1 shows the distribution of questionnaire to various project stakeholders for gathering their views or opinions on causes and effects of delays through their experience.

Source: (Dinesh Kumar R. Issue 03, Vol.04 April 2016)

TABLE 1. Distribution of Questionnaire

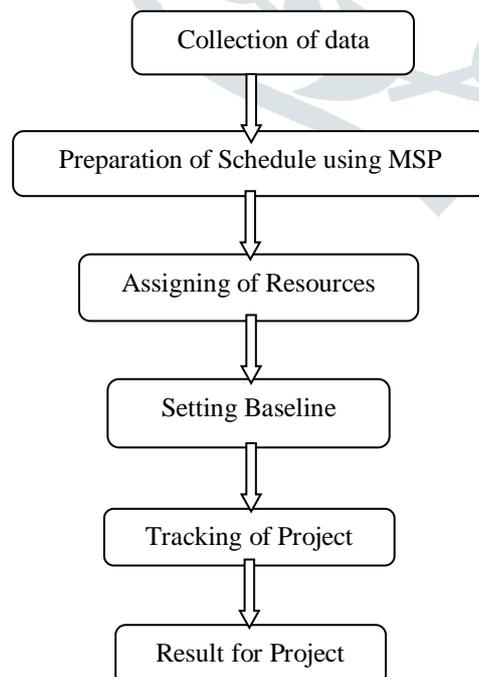
	Frequency	Percent	Valid Percent	Cumulative Percent
Contractor	30	37.5	37.5	37.5
Consultant	20	25	25	62.5
Client	30	37.5	37.5	100
Total	80	100	100	

Fig1 Flow chart of Questionnaire



Through questionnaire survey the most common factor identifying the delays in stakeholders are analyzed, then questionnaire survey is made considering each aspect of delay with respect to their stakeholders. Questionnaire later distributed to the respected respondent, this survey helps us to know which delay factor is affecting the most, amidst them the top 10 causes of delayed were identified with the help of relative importance index method (RII).

Fig 2 Flow Chart for Methodology of project



In the above flow chart each step of the methodology is explained the initial stage is collection of data, in that all the required data to implement the pergola activity has been collected such as R.C.C drawing, architectural drawing and so on. With the help of MSP all the activities are arranged sequentially, it helps to breakdown each sub activity. After assigning the resources it educate

whether the given task is in our budget or not. After setting of baseline, it helps to compare the actual work and the planned work, late completion of a task easily identified through tracking of a project.

IV. Data collection and Analysis:

Towhidd pouroostam and Amiruddin Ismail (Oct.2012) has determined the causes and effects of delay according to contractor, consultant and client using the relative importance index method

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

Where: RII= Relative Index; W= Weight given to each factors of delay by the respondents (ranging from 1 to 5); A= the top weight (i.e. 5 in this case); N= Sample size (i.e. total number of respondents).

Furthermore, the Spearman’s rank correlation was used to compute the relationship amidst different parties or factors about the strength and direction of the relationship. In particular, it was used to show the degree of agreement amidst the different parties. This was obtained using the formula:

$$rs = 1 - 6 \sum d^2 / (N^2 - 1)$$

Where, rs is the Spearman rank correlation coefficient, d is the difference among the ranks which are assigned to variables for each reason or cause and n is the number of pairs of rank.

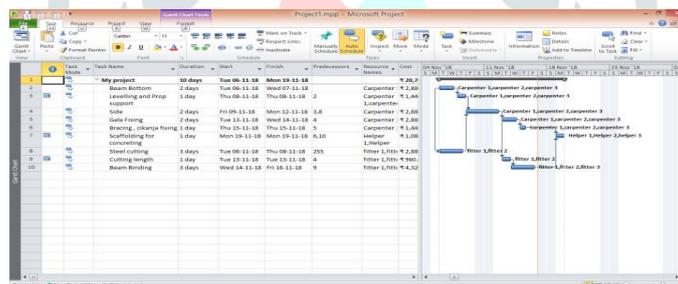
A. Collection of Data:

In the beginning all the relevant data is collected for completing the activity on time as per schedule in MSP. Data like Specification, R.C.C drawing and architectural drawing.

