© 2019 IJSRSET | Volume 6 | Issue 5 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology
DOI : https://doi.org/10.32628/IJSRSET196521

Comparative Analysis of Risk Reduction Using PERT/CPM Technique

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ABSTRACT

This paper analyzed the traditional probability analysis method for duration risk in program evaluation and review technique (PERT) and Critical Path Method (CPM). On the basis of that it simulates the project's duration and analyzes the risk by Monte Carlo simulation method. The PERT/CPM produce begins with the hard work of developing an estimate of the cost each activity when it is performed in the planning way (including any crashing).

Keywords : Risk Optimization, Probability Analysis, Comparative Analysis, Simulation Technique.

I. INTRODUCTION

Project management is the process for time-limited, focused, non repetitive, activities with some degree of risk and usually scope of operational activities for the company is responsible.

PERT (Project Evaluation and Review Technique)

PERT was invented initially to clarify the planning and scheduling of big and complex projects. It is a tool for project management which is used to plan and track schedule to analyze risks in the project and to organize activities within the project. The main goal of PERT computations is to approximate the total time proceed from the start to the end of the project and also defined the same as getting that end date across with the calculation of risk. For achieving this, three estimates of duration are taken for each task, they are as given below:

• Optimistic – the minimum time required for each activity (called Ta)
• Most Likely – the most probable time needed for the task (called Tm)
• Pessimistic – the largest time required for the work (called Tc)

PERT uses standard deviation formula as defined below:

$$Standard\ dev = \frac{pessimistic - optimistic}{6}$$

CPM (Critical Path Method)

This is a way of minimizing the series of scheduled activities, or tasks, in this project. This is a tool of management designed to ensure a project's complete on the time without any delay. It is covers all the critical and non - critical tasks throughout the critical path are recognized.

Hence, the critical path will always contain of activities which have zero slack

Slack or float = > latest (start or finish) time – earliest (start or finish) time

II. PROBLEM RESOLUTION

A complete practical project schedule is expected to get a success and managing the project that accompany and organizes the various activities, and a logical schedule should also predict the completion dates of the project. The problem is to invent the algorithm throughout the risk factor in the project schedule can be reduces by improving the accuracy in the execution times of the project activities.

III. PROPOSED METHODS

In which the proposed approach construct use of the Monte Carlo simulation across with the triangular division for random variant generation is used to finding the three activity time aspects used in the PERT/CPM technique. PERT considers the variability in activity time by considering approximate of time. Monte Carlo Simulation is the modern way to estimate the risk of the project schedule.

Monte Carlo Simulation:

Monte Carlo Simulation, in which each input, is varied inside a predefined range hundreds of times and to produce a set of outputs across with the frequency of occurrence. Hence, the frequency is translated into the possibility of the respective output's occurrence.

$$\text{Criticality Index} = \frac{\text{No. of run for which an activity lies on the critical path}}{\text{Total no. of simulation runs}}$$

IV. RESULTS AND ANALYSIS

Project Data Set: In this project dataset is obtained from the project management construct case study defined the global oil credit card operation project.

Table 1 : Project Dataset

A	*P*	*OT*	*MLT*	*PT*
A	-	1	3	5
B	-	3	4.5	9
C	B	2	3	4
D	A,C	2	4	6
E	D	4	7	16
F	C	1	1.5	5
G	F	2.5	3.5	7.5
H	F	1	2	3
I	B	4	5	6
J	H,E,G	1.5	3	4.5

Where, A= Activities, P= Predecessor, O=Optimistic Time, MLT= Most Likely Time, PT= Pessimistic Time

Activity Criticality Index: In which the result shown in the figure given below describes the criticality index of the activities in the project dataset.

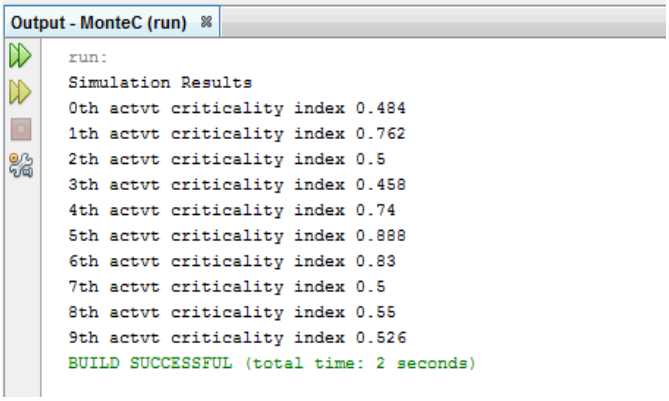

Figure 1. 1st dataset activity criticality index

Comparative Analysis: In this dataset the above figure are shown, we can define the criticality indexes of the activities in the project. From the above figure the criticality index found are the different values that mean the dependencies on the activities are not considered.

Calculated Completion Times: The project deadline is 22 weeks decided by experts.

Table 2 : Completion times project dataset

Method	Estimated Completion Time	Critical Path
PERT/CPM	23 Weeks	B-C-D-E-J
1st Simulation	19.48 Weeks	B-C-D-E-J
2nd Simulation	20.36 Weeks	B-D-E-J
3rd Simulation	21.54 Weeks	B-C-D-E-J
4th Simulation	20.60 Weeks	B-E-J
5th Simulation	19.86 Weeks	B-D-E-J

Comparative Analysis: The upper table represents the completion times of the project defined through the main PERT/CPM method and the time with the introduced algorithm with different type of simulation runs.

It is notice that completion times acquire from the proposed algorithm are more accurate and for each simulation run the critical paths change for the project activities. We can be seen across the above table that contain 23 week of time is changed to 19.48 and several other values.

Risk Percentage of Dataset:

After calculated completion time of project dataset apply monte carlo simulation method for finding much near to outcomes. Here we are applying 5 times for run of simulation with the help of proposed PERT/CPM method.

Outcome of Proposed Method:

It can be simply determined that the completion time accuracy is improved with the current technique in comparison of previous PERT/CPM method. With the older method the probability value found is 0.41 and with the proposed technique, it is improved to 0.71 and the risk value is optimized similarly to 85.23 per to 28.74 per. Hence, it is proved that the described algorithm provides very accurate results in comparison of before one.

V. CONCLUSION

We found that PERT/CPM method is widely used in project scheduling for a better project. The project scheduling is of the major step of the project management procedure. Different type of project management methods are currently being used by many industries and organizations. We have executed a small survey on this topic and establish that it has been used with several methodologies which perform effectively under certain circumstances. We evaluate that this technique has its main restriction that is underestimation or above estimation of completion times of the project in project management.

This paper present a new improved method and its uses the concept of Monte Carlo simulation with triangular distribution to discover throughout the activity time attributes of the project. Here we proposed the algorithm results to the expand rate of probability of the project. The project is completed under the certain defined deadline.

VI. FUTURE WORK

In future work may include increasing the proposed algorithm or a new approach with some different modifications for the better results. The resource limitation can also be included in the analysis to improve the performance of the method.

After the experimentation results have proven that the initiate method illustrates the more accurate values of the completion times for the better project which lead to the increased prospects for the predefined deadlines of the projects that are given by project manager. We also discover that risk in project is reduced with this new method and this was the main objective of this research work.

Hence, the proposed approach gives the improving the results comparison between the PERT/CPM approach.

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Cite this article as :

Suchi Pandey, Hira Singh Yadav, "Comparative Analysis of Risk Reduction Using PERT/CPM Techniques", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 6 Issue 5, pp. 144-147, September-October 2019. Available at doi : https://doi.org/10.32628/IJSRSET196521

Journal URL : http://ijsrset.com/IJSRSET196521