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**A Study on Causes and Effects of Delays in Construction Projects
At Dindigul and Madurai Districts**
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R. Ilangovan, M. Valan Rajkumar and A. Velanganni Joseph
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Abstract

This paper focus on construction delays are common problems in private and government projects in Dindigul and Madurai District. This problem occurs frequently during life time leading to dispute and litigations. Therefore it is essential to study and investigate causes of construction delay. There are a number of definitions for delay: to make something happen later than expected; to cause something to be performed later than planned or to not act timely. Each of these definitions can describe a delay to an activity of work in a schedule. The construction industry is large, unpredictable and requires tremendous capital outlays. Delay of a project is a main factor and the major cause of construction claims. There is an acute necessity for detailed investigations to identify the delay factors and choose correct actions to minimize the adverse effect of delay on time, within cost and for high quality. This research paper present list of construction delays causes retrieved from literature. The feedback of construction experts was obtained through interviews. Subsequently a questionnaire survey was prepared .The questionnaire survey was distributed to Project Engineers from Dindigul and Madurai District. The Data Analysis has carried by Statistical Package for the Social Sciences (SPSS) (Programming with automatic calculation) and the top twenty delay causes of residential construction projects in Dindigul and Madurai District are find out. The number of recommendations ends the paper. The findings of this paper can be used as a reference by project owners, managers, and government agencies in developing their project management strategies.

Keywords: Delay, Causes of Delay, Effects of Delays, Construction Projects

1. Introduction

Project delay can be defined as an incident that causes extended time to complete all or part of a particular projects. Delay can also be defined as the time overrun, either ahead of the date for project completion specified by the contract or further than the extended contract period where an addition of time has been granted. The project delay in the construction industry is a universal or large-scale observable fact affecting not only the construction industry but the overall economy of a country as well. Delay is a pervasive phenomenon in construction project delivery. It is branded as the most common, costly and risky problem encountered in construction project with a debilitating effect on the parties to a contract. It creates adversarial relationships, distrust, litigation, cash-flow problems, project abandonment and general feeling of apprehension towards each other. Delays frequently occur in all phases of construction projects and have been seen as inevitable which consequently results in cost and time overruns. It is seen as the most prolific factor affecting project performance.

The demand of construction clients for the timely delivery of construction projects and the susceptibility of projects to delays and cost overruns has attracted the attention of researchers all over the world, most of who tried to identify the immediate as well as the root causes of project delay. However, despite the various study and investigation into the causes of delays, it has continued to be a deadly monster which plagues the construction industry. Project delay involves manifold multifaceted issues all of which are perpetually of decisive magnitude to the parties to the construction contract. These are issues concern right to recuperate costs of the project delay or the need to extend the project with the substantial right to recovery costs for adjustments to the contract schedules.

One of the main objectives and policies of any public or private sectors dealing with the implementation of project is to upgrade the projects performance process, through reduction of costs, completion of the construction project within their contract sum and time limit and improve quality. Private housing project delays are often caused by circumstances that create barriers to launch and further implementation of project activities. When project delays are unexpected, they are hardly manageable and have rather negative impacts on the project activities and outcomes. An unexpected delay will extends the overall duration of project activities and entails an increase in project costs. It produces time-associated cost effects that will increase the resource consumption and will require extra time upon reaching project success.

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In construction, delay is defined as the time over-run either beyond completion date specified in a contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities. In some cases, to the contractor, delay means higher overhead costs because of longer work period, higher material costs through inflation, and due to labor cost increases. Completing projects on time is an indicator of efficiency, but the construction process is subject to many variables and unpredictable factors, which result from many sources. These sources include the performance of parties, resources availability, environmental conditions, involvement of other parties, and contractual relations. However, it is rarely happen that a project is completed within the specified time.

Accordingly, the contributions of this research are (i) to determine the reasons of delay in the construction sector of Dindigul and Madurai District , (ii) to determine the probability of occurrence of the identified reasons of delay with a subjective and unbiased approach, (iii) to statistically test whether the delays and cost overruns are significant, (iv) to provide recommendations to organizations and companies who play a role in the construction sector of these two district on how to mitigate the delays and (v) and to facilitate the risk management efforts by developing regression models that allow the project managers to reassess the timelines and costs of the construction projects in Dindigul and Madurai district based on the current delay profiles. The successful execution of construction projects and keeping them within estimated cost and prescribed schedules depend on a methodology that requires sound engineering judgment. To the dislike of owners, contractors and consultants, however many projects experience extensive delays and thereby exceed initial time and cost estimates.

