

Evaluation of Various Factors Influencing Construction Delay and Delivery with Fuzzy Method

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ABSTRACT

Today, delays and cost overruns have become commonplace in the industry due to the risks and increasing complexity of construction. Researchers and experts use different methods to measure project delays and distribute responsibility for delays among stakeholders. Foundation delay analysis is considered one of the most reliable methods for construction delay analysis. The analysis, although good, can produce different results depending on the size of the data collected, can be considered owner-contractor speed and also includes many simple tasks due to the relationship between the change of time and the impact of innovation. . Activities. Also consider the impact of success events on resource allocation and subsequent delays. This study provides an exploratory framework for an analytical model that incorporates many factors that can influence construction delays. In this study, we present a weighting and recommendation method that can determine the various factors included in the survey. Finally, the system will suggest different parameters that slow down the paper. Holistic research can be applied to all types of construction.

Keywords - Delay analysis, construction delay, factors and fuzzy base weighting

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I. INTRODUCTION

"Lag" is any situation where everything runs without a noticeable pause, but for a period of time greater than hours. Delay is a term used to refer to any activity that delays construction without limitation and may result in delays beyond the contract date. delays; It is divided into unlimited delays, non-transferable delays, non-reimbursable delays and equal delays. There are many factors that directly or indirectly cause delays. Project dependencies may be delayed for various reasons that may arise from customers, contractors or third parties. Delays in construction are costly; Sometimes they cause great harm to everyone involved. This article focuses on the main factors causing delays and analyzes daily data to reduce delays. The purpose of this study is to identify the main causes of construction delays, the effects of delays, and ways to reduce delays.

Sometimes contractors and owners charge extra to complete the job. If the specified period is exceeded, construction will be delayed. Many construction projects have faced many challenges and delays have become a major problem. In most cases, the main cause of delay is conflict between

customers and suppliers. It is therefore necessary to identify the specific reasons for the delay and take appropriate measures to prevent further harm to those concerned. Current research focuses on several factors contributing to delays.

1. To recognize and classify the elements that contribute to schedule delays in building projects
2. employing the Relative Important Index (RII) approach to rank and quantify the relative significance of schedule delay causes
3. To provide a fuzzy tool-based delay analysis model with reference to a case study and assess the likelihood of schedule delay
4. To propose potential suggestions for reducing construction phase delays

II. METHODOLOGY

The main problem in this part of the study is to establish the process and related process that can help the study complete the research. This chapter discusses various practices, applications, methods, and recommendations, as well as rationales and arguments. The paper selects the study as a

research document that provides support for research and further studies. Moreover, appropriate reasons for choosing the appropriate business strategy are expressed during the discussion and fully supported by the business process and schedules. Based on the general definition of fuzzy rules, many other ways of interpreting fuzzy rules are used for knowledge engineering. These fuzzy rules:

Briefly, the main steps in fuzzy system design are as follows

- First, the research history and sources are reviewed, as well as the current challenges facing the construction industry.
- Find the reasons for construction delays
- Start by examining the current state of the construction industry.
- Change the implementation process.
- Finally, analyze the impact and review after the change.

A. Problem statement

- What are the reasons for delays in infrastructure development? How can these factors be reduced using the Relative Importance Index (FUZZY) method?
- Time constraints are a major issue in many infrastructure projects. It can also increase speed and phase overshoot.
- There is a belief that the agreement is difficult for the owner, and this is the main reason for the contradiction.

B. Questionnaire survey

Semi-structured interviews were conducted with managers of various construction projects experiencing construction delays in India. Project managers are construction professionals who work to solve various project-related problems. Therefore, the project selected leaders who could provide the needed information about the causes and consequences of delays in the construction industry. The form creates good questions to clearly and easily collect respondents' answers for in-depth analysis. Therefore, the planning survey will provide important information for the workplace.

III. DATA COLLECTION FROM DIFFERENT SITES

Data collection is the process of collecting and analyzing information about variables of interest to answer research questions, evaluate hypotheses, and evaluate conclusions.

Humanities, physical and social sciences, economics, etc. All disciplines share the science of data collection. Although the technology used has varied from place to place, the focus on ensuring accurate and honest spelling has not. To measure the latency of each site in this study, data were collected from various surveys of engineers, customers, and managers of specific sites, as shown in Table 4.1. The reasons for the delay will be further investigated based on records

A. Name of Project : Advitiya Apartment

Advitiya is a beautiful Kolhapur project located in the easily accessible Rankala community. There are more than 29 units in total in the project. The project has been carefully designed and the units have been completed. The project includes two beautiful buildings that offer beautiful views of the surroundings. The highly anticipated product will be available on October 1, 2014. Advitiya above the line gets his seal of approval. Evidence of its beginning. Additionally, no approval document is issued. Advitiya project has been developed by Silver Landmarks, a company known for its quality construction.

