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Delay Analysis in Educational Building Construction Projects

Aneesha P[1], Fazil P[2]

[1]Kerala Technical University, MGM College of Engineering and Pharmaceutical Science, Valanchery, Malappuram Dist, Kerala 676552, India
aneesha.p1995[at]gmail.com

[2]Assistant Professor, Department of Civil Engineering, Keralatechnical University, MGM College of Engineering and Pharmaceutical Science, Valanchery, Malappuram Dist, Kerala 676552, India
fazil.ce[at]mgmcet.in

Abstract: ***The most common problems in the construction project is delays, it's very linked to each other. Delays of a construction project can be defined as the late completion of works as compared to the planned schedule or contract schedule. Projects can be delayed due to number of reasons that may be due to the client, the contractor, acts of God, or a third party. They may occur early or later in the project development, alone, or with other delays. Delays can be minimized only when their cause are identified. The objective of this study was to identify the major causes of construction delays and analyze the delay that comes in the private firm and delay that comes in the public sector. This study was carried out based on literature review and a questionnaire survey.***

Keywords: Delay factors, RII method, Private projects, Government projects

1. Introduction

The construction industry is one of the main sectors that provide important ingredient for the development of an economy. However, many projects experience extensive delays and thereby exceed initial time and cost estimates. Construction delays are considered to be one of project success in term of time, cost, quality, and safety. Construction projects in India facing various problems, delay in construction is one of the major issues. It is considered as a common problem in construction projects. In most of the projects, there will be delays and their impact level varies on each project which depends on several factors such as nature and the type of construction, importance of the project, etc. When the project gets delayed, either the delivery time of the project will be extended or the progress of the project will be accelerated heavily in order to deliver it on time. The former will lead to arbitration, litigation, and penalties, etc. and the later will lead to incur additional cost, both will end up with loss of money. In worst case, accelerating the process of the project will also affect the quality of the output which sacrifices client's satisfaction.

The cost of a construction project is one of the most important factors in the construction industry. Due to many reasons, the total cost of a project can significantly vary from the initial estimated cost. The reasons could be changes in scope of work, specifications, or any other contract documents. In the construction industry, variation orders are created when changes occur. It is an official document that states the changes made into the original agreement between the client and the contractor. When a variation order is created, it brings several negative effects to both the client and the contractor. The objective of this study was to identify the major causes of construction delays in educational building construction projects.

2. Objectives of the study

1) To identify the major causes of delays in construction projects of educational buildings
2) To analyze the delay that comes in the private firm and the delay that comes in the public sector
3) To recommend strategies for minimizing delay in the project based on the findings of study

3. Scope of the work

- Time management
- Managing the budget
- Analysing the workloads
- Reducing the non-productivity loss
- Improving the market value of company

4. Research methodology

The research methodology presents processes and techniques that used in this research.

1) Identification of factors
2) Preparation of questionnaire
3) Questionnaire and field survey
4) Data collection
5) Analysis of data
6) Ranking by RII techniques
7) result

5. Data Collection

A questionnaire survey was carried out in offline mode, that is, on site survey was conducted among construction experts who work public sector and private firm.

5.1 Structure of questionnaire

The questionnaire is divided in to 3 parts [appendix A]. Part A, part B and part C.

- Part A - The first part included details about the project.
- Part B - The second part included the relative importance of the causes of delay.
- Part C- included additional comments from the respondents about the project.

5.2 Measurement of data

A total of 20 sites were selected. Of these, 10 are government projects and remaining 10 are private projects. Owners, contractors, supervisors, consultant, labours, site engineers, junior engineers, assistant engineers, and overseers are included in this survey.Projects with various delays were selected (i.e., high level of delay, medium level of delay, low level of delay).

6. Data analysis

6.1 RII method

Relative importance index method is used to analyse the data. The relative importance index analysis was selected in this study to rank the factors according to their relative importance.

In this case 4 point Likert scale were adopted which ranges from 1 (not important) to 4(extremely important) and transformed to relative importance index for each factors using the formula shown below;

Relative importance index RII = $\sum W / A*N$

Relative importance index ranges b/w 0 to 1 i.e. ($0 \leq RII \leq 1$), higher value indicates more importance for that cause of delay. where W = weighting given to each factor by the respondents which ranges from 1 to 4 where '1' is 'not important' and '4' is 'extremely important', A = highest weight (i.e. 4 in this case), and N = total number of respondents (i.e. 20 in the case of government projects & 23 in the case of private projects).

6.2 Analysis result

The RII value detected by using Microsoft excel. The result is arranged in such a way that the largest number gets first rank.

Table 1 shows that the top 10 causes from the result (in case of government project).

Table 2 shows that the top 10 causes from the result (in case of private projects).

