Implementation of Genetic Algorithm Technique in Resource Constrained Construction Project

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Abstract - *Normally construction projects scheduling is following the conventional scheduling methods like Critical Path Method (CPM) and Program Evaluation and Review Techniques (PERT). These methods never consider the availability of the resources in the project. So compared to the traditional methods the genetic algorithm has more advantages as it can consider the objectives of time and cost reduction. The main objective is to Develop a G.A model to reduce the cost of the project and getting effective project schedules to Implement the model on scheduling of Commercial building project. Using primavera software we can schedule the resource constrained project in terms of cost minimization using physical percentage calculation.*

Key Words: Genetic algorithm, resource constraint scheduling, critical path method, delay, construction management, resource levelling, resource smoothening

1. INTRODUCTION

An effective plan should include what objectives are to be obtained, the technology associated with the project that are available at least cost, the duration of the construction. The goal of planning is to minimize resource expenditures while satisfactorily completing a given task .All project schedule has its own predecessor constraints. We can use the GA methods in the project and the delay can be managed it automatically saves the cost. By allocating resource into the schedule we could understand the percentage completion of the project .The traditional methods drawback can be avoided if we are using a GA implemented.

1.1 OBJECTIVE

To conduct a site visit to understand the property and find out the critical factors and calculate the RII index. Develop Genetic Algorithm optimization model to optimize the schedule of resource constrained project. Develop a G.A model to reduce the cost of the project and getting effective project schedules. Implement the model on scheduling of Commercial building project

2. METHODOLOGY

A detailed study on critical factors affecting the cost in different commercial building sites by using questionnaire survey was done. The RII index was calculated. The major 10 problems were identified. A GA model was selected for resource constrained schedule

2.1 Questionnaire Survey

In order to identify the factors a total of 50 questions were distributed to various 50 companies and rated them as from 1 to 5. Never being the lowest and always being the highest.

2.2 IMPORTANCE OF G.A IN CONSTRUCTION PROJECTS

The importance of genetic algorithm in construction projects can be summarized from the survey details are explained below:

- Delay Management (Time)

- Resource Management (H.R)

- Choice Of Technology (Machine & Materials)

2.3 G.A MODEL PROPOSED FOR TIME MANAGEMENT

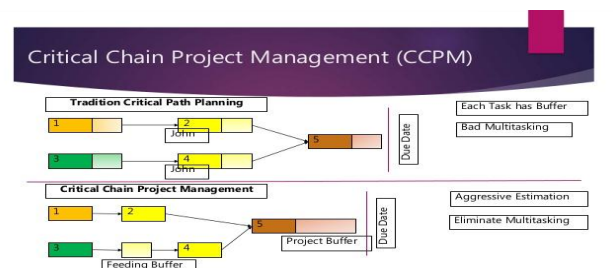For construction projects we can adopt a modified method of C.C.P.M for managing time effectively.

Fig -1: critical chain project management

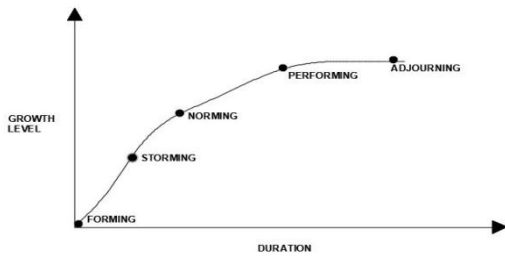## 2.4 OPERATIONS IN RESOURCE DEVOLOPMENT PLAN

Fig -2: Stages of resource development plan

Storming: During this phase, the team begins to address the project work, technical decisions and the project management approach. If team members are not collaborative or open to differing ideas and perspective the environment can become counterproductive.

Norming: In this phase team members begin to work together and just their works habits and behaviors to support the team. The team members learn to trust each other.

Performing: Teams that reach the performing stage function as w well-organized unit. They are interdependent and work through issues smoothly and effectively.

Adjourning: In this phase the team completes the work and moves on from the project. This is typically occurs when staff is released from the project as deliverables are completed or as part of the close project or phase process.