2. Review of Literature

Long Le-Hoai, Young Dai Lee, and Jun Yong Lee have examined; In-planned duration and cost at project closing are the two of criteria of successful project and successful project management. In Vietnam, regularly, construction projects have met delays and cost overruns. This research has employed a questionnaire survey to elicit the causes of this situation by interviewing 87 Vietnamese

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construction experts. Twenty one causes of delay and cost overruns appropriate with building and industrial construction project were inferred and ranked with respect to frequency, severity and importance indices. Spearman's rank correlation tests showed that there are no differences in the viewpoints between three principal parties in the project. A comparison of causes of time and cost overruns was done with various selected construction industries in Asia and Africa. Factor analysis technique was applied to categorize the causes, which yielded 7 factors: Slowness and Lack of constraint; Incompetence; Design; Market and Estimate; Financial capability; Government; and Worker. These findings might encourage practitioners to focus on delay and cost overruns problem that might have existed in their present or future projects.

Kasimu A.M. and Usman M.D. have described; Delay is one of the biggest problems in Nigerian construction industry. Delay can lead to many negative effects such as disputes between the clients and contractors, increased costs, loss of productivity and revenue and termination of contract. However, comprehensive study on this delay is essential. Since the problems are rather contextual, the study focuses on specific causes of delay like insufficient coordination and ineffective communication between involved parties in construction projects. Literature review and a questionnaire survey were targeted at professionals in Nigerian construction industry and these questionnaires have been used as the tools to carry out this study. The study presents the findings of a survey aimed at identifying some of the most important causes of delay in construction projects in Nigeria. It is hoped that these findings will serve as a guide to enhance the performance of the construction Industry.

Greeshma B Sureshand Dr. S. Kanchanasuggest: A project is said to be successful when it is completed in desired time and cost. The Construction industry of India is an important indicator of the development, as it creates investment opportunities across various related sectors. Construction delays can be minimized only when the causes are identified. 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. This research work attempts to identify, investigate, and rank factors perceived to affect delays in the construction projects with respect to their relative importance so as to proffer possible ways of coping with this phenomenon. The construction industry is the tool through which a society achieves its goal of urban and rural development. It is one of the sectors

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that provides important ingredient for the development of an economy. It was through the analysis carried out, top 10 major causes of construction delays in construction industry are Shortage of construction materials, Effect of subsurface conditions and natural disaster, Delay in material delivery, Low productivity of labors, Rework due to errors, Late procurement of materials, Unqualified workforce, Low productivity and efficiency of equipment, Delay in quality control, Poor site management and supervision, Poor communication between parties & Lack of high technology.

M. E. Abd El-Razek, H. A. Bassioni, and A. M. Mobarak inform us: Delay in construction projects is considered one of the most common problems causing a multitude of negative effects on the project and its participating parties. This paper aims to identify the main causes of delay in construction projects in Egypt from the point of view of contractors, consultants, and owners. A literature review was conducted to compile a list of delay causes that was purged based on appropriateness to Egypt in seven semi structured interviews. The resulting list of delay causes was subjected to a questionnaire survey for quantitative confirmation and identification of the most important causes of delay. The overall results indicated that the most important causes are: 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.

The contractor and owner were found to have opposing views, mostly blaming one another for delays, while the consultant was seen as having a more intermediate view. Results' analyses suggest that in order to significantly reduce delay a joint effort based on teamwork is required. Furthermore, causes of project delay were discussed based on the type and size of the project.

Jeremy Lambert has explained: It is readily recognized that project planning is essential to identify what needs to be controlled and project monitoring and control is required to ensure projects finish on time and within budget. However; project performance in the Middle East in terms of timely delivery and within cost parameters remains poor. In Saudi Arabia, for example, Assaf and Al-Hejji 2006 concluded that 70% of projects surveyed experienced time overrun and found that 45 out of 76 projects considered were delayed.

Similar disturbing statistics can be found for Jordan², Kuwait³, UAE⁴, and outside of the region in Hong Kong⁵, Malaysia⁶ and in international development projects⁷ in general. The consideration that poor project planning, monitoring and control plays a major role in the failure of projects is examined in the context of the five major causes of project failure and the reasons behind these causes. Potential mitigating control and monitoring actions are explored to examine whether by their implementation the prognosis for project outcomes can be improved.