B. Preparation of Schedule using MSP Software:

With the help of MSP the schedule is prepared as per the data collected by the clients organization and keeping every perspective in mind right from the solar water criteria till the drawings (R.C.C , Architect) and days are planned for each sub activity to main activity , before preparing the schedule in MSP.

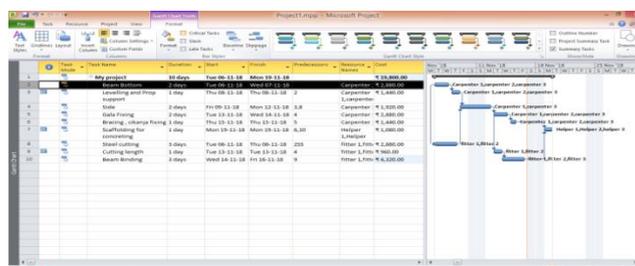
Fig -3: Preparation of Schedule on MSP



C. Assigning of resources:

After preparation of schedule using MSP the next step is to assign the resources, assigning the resources educate you about your project in terms of cost. It helps you know the exact cost for the particular task and hence along with days we can also know the actual cost of our project.

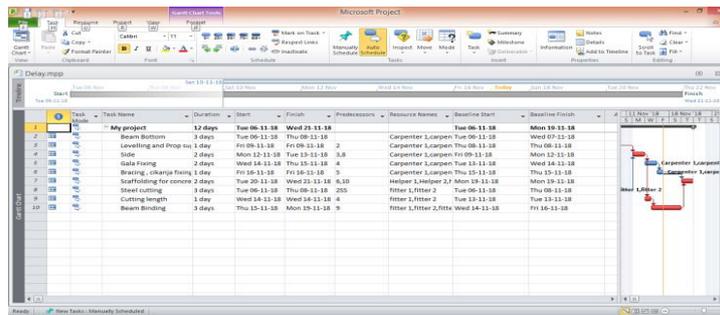
Fig -4 : Assigning of Resources



D. Setting of baseline:

As the baseline is set for the project, progress for the project could be summarized by comparing it with actual schedule i.e. planned schedule is compared with actual schedule.

Fig -5: Setting of Baseline



E. Tracking of the project:

After saving baseline for the project the next step is tracking of the project, tracking of the project is all about gathering the data like number of task completed, hours worked, and cost incurred.

1. Causes of Delay

In below table 2 sample format of questionnaire is given in which factor affecting the causes of delay has been categorized and each delay has got rating from 1 to 4 by the client, consultant and the contractor. The most significant factor is identified along with their relative Importance Index (RII) and ranking.

Source :(Dinesh Kumar R. Vol.3 issue 04 April 2016)

TABLE 2. Sample format of Questionnaire survey

CAT EGO RY	FACTOR CAUSING DELAY	RELATIVE IMPORTANCE INDEX			
		Not IMP	Some IMP	IMP.	EXT. IMP
Owne r	Communication gap between the Engineer and higher authorities.				
	Bureaucracy in client organization				
	Delay in payment (Architectural, government authority and contractor)				
	Insufficient Fund				
	Inadequate Planning				
	Local authorities issue				
	Non availability of material				
	Delay in clearance certificate i.e				
	Delay in decision				
	Change in order and extra order by client				
	Owner lack of experience				
	property tax issue				
Contr actor	Conflicts between the partner				
	Poor site management				

	Unskilled labor				
	Implementing obsolete method during construction				
	conflicts between contractor and other participant parties				
	Shortage of man power				
	Safety violence				
	poor working stability				
	Shortage of material				
	Unclear running bill				
	poor communication and co-ordination				
	Repetition of work				
	Shortage of equipment				
	Inadequate contractor work				
	Inadequate contractor experience				
	Accident during Construction				
	Conflicts with sub contractor during execution				
Consultant	Delays of drawing and specification				
	Poor co-ordination				
	Change in drawing				
	Delays of inspection				
	Insufficient staff				
	Ineffective Planning				
	Slow response in doubts of drawing				
	Corporation permission				
	Poor Liasoning				

In the above table the list of the most common causes of delays has been given. There are various causes of delays from the perspective of different people involved in any given construction project. After considering all the factors from the point of view of the owner, contractor and consultant has been formed and made ready for the survey.

