Identification of Critical Construction Delay Factors

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Abstract— Today in construction industry several challenges are faced by construction projects. Many of them directly affect the construction operation concluding the delay in project or affecting the performance of project. This delay negatively affects economy, growth of infrastructure and the society at large. To improve performance of project it is important to study the delay factors which affect the success of project. The purpose of this study is to logically explore the delay factors of project and how these can be avoided or controlled. With the help of detailed literature review and interviews the construction delay factors were grouped into seven categories, which will give the parameters that could have direct effect on success of project.

Keywords— Causes, Delay Factors, Success, Project, Procurement.

I. INTRODUCTION

Construction delay is considered to be one of the recurring problems in the construction industry and it has an adverse effect on project success in terms of time, cost and quality [10]. Leading to success is highly critical factor in project life cycle. Also due to huge competition in construction industry it is essential to study the causes and critical factors which control the project success. There are number of performance measuring parameters are cited to call a project successful, such as satisfaction of project participants, technical performance of project and number of disputes at the completion of project [7]. Success is defined as the degree to which goals and expectations are met [6]. Project can success or fail independently of the project management process as it is affected by many other factors outside the direct control of the project manager [3]. Eventually project includes huge number of factors and participants which are trying to complete their job at certain date, for a certain value/amount of money. As the construction industry is risky business and the possibility of failure always exists, companies have to consider the parameters which have direct effect on the success in the business [6]. Project performance is depend on various factors such as proper planning and scheduling, total quality management, resource management etc. Hence it is important to find out all possible delay factors of a construction project in order to conclude a better quality and satisfaction to both owner and its participants. The important parameters which control the success of project are cost, time & quality. The project time is usually essential to contracting parties so that to analyze project delays to make right decisions on potential cost compensation claims [4].

II. IMPORTANCE OF THE STUDY

The construction industry is the tool through which a society achieves its goal of urban and rural development. It is one of the sectors that provides important ingredient for the development of an economy. Many construction projects have faced various problems due to the complexity of project, lack of management, improper planning & scheduling etc. these all problems conclude with one of the major problem delay of time. In simplest the importance is that, both for owner & contractor time is money and for this construction schedule should be checked, analyzed & corrective actions should be taken in a timely manner to prevent the recurrence of an event that caused the problem. Delay problems occur frequently during project life-time which may lead to conflicts, contract termination, litigation etc.
Hence it is important to study & analyze causes of construction delay, as the services provided by infrastructure projects serve input for other sectors and cost overrun in these projects lead to an increase in capital output ratio for the entire economy.

III. PROBLEMS FACED BY CONSTRUCTION INDUSTRY

Construction delay factors can generate problems in developing economies. The wealth of any nation is gauged by its performance in infrastructure provision through its construction industry. The construction industry is large, volatile, and requires tremendous capital outlays [5]. The usual remedial effort for delay is to accelerate the remaining activities of the project by employing additional resources or alternative construction methods. Inevitably, this involves extra costs [8].

IV. STUDY OBJECTIVES

The overall objectives of the study described in this paper was,

- To identify the causes of delays that exists in construction sector.
- To identify the critical delay factors in construction sector.

V. CAUSES OF DELAY

Today in construction industry several challenges are faced by construction projects. Many of them directly affect the construction operation concluding the delay in project or affecting the performance of project. This construction delay factors can generate problems in developing economies. The wealth of any nation is gauged by its performance in infrastructure provision through its construction industry. The construction industry is large, volatile, and requires tremendous capital outlays [5].

To understand the success factors of construction project, it is important to elaborate the causes of these delays. The researchers have studied the many causes of delay in construction industry such as shortage of labor supply, delay in progress payment, poor site management and supervision etc. Some of the studies are summarized below (Table 1). Project can success or fail independently of the project management process as it is affected by many other factors outside the direct control of the project manager [3].