3. Methodology

The methodology elements considered include the research design, population, sample size and sampling design, data collection methods as well as data analysis. In this paper the objectives and the aims of this research will be described and explained. The main focus of this study will be on questionnaire survey that was distributed among the selected Engineers from Dindigul and Madurai district in construction industry. The complete research methodology of this study has been shown in Fig.1.

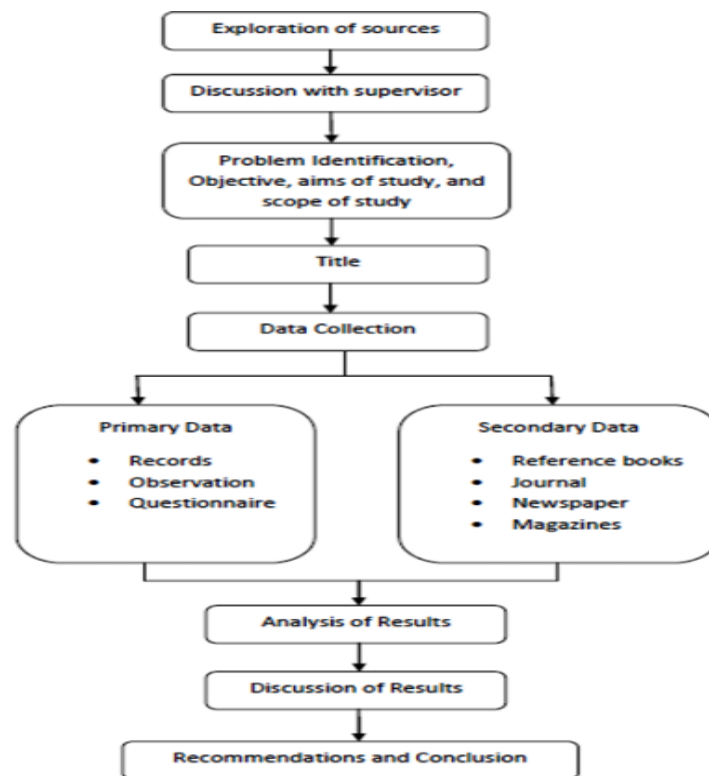


Fig.1 Complete research methodology of the proposed study

Furthermore, statistical package for the social sciences program would be used to analyze collected data. This chapter is divided into main following sections that will briefly be described in this chapter and with more detail in subsequent chapters.

- (i) Questionnaire design,
- (ii) Data collection,
- (iii) Data analysis and
- (iv) Conclusion

3.1 Questionnaire Design

In most of the studies, the questionnaire would be designed according to the objective of the research. In this research, as it was mentioned before, the main aim is causes of delays in construction industry from Dindigul and Madurai district. However, it would be impossible to eliminate all delays but when the reliable data was collected and the related party causing the delay was determined, it would be easier to control the delays of projects. This questionnaire survey was developed to get the opinion of large number of Engineers from different construction industry. Also selected companies help to classification the causes of delay based on Indian construction industry. The questionnaires were prepared in 6 different subcategories:

- (i) Part A: Respondent information,
- (ii) Part B: Contractor Related delay factors,
- (iii) Part C: Consultant Related delay factors,
- (iv) Part D: Owner Related Delay factors,
- (v) Part E: Materials Related factors and
- (vi) Part F: External and Other related Factors

3.2 Data Collection

This part of research refers to obtained data from the questionnaires and it will be used to analyze and determine the most critical parameters and project delivery methods. All the respondents in this research were Engineers and because of the different point of view in each civil engineering field, the final result would be closer to engineers' viewpoint. After collecting the data, the next step is analyzing the data and answer to main objectives of the study. But before analyzing the data, the

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method of analyzing and the computer program that was used, should be determined. Totally 108 engineers are selected as sample from Dindigul and Madurai district. 60 Engineers from Dindigul and 48 Engineers from Madurai district are selected and questionnaires has distributed and collected.

3.3 Data Analysis

The main purpose of this part is determining relative importance of parameters that contribute to causes of construction delays in the selected project delivery method and also revealing the responsible party for each factor. This problem is usually been solved in two different ways:

- (i) Statistical Package for the Social Sciences (SPSS) (Programming with automatic calculation)
- (ii) Relative Importance Index (Handwork with manual calculation).

In this research only statistical package for the social sciences has been used.

