

## REVIEWING TIME AND COST OPTIMIZATION TECHNIQUES FOR SUCCESSFUL CONSTRUCTION PROJECTS

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### ABSTRACT

Nowadays the maximum construction projects are behind the schedule, so difficult task for a project manager to finish the project on time, within the budget and achieve other project objectives. For that constantly measuring progress, evaluation plans & corrective actions should be taken whenever required. Time and cost are major factors to be considered in the execution of projects. Optimization of construction projects is a systematic way to improve the profit margins and obtains best results under given circumstances. There are various tools and techniques which are available for optimization. Optimizing the performance of the different techniques adopted at one stage of the construction process may not be useful if the methods used are not up to the efficient level. There are different softwares used for systematic planning and programming with effective management and it is necessary for completion of projects in time. This paper includes the different softwares and techniques used for time and cost optimization of construction projects.

**KEYWORDS:** Planning, Scheduling, Delay, Time Optimization, Cost Optimization.

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### 1. INTRODUCTION

The construction management is a critical part in the project because it contains the knowledge of controlling the cost, scheduling & resources. A construction contract is unit price, lump sum or cost plus; the construction cost is important factor in all projects. At the same time duration of completion of project is also important. Nowadays major construction projects are behind the schedule. The major factors that impact cost of construction are material, labour, equipment, overhead and profit. (Kerzner, 2003).

There are some traditional methods for effective project management including either Critical path Method (CPM) or the Program Evaluation and Review Technique (PERT) combined with trial and error procedure. Some softwares are used for effective scheduling of projects in construction management. (Lester, 2000; Nicholas, 2001).

It is difficult to attained Project objectives unless proper monitoring methodology is implemented. Employing effective planning in terms of scheduling, budgeting, safety & quality at the early stages of project is very important since it allows control over the process from its commencement phase to its completion phase, minimizes delays and cost over-run & assists in achieving the project objectives efficiently.

#### 1.1 Objectives of Project

- To study the time and cost optimization of construction projects by using project management softwares and various techniques.
- To find the suitability of project management softwares for optimization of construction projects.
- To recommend the suitable project management software to cover all aspects of delays.
- To study the problems related with material management in construction projects.

#### 1.2 Problem Statement

In project it is necessary to decide which optimization is required and detail data of resources that will be used in all stages of construction. The time and cost optimization is necessary as it could minimize both the time and total cost of project. All construction companies should done planning and scheduling before starting any project but some companies did not follow it well.

The time is important constraint of the project and time taken by different activities will lead to delay of the project.

Various softwares are available in market for time and cost optimization but from that Microsoft Project (MSP) &

Enterprise Resource Planning (ERP) can be used for proper planning, scheduling & optimization of resources.

## 2. LITERATURE REVIEW

Optimization of time and cost are required to avoid delay and cost overrun in project as well as various softwares are available that can be used for optimization, therefore rigorous literature review on similar subject has been done and the details are as below:

Chidambarakumar et al. (2017) studied that Planning and scheduling is very much important in construction projects. Proper planning, scheduling and tracking are the main parameters in construction industry. The systematic workflow is obtained by using Critical Path Method and Programme Evaluation and Review Technique. Improper controlling and scheduling will cause the cost overrun and hence increases project duration. In order to minimize the complexity in manual calculations Project Management Software can be adopted. Oracle Primavera P6 is one of the best software in construction management used for Project management.

Malpani et al. (2016) studied that resource optimization and resource levelling problem is common and has been studied many times. They used a software Primavera for existing building and it is conclude that (1) resources levelling is done with the help of primavera software; and (2) resource optimization is possible by using primavera P6. There is direct impact duration on cost of project so it is helpful to do early planning to complete project within budgeted cost.

Kumar et al. (2015) studied that Construction planning and scheduling is an important job in a construction projects. This paper composed of study on the concept of planning and scheduling of various activities which are related to construction projects. In this paper study of project management software (MSP) is also done. Critical path planning and scheduling techniques are used to find out total project duration. In the next step controlling technique is used for optimization of the completion time of the project.

Jonathan Jingsheng Shi et al. (2015) described the term ERP. This paper also included the information about construction enterprise operation with internal resources, external resources and advanced planning to determine the strategy for running the projects on hand and how ERP system can be helpful for planning and scheduling of resources.

Subramani et al. (2014) described how to find out and examine the causes of cost overrun in construction. The results which are carried out from survey showed that, poor contract management, slow decision making, poor schedule management, increase in materials, increase in machine prices, poor design, delay in providing designs, rework due to wrong work, long period between design and bidding time, wrong estimation/ wrong estimation method are the major causes of cost overrun.