<table>
<thead>
<tr>
<th>Searchers</th>
<th>Major causes of delay</th>
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<tbody>
<tr>
<td>Assaf et al. (1995)</td>
<td>- Slow preparation and approval of shop drawings</td>
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<td></td>
<td>- Delays in payments to contractors</td>
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<td></td>
<td>- Changes in design/design error</td>
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<td></td>
<td>- Shortage of labor supply</td>
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<td>- Poor workmanship</td>
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<tr>
<td>Assaf and Al-Hejji (2006)</td>
<td>- Change in orders by the owner during construction</td>
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<tr>
<td></td>
<td>- Delay in progress payment</td>
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<td></td>
<td>- Ineffective planning and scheduling</td>
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<td></td>
<td>- Shortage of labor</td>
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<td>- Difficulties in financing on the part of contractor</td>
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</table>
VI. CRITICAL DELAY FACTORS

Organizing and planning was perceived to be the most important factor contributing to the success while considering the importance weights of the factors [6].

Project is running on many numbers of factors & Participants. These are having individual causes for the construction delay. But the important participants like owner, contractor, and consultant have more influence on project performance [10].

116 critical delay factors are selected and grouped under seven parameters based on literature review as well as interviews. These critical delay factors included in questionnaire are being concise according to previous studies and factors suggested by local experts, which are as follows:

- **Owner Related Delay Factors**
  - Is there trust, understanding & owner decision making authority among & between the owner & lead contractor's teams.
  - Late revising & approving relevant documents by owner
  - changes by owner during construction
  - delays in payments of completed work by owner
  - Lack of communication & co-ordination by owner
  - Conflicts in joint ownership
  - Suspension of work due to owner
  - Misunderstandings in technical dealing with vendors & contractors

- **Consultant Related Delay Factors**
  - Slowness in approving drawing & material samples by the consultant
  - Less authority given to consultant to take decision
  - Total quality management by consultant
  - Mistakes in consultant’s drawings
  - Consultant’s less experience
  - Financial difficulties to the consultant
  - Modification in contract

<table>
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<tr>
<th>Author</th>
<th>Critical Delay Factors</th>
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<tbody>
<tr>
<td>Tommy Y., Ivan W. and Karen C. (2006)</td>
<td>- Unforeseen ground conditions&lt;br&gt;- Poor site management and supervision&lt;br&gt;- Client variation&lt;br&gt;- Inexperienced contractor&lt;br&gt;- Slow co-ordination and seeking of approval from concerned authorities&lt;br&gt;- Inadequate contractor resources</td>
</tr>
<tr>
<td>Sweis, Hammad and Shboul (2007)</td>
<td>- Financial difficulties faced by the contractor&lt;br&gt;- Too many change orders by the owner&lt;br&gt;- Poor planning and scheduling of the project by the contractor&lt;br&gt;- Shortage of manpower</td>
</tr>
<tr>
<td>Saleh, Abdelnaser and Abdul (2009)</td>
<td>- Improper planning&lt;br&gt;- Lack of effective communication&lt;br&gt;- Shortage of supply i.e. steel, concrete etc&lt;br&gt;- Design errors&lt;br&gt;- Slow decision making&lt;br&gt;- Financial issues&lt;br&gt;- Shortage of material</td>
</tr>
<tr>
<td>Wei K. S. (2010)</td>
<td>- Late in revising and approving design documents&lt;br&gt;- Delays in sub-contractors work&lt;br&gt;- Poor communication and coordination change orders by owner during construction</td>
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</table>
• Lack of practical (working) knowledge to the consultant
• Lack of co-ordination of consultant with contractor
• Consultant’s ability of leadership
• Inflexibility of consultant
• Conflicts of consultant with design engineer
• Changes in specification during construction by consultant
• Inadequate site information given to consultant
• Delay in handover of site to contractor
• Conflicts between consultant & contractor
• Complexity of project design faced by consultant
• Difficulties in receiving payments from agencies faced by consultant
• Communication barriers faced by consultant
• All design changes being identified & discussed with vendors & contractors by consultant

