

A Review Paper on Cost & Time Optimization by Using MSP & CPM for the Economical use of Manpower and Equipments in the Construction of Residential Buildings

Mr. Harish Appasaheb Arekar¹ Prof.S.B.Patil²

¹Student ²Assistant Professor

^{1,2}Department of Civil Engineering

^{1,2}Ashokrao Mane Group of Institutions Vathar, Maharashtra, India

Abstract— In most of the reviews of literature it is seen that they are related to the cost optimization by schedule compression by different methods. The present topic is able to support for find out a new solution of cost and time optimization. Such type of study is not observed in any related review of literature, so the topic is novel. It is seen that there is a scope for research work in the area of advance construction and method. It is proposed to carry out some theoretical and analytical studies on proper utilization and combination of the equipment and manpower. After the optimization the cost of the project can be reduced. In this growing construction industry the equipment use is only for the excavation, due the large manpower use the time of the project increases, and also the cost may be increased. The expected outcome of this study is to reduce the total schedule of the project as well as the cost of the project.

Key words: Microsoft Project(MSP), Critical Path Method (CPM)

I. INTRODUCTION

India is the developing country and construction projects and industries play a vital role in the economy of the country. Time and cost are two main concerns in a construction and they are used for planning a project. This has increased the importance of time and Cost optimization in construction projects. It is necessary to estimate the cost and time of each activity through which the whole duration and total cost of the project are determined to complete the task of planning.

Now a days the large amount of construction work is going on everywhere. The size of construction vary from small building to the sky scrapers. The main components of these construction are “cost, time& quality”.

The cost is again divided into material, labour and overhead cost. Mainly the material cost is about 50% of the total cost and the labour costs are about 40% and overhead costs are about 10%.

The work can also be done by using i) manpower, ii) equipment, iii) and both. But it is not possible to do the total work only with manpower or equipments.

Now days the economy is an essential part of any construction as well as the speed of work. The speed can be increased by using equipment but the cost may increase. If the cost reduction will be done using the manpower, the speed reduces as well as quality may not be up to the mark. Therefore the study is intending to optimize the cost and time for the economical use of manpower and equipments wherever possible.

CPM is a traditional networking method widely accepted and applied by construction professionals in simple projects. Involving a form of heuristic approach, the CPM TCO algorithms require one to identify the critical path and

then select which activities to ‘crash’ (reduce time). So to optimize the cost and time the MSP and CPM are to be used.

II. DEFINITIONS

A. Critical Path Method (CPM):

“Is a technique for analyzing projects by determining the longest sequence of tasks (or the sequence of task with the least slack) through a project network.” (Newbold, 1998) By concentrating on the most critical tasks it can be ensured that the project is on time and is keeping pace with the schedule set up.

B. Microsoft Project:

Microsoft Project is a project management software product, developed and sold by Microsoft. It is designed to assist a project manager in developing a plan, assigning resources to tasks, tracking progress, managing the budget, and analyzing workloads. Microsoft Project was the company's third Microsoft Windows-based application, and within a couple of years of its introduction it became the dominant PC-based project management software. It is part of the Microsoft Office family but has never been included in any of the Office suites. It is available currently in two editions, Standard and Professional. 'Project' was an MS-DOS software application originally written in Microsoft 'C' (and some assembly) language for the IBM PC. The idea originated from the vision of Ron Bredehoeft, a former IBM S/E and PC-enthusiast in the early 1980s. The first commercial version of Project was released for DOS in 1984. Microsoft bought all rights to the software in 1985 and released version 2. Version 3 for DOS was released in 1986. Version 4 for DOS was the final DOS version, released in 1986. The first Windows version was released in 1990, and was labelled version 1 for Windows.

III. MOTIVATION

Economy of construction project is the very important. This is depending on the schedule of the work. But the schedule can be reduced with the help of introducing equipments, but all work can not done by the use of equipment and also the cost increases. So to avoid above problem there will be a some combinations of manpower and equipments. The schedule and the cost of the project are reduced with the help of different analytic method. But no one has done the study on reduction of the cost and time by such a combine use of manpower and equipment.