3.4 Calculation Process of Raw Data

In this statistic part, all of raw data were collected from respondents. As mentioned before, by assisting of SPSS program, the calculation could be done easily and faster than other ways. Especially in this case, according to massive volume of calculations, it would have been unavoidable to use other methods. First of all in different views of SPSS program, the parameters and ranking method were entered. After that, the raw data should be put in correct order in data view tab. In this session of research, the mean, variance and standard deviation were needed to be calculated. So to understand a brief description of each parameter, the following parts are presented.

4. Result Analysis and Discussion

The main aim of conducting the analysis for second part of questionnaire is establishing all of one hundred and thirty factors under the identified groups. The ranking method was designed according to importance degree of each parameter. To achieve a better result, all factors were divided into different groups and each group was analyzed separately. With this method, the most influential factor of each group could be revealed easily.

4.1. Result Analysis

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The interviews were conducted 108 project managers /site engineers. The project managers surveyed have an average experience of about 14 years, while site engineers have an average project management practical experience of approximately 9 years. During the interviews, the researcher asked the participants to provide an estimation of importance for each delay factor. The five ranking indices were used to rank delay causes from the viewpoints of the engineers (Project managers and site engineers). Table 1 shows the ranking of the delay causes in descending order of frequency. It presents the 20 most important delay factors according to project managers and site engineers. It can be observed that most commonly delays occur due to non-payment for completed work causes from the viewpoints of the engineers (Project managers and site engineers). Table 1 shows the ranking of the delay causes in descending order of frequency. It presents the 20 most important delay factors according to project managers and site engineers. It can be observed that most commonly delays occur due to non-payment for completed work

Table 1 Ranking of the delay causes in descending order delay

Columns	Ranking of the Delay
1 st column	Strongly Disagreed
2 nd column	Disagree
3 rd column	Neither Agree nor Disagree
4 th column	Agree
5 th column	Strongly Agree

4.2 Explanation of the Guidelines

Depending on the previous analyses, on the recommendations given by the interviewees and on the techniques that were discovered in the literature review, the following explains the most important techniques that project managers can use to discover and reduce delays in construction projects. The ranking the delay factors is shown in Table 2. The following techniques can play the role of the guidelines aimed by this study.

Table 2 Ranking the delay factors from the highly important (Top 20 from 130 Factors)

[Total interviewees=108 (60 from Dindigul District and 48 from Madurai District)]

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S.No	Delay Factors	Total Interviewees				
1	Finance and payments of completed work	0	2	6	32	68
2	Equipment availability and failure	0	0	23	49	36
3	Late revising and approving the design documents by the owner	1	0	50	35	22
4	Poor communication and coordination by owner and other parties	4	11	36	28	29
5	Shortage of equipment	0	2	23	46	37
6	Financial constraints faced by the owner	1	14	30	40	23
7	Too many change orders from owner	1	3	10	57	37
8	Slow decisions making from owner	2	6	15	64	21
9	Lack of coordination with contractor	4	8	28	53	15
10	Inference by the owner in the construction operations	2	6	15	64	21
11	Conflicts between consultant and design engineer	2	2	22	60	22
12	Late drawings and specifications delivery	1	6	29	44	28
13	Low level of equipment-operator's skill	4	4	48	39	13
14	Insufficient coordination among the parties by the contractor	1	26	22	39	20
15	Delay in contractor's claims settlements	4	13	40	29	22
16	Insufficient coordination among the parties by the Owner	0	3	38	43	24
17	Financial problems (delayed payments, financial difficulties, economic problems)	4	8	26	47	23
18	Poor qualifications of consultant engineers staff assigned to the project	0	9	37	51	11
19	Slow responses by the consultant engineer to contractor inquiries	5	11	27	49	16
20	Shortage of construction materials in market	2	4	17	51	34

Project delays have been a topic of concern in the construction industry. Delays have become a universal phenomenon and are almost always accompanied by cost and time overruns. Construction project delays have a debilitating effect on parties (owner, contractor, consultant) to a contract in terms of a growth in adversarial relationships, distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other. Delays can be minimized only when their causes are identified. Knowing the cause of any particular delay in a construction project would help avoiding the same. This project was therefore, aimed at identifying the major causes of delays in construction projects in the Dindigul and Madurai region only Construction Industry through a survey, and quantifies the perceptions of different parties relating to causes, responsible party and types of delay.

Based on the results of the questionnaire survey and information gathered from the literature review, the following conclusions were drawn. Generally, whether a delay is determined to be excusable or non-excusable, a contractor is not entitled to an extension of time or to an upward adjustment in costs without understanding the full context of the contract.