B. Name of Project : Mira bhakti

The residence is now ready for move-in or relocation to Shankar Patil Meera Bhakti Residence located in Rankala Padpath, Kolhapur. They have rooms at various prices. Shankar Patil Meera Bhakti Residency Rankala Padpath has three buildings, each with 11 floors and 243 rooms. Shankar Patil Meera Bhakti Residency is a larger residence spread over 2.98 acres in Kolhapur district.

C. Name of Project : Pratiraj Towers

The most sought after property for individuals looking for immediate investment This and future possibility is Pratiraj Towers which includes buildings. The town is in Bawada, Kolhapur. There are many big businesses near Town Bawada in Kolhapur. Pratik Township & Infra Projects Pvt Ltd is one of the best companies that have successfully completed many residential projects. It offers luxurious and well-designed 1 BHK, 2 BHK and 3 BHK flats at very affordable prices. All units of Pratiraj Towers have built-in wardrobes, modern bathrooms, fully equipped kitchens and spacious living areas. Every room of the house has adequate ventilation.

D. Name of Project : Rudra heritage

Brickstone Rudra property is located in a beautifully designed and natural environment that exudes elegance. Brickstone Rudra Heritage is committed to delivering quality products and focusing on excellence throughout every development process, from concept to completion. Brickstone Rudra perfectly represents the heritage, urban and elegant lifestyle. Each of the 73 specially designed flats in the Mural project is the essence of beauty and simplicity. Designed by internationally renowned architects, the project includes one and two bedroom apartments. Brickstone Rudra Heritage has multiple buildings spread over an area of 0.34 acres

E. Name of Project : Signature Residency-Tarabai Park Kolhapur

The project is built on an area of 0.12 acres. Now its construction continues. Ashtin Signature was launched in April 2022. Ashtin's signed ownership rights will expire in December 2027. There is only one house on the property. Tarabai Park hosts Ashtin Signature.

Table 1 Case Study Structure

Construction Project	Company	Original Completion Date	Actual Completion of the project	Delay (Months)
Adwitiya Apartment	Silver Landmarks	August 2021	March 2022	8
Mira bhakti	Shankar Patil	January 2022	November 2022	10
Pratiraj Towers	Pratik Construction	April 2021	October 2022	6
Rudra heritage	Brickstone	August 2021	November 2022	13
Signature Residency	Ashtin pvt. Ltd.	On Going	On Going	On Going

IV. DATA ANALYSIS

Data prepares survey data and collects responses. Since the results of the studies are mostly based on the explanations of the interviewed people, arranging the items according to their explanations will help to understand the study. This study helps determine the impact of delays in the construction industry by identifying factors that cause construction delays. Accurate expression of research results and understanding of the ideas developed in the literature review section are related to the correct success of the analysis.

Following factors are analyzed:

- Customer-related items: financial and payment for completion, etc.

- Contractors-related: errors in planning, stage construction
- Consultants: contract management, drawing preparation and approval, quality assurance
- Materials-related: Non-materials The problems are good and the goods are not enough.
- Customer related: financing and payment for work done, etc.
- Contractor affected: errors in planning and construction phase.
- Advisor on important matters: contract management, drawing preparation and approval, quality assurance
- Related products: when there is a problem with good things and bad things.

The RII method is used to calculate the most important cause of delay. The survey has a scale of 1 to 5, including mathematics,

$$RII = \sum W \div (A * N)$$

Where,

W= weighting given to each factor by the respondents (ranging from 1 to 5)

A = Highest weight (i.e. 5 in this case)

N =total number of respondents. Higher the value of RII, more important was the cause of delays.

V. OVERVIEW OF FINDINGS

The findings are as follows after a study of Site-1 (Adwitiya flat): Client-Related Factors are a major reason for Site-1's delays.

Table 1 Major delay causing factors for Site-1

Client Related Factors / Respondents	Project Manager	Planning Engineer	Site Engineer	Labour	RII
Finance and payments of completed work	3	2	3	4	0.60
Owner interference	3	4	1	5	0.65
Slow decision making	4	5	5	5	0.95
Unrealistic contract duration and requirements imposed.	5	5	5	5	1
Obtaining permits from municipality	4	5	4	2	0.75

The investigation of site 2 (Mira Bhakti) revealed the following results: The primary cause of delays is contract-related factors.