IV. OBJECTIVES

- 1) To study the required total cost of manpower as well as equipment for the residential building.

- 2) To study the comparative use of manpower and equipment in the form of speed and cost of work.
- 3) To optimize the cost as well as duration of the related project.
- 4) To suggest the beneficial alternatives.

The above points will be studied with the help of minimum three case studies of construction of residential buildings in the nearby area of the researcher.

V. LITERATURE REVIEW

Tatar et al. [1](2015), published the paper on "Optimization tools for time cost trade off applicable in construction project management". The main objective of this study is to explore a various time-cost optimization frameworks that can provide an optimum time & cost value for a project taking into consideration the effect of float loss which involves the funding variability that formulates financial feasibility as a stochastic constraint, transforms it into a deterministic equivalent at a pre-specified confidence level, and solves the system by means of classical optimization techniques. This study presents two new frameworks that are developed to solve the time-cost optimization problem taking into account the float loss impact namely a stochastic framework and a Non-Linear Integer Programming (NLIP) framework. The stochastic framework uses Monte Carlo Simulation (MCS) to calculate the effect of float loss on risk.

Seyed Ali MousaviDehmourdi. [3] (2013), published paper on "Optimization of Construction Cost Applying Advanced Techniques". This paper presents a practical application of linear programming in a real life project problem with two objectives as optimization of transporting cost of equipment and finding the best solution for reducing the functional costs of the equipment. Specially structured linear programming model is used for optimizing the transporting cost of equipment. The break-even analysis is also explored to determine the break even working period of the equipment considered for the purpose of any construction activity the result shows that optimization with advanced techniques really helps in minimization of cost of project. So the Objective of this paper are to apply the principles of engineering economics, finance, basic economic concepts and quantitative techniques to modeling and analysis of civil engineering projects.

Barboleetcet al. [5] (2013), published paper on "Impact Of Cost Control And Cost Reduction Techniques On Manufacturing Sector". The survival today for any company is how to manage its service Cost, quality, and performance. Now a days the customers are continuously demanding high quality and better performance of services and at the same time they want the prices to fall. For this author focus on impact of cost control and cost reduction techniques in present scenario. An objective of this paper is to understand the basic concept of Cost, Cost Control, and Cost Reduction and to study various Tool and Techniques available for Cost Control and Cost Reduction. The Cost Control and Cost Reduction techniques used in manufacturing sector like Value Engineering, Quality Control, and Budgetary Control are specified by the author also cost, cost reduction, cost control etc. Various terms are specified by the author.

Zhouet al.[7](2013), published paper on "A Review Of Methods And Algorithms For Optimizing Construction

Scheduling". Main objective of the paper is to Optimize construction scheduling. For this, author adopted various methods like Mathematical Method, Heuristic Method, Metaheuristic Method. As per the author the Methods and algorithms applied for optimizing construction scheduling efficient and effective.

Gopalet al.[9] (2013), published paper on "Project Cost And Duration Optimization Using Soft Computingn Techniques". The main objective of the paper is to increase the productivity and necessary to forecast the costs arriving from resources so that the total cost of project can be reduced. The Artificial Neural Networks have become well established as viable, multipurpose, robust computational methodologies with solid theoretic support and with strong potential to be effective in any discipline, especially in construction. From survey results comes out that the Neural Networks approach has optimized the total project cost by 3.91%, and the duration of the project has been reduced around 5% of the total duration of the project.

VI. CONCLUDING REMARK

In most of the reviews of literature it is seen that they are related to the cost optimization by schedule compression by different methods. The present topic is able to support for find out a new solution of cost and time optimization.

VII. THE CRITICAL PATH METHOD (CPM)

CPM as a management methodology has been used from the mid 50s. The main objective of the CPM implementation was to determine how best to reduce the time required to perform routine and repetitive tasks that are needed to support an organization. Initially this methodology was identified to conduct routine tasks such as plant overhaul, maintenance and construction. (Moder and Phillips, 1964) Critical path analysis is an extension of the bar chart. The CPM uses a work breakdown structure where all projects are divided into individual tasks or activities. For any project there is a sequence of events that have to be undertaken. Some tasks might be dependent on the completion of the previous tasks while other might be independent of the tasks ahead and can be undertaken at any given time. (Lowe, 1966) Job durations and completion times also differ significantly. CP analysis helps decision makers and project execution members to identify the best estimates (based on accurate information) of the time that is needed to complete the project.

