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Program Evaluation and Review Technique (PERT): An analysis of Scheduling Technique

Executive Summary

During the series of lectures, I came to know that project scheduling plays the key role in the project management and the success of the project depends on the proper scheduling. Different kinds of scheduling techniques are being practiced in the market. Program Evaluation and Review Technique (PERT) is a kind of project scheduling technique. The process emphasizes on the decomposition of the total task in to small components and estimate the time required to finish the small tasks. It also finds out the effective route to get the project done and the method is known as Critical Path Method (CPM). In this report, I have selected PERT for analysis and I have discussed about it from different aspects. I highlighted the advantages, disadvantages, challenges, barriers, drivers and new development about the technique. This technique helps to reduce time and cost in a big way. It is used to take command over the minute details of the project. But it needs proper coordination among the departments and within the employees to make it successful. A proper estimation of time is also needed to get the idea of which route to follow. A wrong estimation of time will delay the project further. While doing the analysis, I took the assistance from secondary research and consulted some of the academic papers.

Content

Introduction

Time is a major concern of any project. That is why time management has become so vital topic of discussion these days. I learnt that project management deals with resource planning. The process of 'Project Management includes organizing, motivating, activity of planning, controlling resources, to reach certain goals of the organization or for proper completion of any project. Both financial and human capitals are integral part of project management. It is more applicable where a set of complex components are present in the process.

I understood that this process helps to identify by what time different parts of the project are to be finished and by whom, etc. Issues like quality control, maintenance of standard, risk management are being addressed in the system. Under project Management there are five 'control factors' which needs to be managed. These are Time, Quality, Money, Information and Organization.

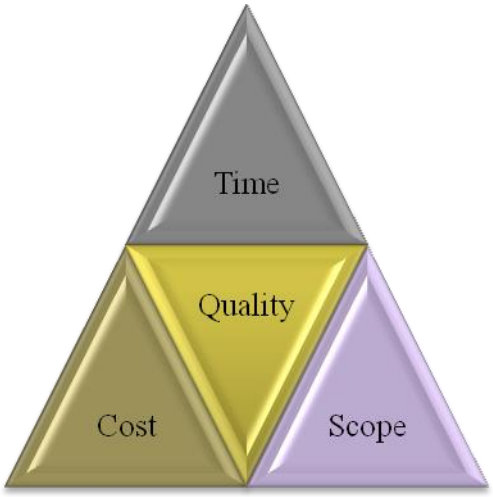


Diagram 1: Project Triangle

I found that, according to Baars (2006), if projects are divided into phases, then it helps to go for the best possible direction. In this segmentation process the total work load of the project gets divided into small components and become easier to monitor.

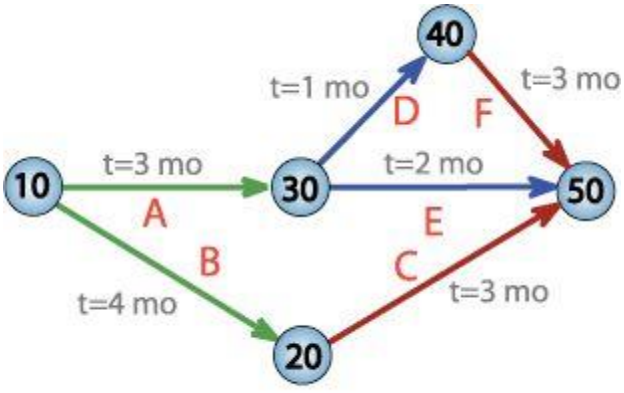
Background

Project cycle plan

According to Atkinson et al., (2006), uncertainty is a major challenge for the projects. A proper scheduling technique can address the uncertainties issues by minimizing the risk factors. Scheduling is extremely important part of project management. Scheduling is done with the help of simulation process. I also took note from Pearlson & Saunders,(2006). The researches argued that project cycle arranges discrete project activities into proper order according to a timeline. There are many scheduling techniques in practice, such as Linear scheduling, Project Control and PERT.

Program Evaluation and Review Technique (PERT): I come to know that, this process was developed in 1950s by the United States Navy. But this process is used in software, construction and other sector in a big way.

According to me, the primary objective of the process is to simplify the components of the project into small parts. It helps to determine the minimum time required to complete the total process. The concept of PERT is similar to Scientific Management by Fredrik Taylor, which was further developed by Henry Ford.



PERT network chart for a seven-month project with five milestones (10 through 50) and six activities (A through F)

Diagram -2: PERT Network

According to me, followings are the steps of PERT process

- At the outset, specific activities and milestones have to be identified. This process helps to sequence the project. The directed arcs are denoted as activities. Each of the arcs has a definite duration. This is called ‘activity on arc’
- Nodes are represented as events. Proper sequence of activities has to be defined.
- The activities (arc) cannot start journey for the next node until all of the activities are completed the previous one. It can be demonstrated that, no one can go away until everyone has entered.
- There is a single starting node and single ending node. Arcs move in between these two points.
- Network diagram should be done in a proper manner. The network should be unidirectional process and there should be no cycle in the process. Several drafts may require to draw a proper diagram.
- The estimated time has to be allotted to each activity. Proper time estimation is the most vital part in the entire scheduling process. Manual and statistical processes are followed to determine this.
- PERT diagram is drawn to find out the effective route to complete the project. This is called critical path.
- The actual work process should follow the critical path. The PERT chart has to be updated along with time.