Table 1: Result of Government Project Analysis

No	*Delay Factors*	*RII*	*Rank*
1	Shortage of labors	0.719	1
2	Weather, climate (hot or cold) & rain effects on construction activities	0.687	2
3	Shortage of construction materials in market	0.656	3
4	Delay in manufacturing special-building materials	0.656	4
5	Civil unrest/public strikes	0.656	5
6	Poor communication and coordination b/w the participants of the construction project (owners, contractors & sub-contractors, designers, consultants, workers and suppliers)	0.625	6
7	Delays in sub-contractors work and their incompetent which leads to frequent change in subcontractors	0.609	7
8	Late procurement of materials/late ordering	0.609	8
9	Unclear and inadequate details in drawings and also slow response on doubts arising from the drawings	0.594	9
10	Labor strikes at site	0.594	10

Table 2: Result of Private Project Analysis

No	*Delay Factors*	*RII*	*Rank*
1	Shortage of labors	0.864	1
2	Late in revising and approving design documents	0.722	2
3	Change orders (plan/design) & extra orders by owner during construction	0.694	3
4	Slowness in decision-making process	0.687	4
5	Damage of sorted material while they are needed urgently due to improper storage of materials	0.682	5
6	Personal conflicts among labors	0.659	6
7	Shortage of construction materials in market	0.659	7
8	Complication of hiring and transporting to the site	0.659	8
9	Sudden increase in quantity needed	0.636	9
10	Low skilled/productivity level or unqualified labors	0.614	10

Figure 1 shows that the pie chart representation of the result of government project analysis.

Considering the top 10 causes, the external contributed factors & material contributed factors are 30% each. Labor contributed factors are 20% and consultant and contractor contributed factors are 10% each.

Figure 2 shows that the pie chart representation of the result of private project analysis.

While in the case of private project analysis the labor contributed factors, material contributed factors, and owner contributed factors have equal importance. They are 30% each and the remaining 10% is equipment contributed factors.

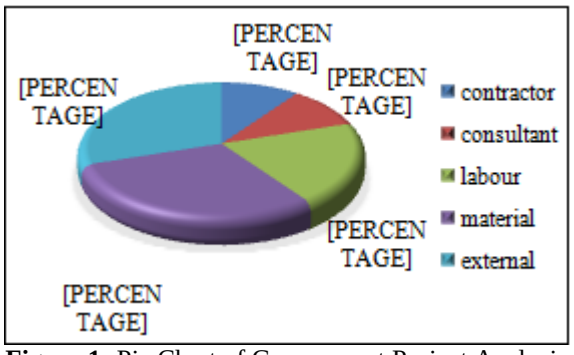

Figure 1: Pie Chart of Government Project Analysis

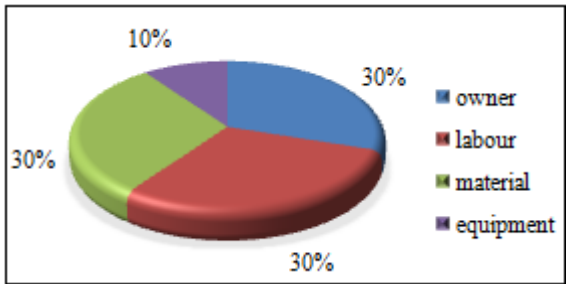

Figure 2: Pie Chart of Private Project Analysis

7. Conclusions

The findings of this study serve as a basis for making the following conclusions and recommendations:

- The purpose of this study was to identify and understand the factors that causes delay in educational building construction projects
- Over the study we have gone through the basics of the causes of the delays and their effects. The questionnaire was designed to get the data from the journals and well experienced engineers working in many of the companies and tried to understand the main reason for the delays in the execution of the projects
- From the comprehensive study fifty five causes of delay were selected
- This paper contains the findings of a questionnaire survey conducted among owners, contractors, engineers, construction managers and labors who work on educational building construction projects
- In this paper, the private project works and government project works were analyzed separately
- This paper shows that labor contributed factors and material contributed factors are common reasons that come up in a construction project
- The study shows 10 causes out of 55 are have the highest Severity in case of government projects; Shortage of labors, weather, climate (hot or cold) &rain effects on construction activities, shortage of construction materials in market, delay in manufacturing special building materials in market, civil unrest / public strikes, poor communication and coordination between the participants of the construction projects, delays in subcontractors work and their incompetent which leads to frequent change in subcontractors, late procurement of materials / late ordering, unclear and inadequate details in drawings and also slow response on doubts arising from the drawings, labor strikes at site
- In the case of private projects the 10 top most significant factors are;Shortage of labors, late in revising and approving design documents, change orders & extra orders by owner during construction, slowness in decision making process, damage of sorted materials while they are needed urgently due to improper storage of materials, personal conflicts among labors, shortage of construction materials in market, complication of hiring and transporting to the site, sudden increase in quantity needed, low skilled productivity level or unqualified labors
- The major reason behind all these causes is lack of commitment and coordination within the project participants. The commitment of the project participants drastically affects the quality and the progress of the project
- Commitment from top to bottom level management is more important in which periodic review and correction should be made in all aspects (safety, quality, material, equipment) to avoid unnecessary delays and cost overruns

8. Recommendations

A project can be delayed for a number of reasons. Many of them are beyond our control. Project delays are a serious issue. They can take over budget. Clearly, delays are best avoided, but that is never entirely possible. While certainly take steps to keepproject on track and to mitigate the damage from delays that do occur. Following are the 12 steps to avoid and overcome project delays.