Table 2 Major delay causing factors Site 2

Contractor Related Factors/ Respondents	Project Manager	Planning Engineer	Site Engineer	Site Supervisor	RII
Sub-Contractor	4	3	4	5	0.80
Site management	1	4	5	5	0.75
Construction methods	1	3	2	3	0.45
Preparation and approval of drawings	4	5	4	3	0.80
Mistakes during construction stage	5	4	3	3	0.75
Inadequate contractor Experience	5	5	4	4	0.90
Mistakes in preliminary stage (Soil investigation)	5	5	4	5	0.95
Financing by contractor during construction	5	5	5	5	1

The examination of Site-3 (Pratiraj Towers) revealed the following results: The two primary sources of delays are labour equipment problems and material-related factors.

Table 3 Major delay causing factors Site 3

Material Related and Labour Equipment Factors/ Respondents	Project Manager	Planning Engineer	Site Engineer	Site Supervisor	RII
Quality in material	4	3	4	4	0.74
Shortage in material	5	5	5	5	1
Labour supply	5	5	5	3	0.90
Labour Productivity	3	4	2	3	0.60
Equipment availability and failure	4	3	3	5	0.75

The following conclusions came from the examination of Site-4 (Rudra heritage): The primary reasons of delays are external and contract relationship-related factors.

Table 4 Major delay causing factors Site 4

Contract Relationship Related Factor/ External factor	Project Manager	Planning Engineer	Site Engineer	Site Supervisor	RII
Inappropriate overall organization structure linking to the project.	4	5	3	4	0.8
Lack of communication between parties.	2	3	2	2	0.45
Weather condition.	3	1	2	4	0.5
Regulatory changes	4	5	4	3	0.8
Problem with neighbours.	5	4	3	4	0.8
Unforeseen site condition	1	1	1	1	0.2
Accidents during construction.	1	2	1	3	0.35

The investigation of Site-5 (Signature Residency) results in the following conclusions: The two primary sources of delays are Consultant Related Factor Respondents and Contract Related Factor Respondents.

Table 5 Major delay causing factors Site 5

Consultant Related Factor and Contract Related Factor Respondents	Project Manager	Planning Engineer	Site Engineer	Site Supervisor	RII
Contract management	3	2	3	4	0.6
Preparation and approval of drawings.	3	4	5	2	0.8
Quality assurance.	4	4	5	3	0.8
Waiting time for approval of drawings.	5	5	5	5	1
Change orders.	2	3	2	1	0.4
Mistakes and discrepancies in contract document	3	4	2	3	0.6
Major disputes and negotiations.	3	4	3	4	0.7

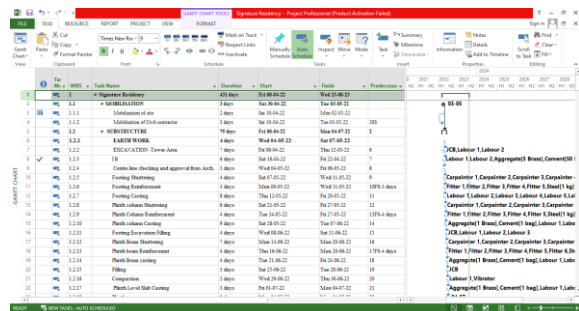


Fig 1 Scheduling In MSP

Table 6. Site Investigation

Sr No	Factor	Project Manager	Planning Engineer	Site Engineer	Labour	RII	Rank
1	Finance and payment of works	3	2	3	4	0.6	9
2	Owner Interference	3	4	1	5	0.65	8
3	Slow decision	4	5	5	5	0.95	2
4	Unrealistic contract duration and requirement imposes	5	5	5	5	1	1
5	Sub - contractor	4	3	4	5	0.8	4
6	Site Management	1	4	5	5	0.75	5
7	construction method	1	3	2	3	0.45	11
8	Inadequate contractor Experience	5	5	4	4	0.9	3
9	Mistakes in Preliminary Stages (Soil Investigation)	5	5	4	5	0.95	2
10	Financing by Contractor during construction	5	5	5	5	1	1
11	preparation and approval of drawings	4	5	4	3	0.8	4
12	Mistake during Construction stage	5	5	3	3	0.75	5
13	Quality in material	4	3	4	4	0.74	6
14	obtaining permits from municipality	4	5	4	2	0.75	5
15	shortage in material	5	5	5	5	1	1