➢ Contractor Related Delay Factors
  • Contractor’s inadequate planning & scheduling
  • Lack of experience of contractor for decisions
  • Contractor’s slowness in site mobilization
  • Contractor’s slowness in preparation of documents & material samples
  • Contractor’s Poor site management & supervision
  • Conflicts with sub-contractor
  • Rework in construction faced by contractor
  • Is contractor compatible with new technology
  • Compatibility of contractor with new software’s
  • Poor understanding of accounting & financing project
  • Poor managerial skills in contractor
  • Inadequate handling of project progress by contractor
  • Risk analysis & management by contractor
  • Availability of & systems document of the project to the entire team
  • Regular updation in execution plan including team RACI charts of all team members/contractors
  • No changes are picked up for all relevant & latest documents
  • Source updation in the design engineering documents & related

➢ Material Related Delay Factors
  • Shortage of material
  • Changes in quality of material
  • Frequently unexpected modifications in specification of material during construction
  • Slow process of material selection
  • Poor Material management
  • Material damage in storage
  • Escalation of material prices
  • Late in finalizing finishing material due to availability of varities in market
  • Insufficient turnover & startup resources makes project slow
  • Lack of site receiving inspection system
  • Materials not in right place when needed
  • Untimely delivery

➢ Labor & Equipment Related Delay Factors
  • Poor labor supply & labor productivity
  • Disputes in labor
  • Labor strikes
  • Unavailability of equipment
• Delay in equipment delivery
• Shortage of recent technology equipment
• Large or long lead-time equipment been received as requested
• No use of checklist
• Unavailability of equipment lists & related design data
• Seasoned operators
• Space limitations at site for temporary & permanent equipments
• Manpower loading accessible from the available supervision & skilled tradesmen pool
• Lack of safety
• effective inspection & expediting visits

➢ Project Related Delay Factors
• Traffic control at site
• Changes in site conditions
• Unforeseen ground conditions
• Insufficient data collections & survey
• Changes in site topography after design
• Restricted access
• Accidents on site
• Problems due to existing structures
• Unavailability of utilities in site area
• Change in economic conditions & increase in quantity of material
• Rework due to error in construction
• Issue & implementation of quality plans & inspection test plans ITP’s

➢ External Related Delay Factors
• Inclement weather effects
• Inaccurate cost estimates
• Restriction due to site location
• Changes in government regulation & laws

VII. REMEDIAL MEASURES

1. Proper communication and coordination system between owner and contractor should be developed. Changes and alterations in planning execution should be discussed and pre-informed so that it will not lead delay. Payments should be done on time so that project performance will not get affected.

2. Communication as well as document system should be developed so that drawings and their mistakes (if any) can be corrected as soon as possible. Implementation of practical knowledge also for junior consultant’s proper training course should be developed. The role of this training programme should include leadership skill development, co-ordination system improvement.

3. Decision and steps taken during project life cycle should be beneficial for project performance. Use of MSP, Primavera or any other planning & scheduling software must be compulsory. As the construction projects include huge number of participants, team approach should be developed. Contractor should employ different teams like, technical team; finance team; research team etc and each team will have their specific goal or purpose. Technical staff should be assigned to project according to their area of expertise or capability. This will be helpful to reduce the rework as well as overcome the problem of inadequate handling of project progress. Meeting between all teams should be arranged to build up effective management between project teams.

4. For the implementation of material management and quality assurance a dedicated team should be deployed. The role of this team should be material procurement, vendor selection, inspection. Thus it will be helpful in stores management as well as overcome the factor of untimely delivery. In project cost estimation this team will be helpful for alerting the factor of price escalation.
5. To improve labor productivity and skill, training programme should be developed and implemented. To avoid accidents on construction site, safety tools, safety training programme as well as safety plan should be prepared. In order to generate safety awareness of different safety gadgets to workers and employees, Construction Company should plan for safety budget.

6. During selection of construction equipment by contractor due consideration should be given to its owning cost, its operating cost, operating fuel cost and maintenance cost. To assist equipment selection process optimization model, graphics model, artful intelligence based model must be used depending upon project. To avoid unavailability and shortage of construction equipment a proper equipment vendor database should be maintained by contractor.

REFERENCES