Advantages of using the Critical Path Method:

In the age where tools available to management are constantly changing and improving the ability of CPM to still command respect among the project teams and managers is testimony to the fact that this tools has proved very valuable and beneficial. Listed below are some of the major reasons why CPM is still used in organizations today

- 1) CPM encourages managers and project members to graphically draw and identify various activities that need to be accomplished for project completion. This step encourages all members in the project team to evaluate and identify the requirements of the project in a critical and logical fashion. Activities that precede and follow other activities also require their own evaluation and analysis. This factor become very important if the activities are conducted at different physical location and

the time and cost element is also subjected to external variables that have the potential to seriously impact the project time.

- 2) The network diagram also offers a prediction of the completion time of the project and can help in the planning and scheduling of the activities needed for the completion of the project.
- 3) Identifying the critical path for the project is the next stage of the analysis of the network diagram. In doing this, the management of the project has a reasonable estimate of the potential problems that might occur and the activities at which these problems might occur. In many cases the critical path also determines the allocation of resources. The interpretation of the network diagram also ensures that the same resource is not allocated for the same period of time.
- 4) CPM also encourages a disciplined and logical approach to planning, scheduling and managing a project over a long period of time. Often, the root cause of many project overruns is the failure to identify the factors that have the potential to seriously impact the project. By forcing individuals in the project team to identify activities, attention to details can be achieved. In turn, this helps a true and much more accurate picture of the processes that need to be set up for the project and the time and cost that is needed for every stage.

Disadvantages of Critical Path method:

CPM has a number of advantages and it has been able to provide companies using it a yardstick and a reasonable estimate of the time needed for the completion of the project. The main disadvantages of the critical path method are listed below. Many disadvantages are as a result of the technical and conceptual factors involved in the CP analysis (CPA) process

- 1) The CPA process can become complicated as the scope and extent of the project increases. Too many interconnecting activities can result in the network diagram becoming very complicated. The risk of making a mistake in calculation of the critical chain becomes very high as the number of activities increase.
- 2) The CPA depends on the fundamental concept that the managers and personnel involved in the project team are well versed with the various activities. "Unfortunately, practical experience has shown that the principal assumption underlying CPM techniques, i.e., the project team's ability to reasonably predict the scope, schedule, and cost of each project, is frequently far beyond control." (Knoke and Garza, 2003)
- 3) The task of understanding the needs of the critical path get more complicated when there is more than one critical path in the project. In many situations, these paths might be parallel and feed into a common node in the network diagram. It becomes difficult in these situations to identify the best utilization of technology and resources for the critical paths.
- 4) In many cases, as the project progresses, the critical paths might change and evolve and past critical paths may no longer be valid and new CP have to be identified for the project at regular intervals. This implies that the project manager and project member have to constantly review the network diagram initially created and identify the shifting and movement of the critical path over time.

VIII. MICROSOFT PROJECT

Microsoft Project is a project management software product, developed and sold by Microsoft. It is designed to assist a project manager in developing a plan, assigning resources to tasks, tracking progress, managing the budget, and analyzing workloads. Microsoft Project was the company's third Microsoft Windows-based application, and within a couple of years of its introduction it became the dominant PC-based project management software. It is part of the Microsoft Office family but has never been included in any of the Office suites. It is available currently in two editions, Standard and Professional. 'Project' was an MS-DOS software application originally written in Microsoft 'C' (and some assembly) language for the IBM PC. The idea originated from the vision of Ron Bredehoeft, a former IBM S/E and PC-enthusiast in the early 1980s. The first commercial version of Project was released for DOS in 1984. Microsoft bought all rights to the software in 1985 and released version 2. Version 3 for DOS was released in 1986. Version 4 for DOS was the final DOS version, released in 1986. The first Windows version was released in 1990, and was labelled version 1 for Windows.