TABLE3. Top 10 causes of delay

Category	Factor causing Delay	W	RII	RANK
Owner	Insufficient Fund	293	0.91	1
Contractor	Shortage of material	280	0.875	2
Contractor	Poor communication and co-ordination	266	0.83	3
Owner	Conflicts between the partner	253	0.8	4
Consultant	Change in drawing or revised drawing	250	0.78	5
Contractor	Unskilled labor	240	0.75	6
Consultant	Slow response in doubts of drawing	226	0.71	7
Contractor	Repetition of	220	0.68	8

	work			
Contractor	Implementing obsolete method during construction	213	0.66	9
Client	Delay in progress payment	200	0.625	10

From the analysis of the result we have found out the top 10 causes of delays in construction industry. Insufficient fund and shortage of material are the first and the second most common causes of delay from the top 10 causes. Moreover the analysis also shows that delay in progress payment is the tenth most common cause of delay.

V. Result and Discussion:

After setting baseline and tracking the project, it was revealed that due to change in R.C.C drawing, the task got delayed. As critical activity is the longest duration in the CPM method once should avoid the delay of critical activity, in the schedule of MSP the only activity which can be delays are the sub critical activity.

TABLE4. Comparing two parameters

Delay Factor	Questionnaire	Site	D	D2
Insufficient Fund	1	4	3	9
Shortage of material	2	2	0	0
Poor communication and co-ordination	3	3	0	0
Conflicts between the partner	4	5	1	1
Change in drawing or revised drawing	5	1	4	16
Unskilled labor	6	7	1	1
Slow response in doubts of drawing	7	6	1	1
Repetition of work	8	9	1	1
Implementing obsolete method during construction	9	8	1	1
Delay in progress payment	10	10	0	0
				30

Applying Spearman co relation in the above table, and comparing the practical experience and the questionnaire, it helps to correlate both the cases. The value of r_s i.e. Spearman rank co-relation is 0.82, indicates that both the parameters are related to each other.

Conclusion:

In this study the projects which were included were residential and commercial buildings. This study identified the various causes and effects of delays in Indian Construction Projects. In this study a list of 38 common causes of delays was formed and then a questionnaire was distributed from which the top 10 most common causes of delays were found out. This was done from the owner, contractor and consultant's viewpoint. The top 10 most common causes of delay were: (1) Insufficient Funds, (2) Shortage of Material, (3) Poor communication and co ordination, (4) Conflicts between the partners, (5) Change in Drawings or Revised Drawings, (6) Unskilled Labor, (7) Slow Response in doubts of Drawing, (8) Repetition of work, (9) Implementing Obsolete Method during Construction, (10) Delay in Progress Payment. Effects

The total of six important effects of delays were found and they are; time overruns, cost overrun, disputes, total abandonment, arbitration and litigation.

In order to avoid delays certain factor should be taken care of. The research focuses on delays, with respect to payment from client to various parties and suggest that client should clear the running bill as per promised time of payment and also the clear lines of communication should be followed on site, adequate planning is needed in order to complete the project on time, architect should clear the doubts of drawing as promptly as possible. The contractor should be flexible with each new method of construction; the obsolete method should be avoided in order to prevent delays.

Hence, the inference after all the investigation through MSP is that adequate planning is required before beginning any activity. If in the initial stages proper strategic planning has been done then it would have avoided the delays in the pergola activity. In actual practice these delays are bound to happen until and unless proper actions are taken to control such unexpected events that occur on site, that lead to delays and thus also affect the cost of the project.

Hence, good practice in planning and proper co-ordination will be required for completing the project on time.

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