2.5 IMPORTANCE OF LINEAR TRANSPORATION METHODS IN G.A

Linear Programming and Genetic Algorithm (LP-GA) combination are used to compute reserve analysis in project management. Its computation time is compared with the time required for simple GA. Some of the linear transportation methods for G A analysis are column minima method, row minima method, North west corner rule method.

2.6 PLANNING, CONTROLLING AND MANAGING PROJECTS

It is very important to understand the team members and other project owners involved in project to get the associated recommendation that help the smooth primavera implementations the lead to our goal. It is a critical tool to help your company stay targeted and accomplish its goal.

2.7 GENETIC ALGORITHM IN THE PROJECT EXECUTION LEVEL

By the all above procedures the GA implemented work schedule has been prepared. As it satisfies the Delay matters, Resource management save this schedule as our baseline; means what is the actual expectation. But when the execution of the project started there may be a lot of chances to vary from the previous baseline. It may lead to change in schedule, budget and the scope. Execution of project work and tracking of its behaviour is known as Update progress or Tracking progress. After updating the project schedule we can enter the actual work occurred on the work site. It is called as Physical percentage of completion. The primavera shows schedule that time as the percentage completion of schedule.
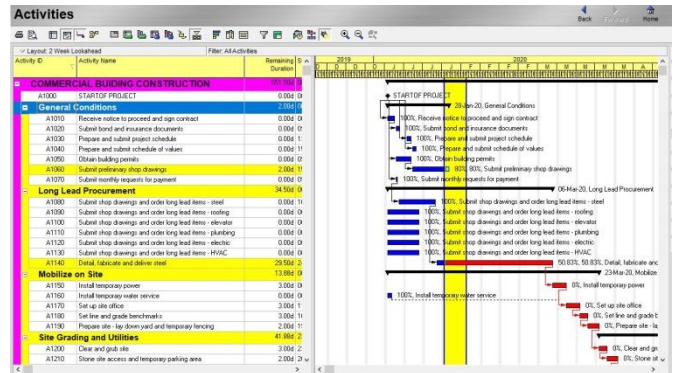

Fig -3: Project execution level in primavera software

2.8 PHYSICAL % UPADATION USING PRIMAVERA ON G.A MODEL

Let us work with the physical % updating against our primavera case study. The project is under updating for a period of time. As a result it is observed that the completion % is marking in each specific columns there. Here three types of % complete can be seen

Fig -4: Updation of physical percentage

Schedule % complete: It indicates the % completion expected by the created schedule or based on the duration of baseline associate with the project.

Unit % complete: It indicates the effective utility and participation of specific resources who is assigned to the activities.

Physical % complete: It is calculated based on the real completion % of work by proper measurements. It is highly related to the taking time and also the effort taken by the resources.

The actual total cost is calculated based on the scheduled % completion where the physical % of cost is calculated based on the updating in unit % completion table. The unit % completion is manually marked against the physical % updates that we have performed at the work site by weightage analysis and real time measurements.

3. RESULT FROM G.A BASED PHYSICAL % UPDATION WORK SCHDULE

The critical factors identified on the basis of RII factors has been identified and grouped for delay management which represents time management in which critical chain path method can be used. The next identified is resource management which can be done by resource levelling, resource, smoothening, .The next identified is choice of technology. Execution of project work and tracking of its behaviour is known as Update progress or Tracking progress. After updating the project schedule we can enter the actual work occurred on the work site. It is called as Physical percentage of completion. The primavera shows schedule that time as the percentage completion of schedule. As per the schedule time usage we reach 1.2.47%but by updating physical % method our work is 10.67% units are completed. It is not a problem in schedule performance as our non-critical activities get delayed but enough buffer in the activities. We can level & smooth activities for better result. Actual total cost shown as Rs. 1,337,500/- , but physical % cost shown as Rs. 1,032,000/. Therefore a cost difference of Rs.3,05,500 is obtained.

4. CONCLUSION

Genetic algorithm of resource constrained schedule in construction project depends on all external and internal factors in the project. success rate of G.A based on effective developments, analysis, levelling, smoothing& effective distribution of the resources in the project. In resource constrained scheduling physical % updation plays the vital role without resource management physical % updation not possible. Rolling wave planning is essential for implementing GA based approach.

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