Salunkhe and Patil (2014) Studied that the Construction delay is considered to be one of the frequently occurring problem in the construction industry and it has an adverse effect on project completion in terms of time, cost and quality. The time and cost for performance of a project are very important to the employer and contractor. The author focuses on the types of construction delays due to which project suffer the time and cost overrun and gives the external and internal factors that impact the construction process. This paper describes the effect of delay in large construction projects.

Memon and Rahman (2014) suggested that time is the biggest element that every contractor has to deal with while practicing the construction activities. Author analyzed commonly used techniques and software of time management together with their effectiveness level in large construction projects. The data was collected from the various construction organizations that deal with huge projects. Relative Importance Index calculation was applied to assess the level of effectiveness for time management techniques and software packages adopted in the construction projects. The results illustrates that most common and effective time management technique and software Package are CPM and Microsoft Project respectively. These techniques are brought into practice but practitioners did not accomplish the goals of respective organization.

Shanmugapriya and Subramanian (2013) studied that Time overruns and Cost overruns has been a major problem in many Indian construction projects. The objective of this paper is to study the significant factors which cause Time overruns and Cost overruns in Indian construction projects. The result achieved from the survey explained that the major causes for time overruns are contract modification, material market rate, and high level of quality requirement. Also the major causes for cost overruns are, change in material specification, high transportation cost, and escalation of materials price.

Pawar and Attarde (2013) describe that planning and scheduling is done using the tools and devices are helpful in comparing the project with stipulated cost, time and quality. It is useful to plan and evaluate the resources for the construction of the building project. Author compares the cost variation due to the delay of the project and rescheduling the project by crashing process.

Anantatmula (2010) found out that by applying project management concepts, tools, and techniques planning can be improved after comparing the planning aspects of a conventional business project with the planning of an academic degree. Author also helps to describe the application of project planning techniques to manage the multiple constraints and the complexity related with academic advising and planning.

### 3. METHODOLOGY

There are various techniques used for time and cost optimization in construction projects. To overcome this issue, collect all possible reasons for delay and cost overrun of project from ongoing site. Then use the gathered details to reduce the time and cost of project by applying various optimization techniques in practice. Some softwares are also helpful for planning, scheduling and controlling of construction projects.

To gather the details related to delay and cost overrun, collect the data from sites in systematic and periodic manner which will give clear idea about the delays in quantifiable manner. Consider all the minute details while collecting the details. This process will help in planning upcoming projects in efficient manner. There are various tools/systems available to compile and create the data repository in efficient way.

#### 3.1 Reasons for Delay in Construction projects

- Delay due to Equipment Breakdown
- Delay due to idle Equipments.
- Delay due to unavailability of materials.
- Delay due to unavailability of spare parts of equipments.
- Delay due to labour strike.
- Rework in design
- Slow decision making
- Poor estimation
- Poor planning

#### 3.2 Construction Time

The construction projects divided in various activities. An activity has recognizable dates to begin and end. The duration of an activity is the estimated time that will be required to complete it. In construction unit of time is

measured in hours, days, week, month, years etc. The work will be completed on a continuous and uniform basis within standard work day and work week except the weekends and holidays. Activity duration is directly depending on the resources applied and the productivity of those resources. Time estimation is important for many reasons-

- To calculate the start or end of specific activity.
- To improve work efficiency and to resolve delay claims.
- To calculate project completion date.

##### 3.2.1 Time Factors

Below are some of the factors need to follow in order to complete the project within specified duration as per the requirement of stakeholder:

- Consider lowest possible detail while planning
- To work activities simultaneously
- To do work maximum with equipments
- Proper use of available resources
- Proper selection of suppliers
- Use of RMC plant
- Use of skilled labour
- Use of new equipments for high efficiency and greater production
- Proper planning of site layout so that material and equipment transportation will be easier
- Proper planning and scheduling of all activities
- Maintenance workshop should be near to site, Etc

### 3.3 Construction Cost

The total estimated cost of a project to carry out the work is known as the construction cost it contains direct cost as well as indirect cost. The application and use of money, manpower, machines, material and time for the performance of the various activities are all associated to those common measures of cost.