- Set realistic goals for the projects
- Hold a team meeting
- Gather the right resources
- Schedule carefully
- Track and measure progress
- Forecast
- Use of project management tools and techniques
- Minimize construction delays and blockers
- Improve management methods
- Proper planning
- Assign clear roles and responsibilities
- Establish clear communication between parties

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Appendix A
Questionnaire for Field Survey

The information in the questionnaire is required only for project purpose and under no circumstances will the names of individuals be revealed. The personal data sought is only for authenticity of the project.

The objective of this survey is to identify the major causes of delay in construction Projects. Following are the factors based on literature review. Please rank these factors on the scale given to the best of your knowledge. The responses received will be used solely for academic purposes**.**

Part A
Basic Information

No	Details	Responses
1	Name Of Respondent	
2	Category Of Respondent	
3	Name Of The Project	
4	Type Of Project	

Part B
Factors causing delay

Category	Factors causing delay	Relative importance			
		1	2	3	4
Owner contributed factors	Delay in progress payments				
	Change orders (plan/design) & extra orders by owner during construction				
	Owners lack of experience and involvement				
	Slowness in decision-making process				
	Late in revising and approving design documents				
	Unavailability of professional construction management (i.e.consultant)				
Contractor contributed factors	Delay in progress payments				
	Inadequate contractor's work & experience & also poor risk management and ignorance				
	Poor supervision & managerial skills and lack of training personnel				
	Delays in sub-contractors work and their incompetent which leads to frequent change in subcontractors				
	Delay in site mobilization				
	Disputes between labour in site				
Consultant contributed factors	Poor qualification & Inadequate experience of consultant’s engineering staff				

	Delay in approving overall designs, shop drawing, sample tested materials and major changes in the work				
	Incompetent/Poor management by consultant				
	Delaying in performing site inspection & testing				
	Consultant's reluctance for change and their inflexibilities				
Designer contributed factors	Unclear and inadequate details in drawings and also slow response on doubts arising from the drawings				
	Mistakes and discrepancies made in design documents leads to frequent revisions of drawings/designs				
	Using poor/old engineering design software				
	Financial problems				
	Misunderstanding of owner's requirements by design engineer				
	Inadequate design team experience & delay in producing design documents				
Labor contributed factors	Low skilled/productivity level or unqualified labors				
	Shortage of labors				
	Personal conflicts among labors				
	Labor strikes at site				
	Nationality and language of labor				
	Labor Safety & health problems when working in hazardous conditions and their absenteeism				
	Lack of motivation				
Material contributed factors	Delay in material delivery especially while importing				
	Shortage of construction materials in market				
	Late procurement of materials/late ordering				
	Delay in manufacturing special-building materials				
	Damage of sorted material while they are needed urgently due to improper storage of materials				
	Late in selection of finishing materials due to availability of many types in market				
	Price fluctuation/inflation in material prices				
	Sudden increase in quantity needed				
Equipment contributed factors	Equipment breakdown and their idle time and lack of tool in market				
	Shortage of heavy equipment when needed				
	Low level of equipment-operator's skill				
	Low productivity and efficiency of equipment				
	Lack of hi-tech, advanced and special equipment				
	Complication of hiring and transporting to the site				
External contributed factors	Effects of unforeseen subsurface and changing ground condition (e.g. Soil, high water table) factors				
	Delay in obtaining permits from municipality				
	Accident during construction				
	Changes in government regulations and laws				
	Unavailability/poor temporary facility of utilities in site (such as water, electricity, telephone, etc)				
	Weather, climate (hot or cold) & rain effects on construction activities				
	Civil unrest/public strikes				
	Aggressive competition at tender stage				
	Effects of social and cultural factors				
	Poor communication and coordination b/w the participants of the construction project (owners, contractors & sub-contractors, designers, consultants, workers and suppliers)				
	Improper project document management				

Part C

Comments

If you have any additional comments that would help us to understand about delay of your construction projects. Please add these below:

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Author Profile

Aneesha PM.Tech in Construction Engineering and Management (MGM College of Engineering and Pharmaceutical Sciences, Valachery, Kerala) from APJ Abdul Kalam Kerala Technological University.