16	Labour Productivity	3	4	2	3	0.6	9
17	equipment availability and failure	4	3	3	5	0.75	5
18	Labour Supply	5	5	5	3	0.9	3
19	Weather Condition	3	1	2	4	0.5	10
20	Regulatory Changes	4	5	4	3	0.8	4
21	Problem With Neighbors	5	4	3	4	0.8	4
22	unforeseen site condition	1	1	1	1	0.2	4
23	Accident during construction	1	2	1	3	0.35	13
24	Major disputes And Negotiation	3	4	3	4	0.7	7
25	Inappropriate Overall Organization structure linking to the project	4	5	3	4	0.8	4
26	Lack of communication between parties	2	3	2	2	0.45	11
27	Equipment availability and failure	2	1	1	3	0.35	13
28	Changes orders	2	3	2	1	0.4	12
29	Mistakes and Discrepancies in contract document	3	4	2	3	0.6	9
30	Contract Management	3	2	3	4	0.6	9
31	preparation and approval of drawings	3	4	5	-	0.8	4
32	Quality Assurance	4	4	5	3	0.8	4
33	Waiting Time for Approval of drawings	5	5	5	5	1	1

VI. CONCLUSION

- Since time management is very important in the construction industry, where time is money, predicting the risk of delay is very important for the success of the work. From a total of 76 variables causing delays, the 10 most important factors were identified: suppliers-related factors, some external factors, and sometimes product-related issues that are responsible for the delay.
- Perform a fuzzy operation on the key data obtained to calculate the relative importance of each element. Fuzzy weight is used to determine the significance of the delay. This ranking is used to determine the importance of the top and bottom points. Thanks to this study, the following results were obtained. The answers were recorded and the results of the survey data were organized in the form. Since most research findings relate to participants' explanations of the findings, it

is good to organize the items according to their explanations.

- The process of creating a list of factors causing construction delays will assist in investigating the impact of work delays. For the construction site - 1 main reason for the delay is the unrealistic estimate of the contract period, for the construction site - 2 the financing of the supplier during the construction period, for the construction site - 3 no information, for the construction site - 4 not construction of all necessary organizations. For Construction Site after project and neighbor problems - 5 Waiting time for approval of drawings gives RII the highest price.

A. Recommendation

- According to the study, the flow of money, continuous supply of material in proper quantity and quality, approval of drawings, The major reasons for construction project delays include the contractor's lack of funding during the project, the project's general organizational structure being ineffective, and issues with the neighbors.
- Uncontrollable sources of delay, such as issue resolution, market conditions, economic conditions, and project managers' risk-taking abilities, are also key factors for project work delays in the construction sector.
- Above, the delay may be controlled or minimized by utilizing project management software's like MSP and Primavera software for correct planning, then reviewing cash flow diagrams, and employing various material management techniques such as ABC analysis, inventory control techniques, working capital management, and good contract management.
- For Construction Site -1 major delay causing factor predicts unrealistic contract duration, for that factor of delay will recommend Changed orders, errors, and inconsistencies in the contract documents are all appropriate contract considerations.
- For Construction Site -2 Agreement with their clients specifies that the contractor will get payment in terms, agency must pay the contractor within 30 days following submission of RA invoices. finance by contractor supplier during construction, for that element of delay will recommend..
- For Construction Site -3 Lack of materials for that delay factor will advise using the proper cloud ERP system to help solve some

of the issues. Enterprise resource planning is known by the acronym "ERP." An ERP system allows organisations of any size to unify their various systems under one roof.

- For Construction Site - 4 Inappropriate overall organization structure following on project and the Neighbors Problem for that factor of delay will recommend that Create a Chain of Command and divide responsibilities of organization, it can be organize by Primavera
- For Construction Site - 5 It is in the interests of both the designer and the client to know that the requirements in the contract have been met, as well as the requirements of ISO 9001 if the designer is accredited to that standard. This will be recommended by the waiting time for approval of drawings for that element of delay.
- After analyzing all sites the main and common factors for the delay are regarding material, labour and contractor management affects the delay for all above sites. For this structure, the Six Sigma effect and CPM process should be implemented using MSP or Primavera, which can preview important tasks and help manage materials, work and people.
- Six Sigma is very useful for expressing good design ideas in a better way; It should also include negative financial aspects. Software like MSP and Primavera will provide cash flow in the field, which can help with future financial planning.

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