Based on the overall results, we can conclude that the following is the ranking of responsibilities of the contractual from the most responsible (1) to the least (5):

- (1) Contractor = 44%
- (2) Owner = 24%
- (3) Government = 14%
- (4) Shared = 12%
- (5) Consultant = 6%

5. Analysis of Cost Performance due to Construction Delays

Project delays have been a topic of concern in the construction industry. Delays have become a universal phenomenon and are almost always accompanied by cost and time overruns. Construction project delays have a debilitating effect on parties (owner, contractor, consultant) to a contract in terms of a growth in adversarial relationships, distrust, litigation, arbitration, cash-flow problems, and a general feeling of apprehension towards each other. Delays can be minimized only when their causes are

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identified. Knowing the cause of any particular delay in a construction project would help avoiding the same. This project was therefore, aimed at identifying the major causes of delays in construction projects in the Construction Industry in Dindigul and Madurai district through a survey, and quantifies the perceptions of different parties relating to causes, responsible party and types of delay.

This research project was limited to building projects in the Dindigul and Madurai region only. Based on the results of the questionnaire survey and information gathered from the literature review, the following conclusions were drawn. Generally, whether a delay is determined to be excusable or non-excusable, a contractor is not entitled to an extension of time or to an upward adjustment in costs without understanding the full context of the contract.

Code-Related Delay is ranked as the most critical category followed by Design-Related Delays, Construction-Related Delays, and so on, as shown below. In general, the ten (10) most critical causes (across the six sub-headings given above) of delays are:

Sl.No.	Description	-----
1	Building Permits Approval	3.83
2	Change order	3.81
3	Changes in Drawings	3.76
4	Incomplete Documents	3.63
5	Inspections	3.40
6	Changes in Specifications	3.37
7	Decision during Development Stage	3.35
8	Shop Drawings Approval	3.23
9	Material delivery	3.15
10	Severe weather conditions on job site	3.00

Based on the overall results, we can conclude that the following is the ranking of responsibilities of the contractual from the most responsible (1) to the least (5):

1	Contractor	46%
2	Owner	23%
3	Government	16%
4	Consultant	12%
5	others	3%

In most of the cases, it is found that when the contractor has the responsibility, the type of delay respectively is Non-Excusable when the responsibility is the owner's or the consultant's it is an Excusable Compensable Delay; and when the government is responsible, the delay is considered an Excusable Compensable. The consultants play a very important role in Design-Related Delays because as they are in charge of the design process in conjunction with the owner of the project. On the other hand, the government plays the most important role. The contractor has the major responsibility for delays in Construction-Related Delays. Delays due to Financial/Economical Causes as well as Management/Administrative Causes share an intermediate position of importance, just presenting one Key Delay – Delayed Payments. These categories do not have the same negative impact on project completion times as other factors considered in this study such as code, design and construction related issues.

Based on the findings of this study, the authors would like to recommend that the Buildings Permit Approval Process be streamlined as much as possible and changes in Laws and Regulations be made keeping in mind the negative impact it causes in terms of construction project cost and time. Design related issues such as changes in drawings, incomplete and faulty specifications and change orders have a very damaging effect on project completion times and invariably lead to cost escalations as well. These are issues that can be controlled with proper design process management and timely decision- making. It is a well-known fact that decisions made early in the life of a project have the most profound effect on the project's objectives of delivering a safe, quality project within the time and budget allocated.

6. Conclusion

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The main objective of this research which has been determined at the beginning of study was identifying the major causes of delays in three different projects delivery methods. These objectives were performed through questionnaire survey which was designed with regard to the knowledge of Dindigul and Madurai district construction companies and their respond had a significant influence on this research. Also the oral interviews during the process of filling questionnaire helped in realizing the best answer for the main and also side objective of the study. In addition to those, after the data was analyzed, a few meetings had been arranged with Engineers from Dindigul and Madurai District final results were shared with those companies. During each session, they told their opinion about the result and tried to find a solution for how to decrease each critical parameter.

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R. Ilangovan
 Department of Civil Engineering
 University College of Engineering
 Dindigul-624622
 Tamilnadu
 India
ilango1968@gmail.com

M.Valan Rajkumar
 Professor
 Department of Electrical & Electronics Engineering
 Gnanamani College of Technology
 Namakkal-637 018
 Tamilnadu
 India
valanrajkumar@gmail.com

A.Velanganni Joseph
 Department of Youth Welfare Studies
 Madurai Kamaraj University
 Madurai-625021
 Tamilnadu
 India
dravjoseph@rediffmail.com

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