Critical Path Method (CPM) is followed by project managers because if any other path is followed then it will take longer time compared to CPM and the entire project will get delayed. Winter et al.,(2006) argued that, considerable attention should be given to the process of PERT network. Cause the success of any project depends on the process of the network. The proper process and proper channel can be developed by Inquiring and rethinking method.

Monhor (2011) argued that the idea of critical path is the key issue in the temporal analysis of project scheduling in deterministic arrangement. The very essence of the CPM consists in identifying the critical path, i.e., the longest path in the flow of project network; because it carries information on how far it should take to finish the entire task. The challenges is how could a stochastic counterpart of the critical path be projected is a significant issue in stochastic PERT.

Probabilistic PERT

I have learnt that probabilistic PERT is being practiced to estimate the duration. In statistical theory, it is assumed that there are some errors always involved in estimation. In this case as well the initial duration contains some error part. Some assumptions are done to do that. For instance the project duration follows normal distribution pattern. So probability of the duration of a work can be calculated from normal distribution. It also follows the beta probabilistic distribution. Wang (2005), argued that probabilistic scheduling techniques are dependent on a single network and assume the links (or logic or sequences) between activities to be fixed. Nevertheless, few links can be changed or soft. The existence of soft links from one point to another point denotes that the implementation of these activities has several optional sequences. Many projects consider uncertain activity durations as probabilistic soft links.

Activity Expected Time: I have learnt about the activity expected time and it is being calculated on the basis of three possible outcomes. De Marco, (2011), has also argued that three estimations are measured, most likely scenario, optimistic scenario and pessimistic scenario. The expected time is being calculated on the basis of all the three factors. Four times extra weighted is given to most likely factor compared to optimistic or pessimistic assumption. All these factors are added together and divided by six.

$Te = [To + (4 * Tm) + Tp] / 6$

Here

Te = Expected time

To=Optimistic time

Tm=Most likely time

Tp= Pessimistic assumption of time required

Generally optimistic time is the shortest time required to complete the task. Most likely time is the highest possible time duration to finish it. Pessimistic time is the longest possible time it may require to get the work done.

Activity and project standard deviation

According to me, variance calculation is important for the proper estimation of time require. It is said that if three standard deviation times were chosen for the pessimistic and optimistic times, then there should be six standard deviations within these values, so the variance will be

$\boldsymbol{\sigma e}=(\boldsymbol{Tp}-\boldsymbol{To})/\mathbf{6}$

$\boldsymbol{\sigma e}$= Estimated Variance

Velasco et al,(2011) explained that the Mean and Variance of the time of the activity calculation is important for activity completion for practical applications.

Rationale for using PERT

The technique is generally used in the field of Hospital planning, educational planning, real estate development, social security and even different types of financial and accounting activities. According to me, there are enough reasons to introduce PERT technique in the process management. The process is fundamentally strong and supported by statistical tools and probabilistic assumption. To get the command over the entire process including the minute details, managers use the process. Which task should be done first, which task will follow which task, which job will be done by whom, the answers of all these questions are being answered in the PERT CMP method.

However it is clear to me that it need a huge team effort to make the PERT process successful. Smith & Imbrie (2005), opined the same and admitted the significance of teamwork. As the next work starts immediately after the completion of previous work, a high quality of communication is needed to get the work done. Coordination among the diferent departments and the understanding among the employees are required because the small parts of the job are done just back to back.

Advantages and Disadvantages

Advantages of PERT:

I found that PERT technique is widely accepted across the world because of its usefulness. Though it is a statistical tool, it is easy to calculate and understand by any of the individual. It explicitly breaks the components into small parts. That is why it does not appear very difficult to identify the critical path or most effective route to finish the project. I also comes to know that the process also identifies early start, slack, late start for each activity. It improves the decision making process by reducing the overlapping activities and understanding the minute activities in details. So it helps to achieve the goal of the organization within the given constraints. Another positive point is that, huge data can be presented in a diagram through PERT-CPM method and decision can be taken easily. I found that according to Sharma (2006) management can concentrate on the vital activities (i.e. 10%-20%) by allocating resources and avoiding other activities. The researcher also described PERT as a logical thinking device for scheduling the project and allocating labor, time and money accordingly. Azarona (2007) also argued that time-cost tradeoff can be better understood with the help of PERT network. It also predicts schedule slippages and cost overrun.