Net cost is the sum of direct and indirect cost

- Direct cost- These are directly chargeable and can be identified specifically according with the activities of the project. Such as equipment, labour, materials etc.
- Indirect cost- These are not specifically identified but, they are being associated with a particular work item. It includes site management, supervision, offices, canteen, storage sheds, cars and other than sport temporary roads and services etc.

#### 3.3.1 Cost Factors

Below are some cost factors required to consider for completion of the project in specified cost with maintaining the quality:

- Use of Alternate materials
- Use of skilled labour so that wastage should be minimum
- Use of resources for more efficiency and quality
- Proper selection of supplier, etc

### 3.4 Time and Cost Optimization Concept

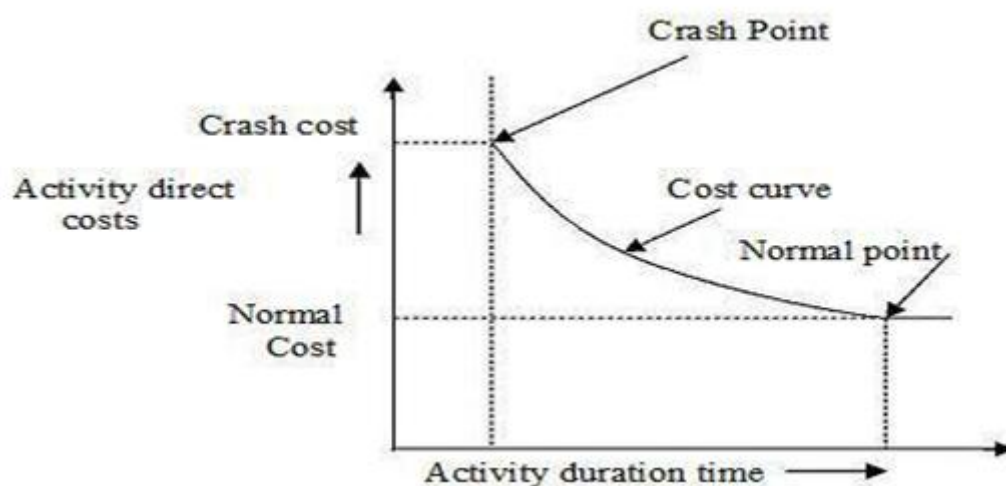
In the construction field, early completion of project transformed in to some kind of opportunity such as bonus of early completion or saving in overhead. The cost optimization is a process which is carried out throughout the construction period to ensure that the cost of the building should be within the estimated cost limits.

Many times, in the construction field the lowest tender price should not be the only criterion for project success and thus concurrent optimization in both time and cost is highly encouraged and desirable.

### 3.5 Time and cost relationship of an activity

Chitkara (2005) said the relationship between cost and time is a very important aspect in the control of costs on construction site. It is very important to record all the works involving materials, plant and labour on sites. This helps the contractor to know the costs and expenses of the resources which are used on site and it compare with the initial cost budget.

Time-cost relationship for a single activity is illustrated in Figure. As shown in below figure, the least direct cost which is required for completing an activity is called the normal cost, and the corresponding duration of an activity is known the normal duration. The shortest possible duration required for completing the activity is referred as the crash duration, and the corresponding cost is the crash cost



*Fig. : Typical relationship between time and cost of an activity (Hegazy, 2002)*

### 3.6 Software for Management

Project Management is a process of planning, organizing and managing activities and resources to accomplish a defined objective within constraint time and cost. Generally, to see project failing to achieve its mission within specified time and cost. The factors which are contributing to overrun are inadequate project information, poor planning for implementation and lack of project management during project execution. As project become larger and more complex, the ability to exchange information on a timely basis get reduced.

Construction industry sources suggest that 85% of the project managers time is spent on communication and 70 % of project documentation is paper based. So there comes need of softwares to overcome the failure due to lack of management. There are different softwares that can be useful in project management are MSP, Primavera, ERP etc.

Mainly MSP is used for planning and scheduling activities during construction and ERP is used for material management like order quantity, store management, distribution of goods etc.

## 4. CONCLUSION

Proper planning, selection, procurement of material, installation, operation, maintenance and equipment replacement policy plays important role in construction management for successful completion of project.

From the above paper we studied that the various factors that can be helpful for time and cost optimization to avoid delay and cost overrun. At the same time we can use various softwares for time and cost optimization like MSP, Primavera and ERP etc. from that Microsoft Project is suitable for planning and scheduling of activities and it is user friendly software than other softwares. It makes easier to collaborate on large projects and will be

able to track the progress of projects. ERP is used for material management. It increases the productivity and efficiency.

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