

A Critical Review on Project Management techniques: PERT and CPM

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Abstract— Project Evaluation and Review Technology (PERT) and Critical Path Method (CPM) are vital techniques for the planning, scheduling and managing large projects in terms of cost, path and time. The CPM and PERT is a fundamental technique developed for project management assuming under the unlimited resource availability. The practical problem of allocating resources over the time to perform collective tasks arises in a variety of situation and frequency the scheduler must take account of the trade-off between availability of resources and activity duration. To solve these problems use of mathematical models could not solve bigger or complex problems. The scheduling of tasks and the allocation of resources in medium to large schedule projects is an extremely hard problems and challenges of project management due to its complexity and therefore PERT and CPM are ideal solutions.

Keywords: PERT/CPM, Network diagram

I. INTRODUCTION

Network analysis and research techniques are the general name given to certain specific processes which can be used for planning, management and control of project. The task of managing a large scale project includes several tasks such as scheduling a number of activities throughout the enterprise; planning for the execution of the entire process, time estimation etc. To provide some ease to the project manager two operational research techniques called PERT and CPM.

The research was referred to as the Program Evaluation Research Task (code-name PERT). In February of 1958, Dr. C.E. Clark, from the PERT team, introduced the first arrow diagram. PERT, later referred to as the Program Evaluation and Review Technique, was applied to the Fleet Ballistic Missile Program later that year. With over 3,000 contractors, vendors, and other teams involved, it was of strategic importance to complete the project quickly and efficiently. PERT proved its worth, and was given credit for taking two years off the estimated time needed to develop the Polar missile, and is still the standard for all Navy projects today.

CPM and PERT were developed independently, but their main difference is that CPM uses deterministic (known) activity durations and PERT consists of probabilistic activity durations. In this project I will be analyzing both methods and demonstrating their application through example. I will also create an example from scratch, solve using both methods, and analyze the results, highlighting advantages and disadvantages of both methods. Both CPM and PERT are network based techniques. They are vital tools in the planning, scheduling, and control of projects. A project is a collection of interrelated activities with each activity consuming time and resources.

CPM/ PERT analysis have the capability to be adopted in a scheduling system which involves the activities of the project, times and critical paths. For example, in certain

circumstances, contractors may face conflict decisions such as which parallel activities that need to be prioritized. Besides, another issue is the earliest time to start the prioritized activities. Generally, many SME contractors used their intuitions or discretion to plan and schedule the construction activities. However, one of the drawbacks of this traditional method is the susceptibility to errors. Therefore, we propose a practical approach to develop an application to assist SME contractor in scheduling their construction project activities. In this paper we test the feasibility of the CPM/PERT approach in scheduling the activities for parking lot construction.

A. Overview on Construction Project using CPM/PERT:

CPM/PERT has been actively used in many area such of construction, IT, manufacturing and defence organizations [3]. For example, Lee et al. [4] constructed a Program Evaluation and Review Technique (PERT) to find the critical activities when constructing the plant and to calculate the total project cost and total duration time for the project under normal condition. Gladysz et al. [15] modified the PERT method with mixed linear programming to illustrate the construction project. Dolabi and Abbasnia [2] proposed a methodology of Heuristic Line of Balance (HLOB) from CPM/Line of Balance (LOB) for scheduling projects with serial activities. This proposed method was successfully tested on large-scale highway project. Boushaala [6] proposed a PERT/CPM and Petri Net (PNs) Tools for project scheduling. Aziz [1] developed Repetitive-Project Evaluation and Review Technique (RPERT), which is a simplified software and generated the expected project completion probability of a specified/ certain duration (contract duration). Thus this paper proposed a CPM/PERT method for a real case of parking project.

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II. ANALYSIS OF NETWORK

A. PERT: Project Evaluation and Review Technique

PERT has based on three time estimates: Optimistic time, most likely time and Pessimistic time. For these time

estimates PERT uses a beta probability distribution. According to Beta distribution, the expected time for each activity can be approximated by using the following weighted average formula: Expected time (E) = (Optimistic time+4*Most likely time+ Pessimistic time)/6 This expected time has used to calculate the minimum possible time of project completion. To calculate the variance for each activity completion time, if three standard deviation times were selected for the optimistic and pessimistic times, then there are six standard deviations between them, so the variance is given by: Variance= [(Pessimistic-Optimistic)/6]² The variation in the project completion time can be calculated by summing the variances in the completion time of the activities in the critical path.

B. CPM: Critical Path Method

CPM is for projects that are made up of a number of individual activities. If some of the activities require other activities to finish before they can start then the project becomes a complex web of activities.

- 1) Network: It is a graphical representation of logical and sequentially connected activities and events of a project. Network is also called arrow diagram. PERT (Programme Evolution Review Technique) and (Critical Path Method) are the two most widely applied techniques.
- 2) Project: A project is defined as a combination of interrelated activities which must be executed in a certain order in for its completion.
- 3) Float: Float of an activity represents the excess of available time over its duration.

C. Distinguish Between PERT and CPM

PERT (Programme Evaluation Review Technique)	CPM (Critical Path Method)
1) PERT is event oriented.	1) CPM is activity oriented.
2) PERT is probabilistic.	2) CPM is deterministic.
3) PERT is primarily concerned with time only.	3) CPM places dual emphasis on project time as well cost.
4) PERT is generally used for projects where time required to complete the activities is not known a priori. Thus PERT is used for large, R&D type of projects.	4) CPM is used for projects which are repetitive in nature and comparatively small in size.
5) Three time estimates are possible for activities linking up two events.	5) One time estimate is possible for activities (No allowance is made for uncertainty)

D. Benefits of CPM/PERT

- 1) Useful at many stages of project management
- 2) Mathematically simple
- 3) Give critical path and slack time
- 4) Provide project documentation
- 5) Useful in monitoring costs.

III. CONCLUSION

These technique completely rely on three time estimates for further calculations to complete the project: the most probable (most likely time), the most promising (Optimistic time), and the most unfavorable (Pessimistic time).

Frequently, PERT and CPM are two project management tools which are used together to overcome the difficulties such as risks, project completion date, costs of extra resources, Progress monitoring and so on of a project manager occurring at the time of project management.

As a project manager working with a project for the first time it would probably be best to use PERT. After using the method and getting more consistent completion times for activities, they at that point can become the duration of those activities using CPM.

CPM/PERT is an efficient method to be used in scheduling the construction project and cost overrun in infrastructure projects ,total time to complete the project, scheduled start and 8. Ansah, R.H. and S. Sorooshian, 2017. Effect of leancompletion time for each activity, the activities are critical tools to control external environment risks ofand the time taken for non-critical activities that can be construction projects. Sustainable Cities and Society,delayed during the project execution.

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