Disadvantages of PERT:

I have understood that apart from the positive points of PERT technique, the process has some shortcomings too. For instance, there can be a good number of potential events and the number can go as high as hundred or thousand, then it will be a tedious job to identify CPM. PERT is not a very suitable or scalable option for smaller projects. Sometimes a lack of time frame makes it difficult to understand the project. If it is a big project with a number of activities, then the PERT network diagram will also become big. A special sized paper will be required to accommodate the whole diagram. If the process of the project becomes unwieldy it becomes unmanageable. I read that Ting-wei (2010), made an argument that the general process can not only give emphasis to the factors of the key lines, but also considers some unimportant key line. As PERT does not takes into account all these factors, still there are some problems in real life application. Another allegation was brought by Schonberger (1981) as stated that the deterministic critical path sometimes understates the likely project duration. That is why a

number of projects which follows PERT –CPM method takes more time to complete it. According to researchers, the reasons behind the shortcoming are that the entire process is based on probabilistic assumption. When the assumptions go wrong the schedules of the projects get delayed.

I have understood that uncertainty is a major challenge it these cases. In real life projects, many things don't move according to the original plan due to many unavoidable circumstances. This is the only reason why a huge uncertainty or risk is involved in the process. According to Kerzner (2013), the lack of interface between the internal department create problem in the continual flow of work and also give imperfect figures about the estimated time required to complete any particular task.

Drivers and Barriers

Driver or PERT

I feel that nowadays internet is playing a major role in the application of PERT. With the help of Word Wide Web, appropriate paths can be selected for different kinds of activities. The digital facilities have also helped manager to go for perfect planning process. As it is a statistical tool, it easily gets fit into the software and generates correct results. I read that according to McCue (2009), the risk element in the process gets removed or reduced if PERT technique is applied.

People are using the technique more and more because the process is not mathematically complex and easy to understand. It can be represented graphically and made it clear to the employees about their own responsibility and tasks. It helps to reduce cost and time in a big way. PERT give stress on the connection between the time each activity and the cost structure associated with each and every phase.

Barriers of PERT

I have seen that many people do not like PERT because of its limitations. There are many people Precedence relationships have to be defined and networked together. Too much interdependence

is making the process difficult. The entire PERT process is dependent on a single point agenda, that critical path method. Apart from this it has hardly any existence. Time estimation is highly subjective and sometimes the time is manipulated by managers. The efficiency of the model gets reduced if it is not getting the proper figures. Though it is following beta probability distribution but at times the actual time does not tally with the estimated time in the given model. An error part still exists in the model. That is the challenging part for the project managers. These kinds of shortcomings are holding back the growing popularity of the model. Apart from these factors, many new scheduling techniques and simulation process are coming into the market and capturing the market. Everyday new things and replacing the older ones and that is the challenge.

New development of PERT

I found that researches are willing to improve the process of PERT networking. Researchers are also trying to minimize the shortcomings, if PERT CPM model such an initiative is taken by Yunning (2010).He suggested three points to improve the process. First point is, the model follows the Monroe method to upgrade the normal beta distribution. It needs to be addressed. Second observation is, it can be improved the correctness of the normal process of three times estimation. It can be done by following the restrictive probability to determine the three times and the minimal deviation process. The Third point is that it takes into account the impacts of the secondarily crucial link of flow.

The theoretical concept of PERT, CPM and proper scheduling of project management has developed for many years. Diamantas et al., (2007) explained that, Project schedule development with CPM is unable to handle the uncertainty part properly, that is why PERT and Monte Carlo Simulation (MCS) are the most commonly used techniques in top end companies. But the new digital media has come up to help the concept and some good application software has been developed. For instance, Microsoft Visio is one of the applications of Microsoft Office like MS Excel and MS Access. With the help of Microsoft Visio, proper PERT charts Gantt charts can be drawn. It automatically gives the indication of the effective route or the critical path of the entire project. Apart from this, a number of software is available in the market which serves the purpose of PERT network and analysis. These can be downloaded from the internet.

Conclusion

There are fundamentally two barriers to any project, Time quality and scope. Time management is a major challenge for any project manager. That is why scheduling has become so important in the field of business management. There are few techniques to do scheduling in project management. Program Evaluation and Review Technique (PERT) is one of the scheduling techniques. It divides the total big project into smaller sub activities and organize them in a single direction. Then time is given to each small task to know about the actual time duration of the project. In this way the effective way to do it or critical path is being determined. This technique helps to reduce time and cost in a big way. It is done to take command over the minute details of the project. The process emphasizes on the decomposition of the total task into smallest components and estimate the time required to finish the tasks. But it has some negative points too. If the coordination and teamwork is not in order then PERT is a difficult process to execute. because one set of activity initiates just after the completion of previous task. If the time estimation goes wrong for the small tasks then the total time required for the entire project will change drastically. Cases are also there where the theoretical estimation does not tally with the real life application and real life projects get delayed.

However, from the above discussion, I found that PERT is a conventional, statistics based fundamentally strong technique. A number of cases are there where projects managers got benefitted by using the PERT technique. Though in current business scenario many modern scheduling techniques have arrived but PERT is still well accepted and widely practiced. I found that a further detailed study is needed about the drivers and barriers of PERT.

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