Project creates budgets based on assignment work and resource rates. As resources are assigned to tasks and assignment work estimated, the program calculates the cost, equal to the work times the rate, which rolls up to the task level and then to any summary tasks and finally to the project level. Resource definitions (people, equipment and materials) can be shared between projects using a shared resource pool. Each resource can have its own calendar, which defines what days and shifts a resource is available. Resource rates are used to calculate resource assignment costs which are rolled up and summarized at the resource level. Each resource can be assigned to multiple tasks in multiple plans and each task can be assigned multiple resources, and the application schedules task work based on the resource availability as defined in the resource calendars. All resources can be defined in label without limit. Therefore, it cannot determine how many finished products can be produced with a given amount of raw materials. This makes Microsoft Project unsuitable for solving problems of available materials constrained production. Additional software is necessary to manage a complex facility that produces physical goods.

The application creates critical path schedules, and critical chain and event chain methodology third-party add-ons also are available. Schedules can be resource leveled, and chains are visualized in a Gantt chart. Additionally, Microsoft Project can recognize different classes of users. These different classes of users can have differing access levels to projects, views, and other data. Custom objects such as calendars, views, tables, filters, and fields are stored in an enterprise global which is shared by all users.

IX. METHODS

Most of the literature reviews are related to the cost optimization by compressing of the schedule with the use of different methods. Such type of study is not observed in any related review of literature, so the topic is novel.

It is seen that there is a scope for research work in the area of advance construction and method. It is proposed to carry out some theoretical and analytical studies on proper

utilization and combination of the equipment and manpower. After the optimization the cost of the project can be reduced.

As the research work is in process, it is found that presently the equipments are mostly used only for the excavation work of building construction. So there is a scope to study and analyze the use of equipments in building construction area, therefore the researcher has selected the case studies of building construction.

X. CONCLUSION AND DISCUSSION

In this growing construction industry the equipment use is only for the excavation, due the large manpower use the time of the project increases, and also the cost may be increased.

The expected outcome of this study is to reduce the total schedule of the project as well as the cost of the project.

REFERENCES

- [1] Tatar Bhushan V., Patil Rahul S., (2015). "Optimization tools for time cost trade off applicable in construction project management", International Journal of Science, Technology & Management, Volume No. 04, Issue No. 01, P.P. 181-187.
- [2] PawarSandip, P. M. Attarde, (2015). "Time and Cost Planning in Construction Project" International Journal of Science and Research (IJSR), Volume No. 4, Issue No. 8, P.P.422-425.
- [3] DehmourdiSeyed Ali Mousavi, (2014). "Optimization Of Construction Cost Applying Advanced Techniques" International Journal Of Structural & Civil Engineering Research, Volume No. 3, Issue No. 3, P.P.48-54.
- [4] Memon A.H, Rahman I.A, MohdRazaki Abdullah, Ade Asmi Abdu Azis, (2010). "Factors Affecting Construction Cost In Mara Large Construction Project: Perspective Of Project Management Consultant", International Journal Of Sustainable Construction Engineering & Technology Volume No. 1, Issue No. 2, P.P.40-54.
- [5] Barbole A.N., Nalwade Y. D., Parakh S. D., (2013). "Impact Of Cost Control And Cost Reduction Techniques On Manufacturing Sector" Indian Streams Research Journal Volume No. 3, Issue No. 5, P.P.1-8.
- [6] Anyanwu C.I., (2013). "Project Cost Control in The Nigerian Construction Industry" International Journal Of Engineering Science Invention Volume No. 2, Issue No. 12, P.P.65-71.
- [7] Zhou J, Ped Love, Wang X, Teo Kl, Irani Z, (2013). "A Review Of Methods And Algorithms For Optimizing Construction Scheduling" Journal Of The Operational Research Society Volume No. 64, Issue No. 8, P.P.1091-1105.
- [8] Patel Khyomesh V., Prof. Vyas Chetna M., (2011). "Construction Materials Management On Project Sites" National Conference On Recent Trends In Engineering & Technology B.V.M. Engineering College, V.V.Nagar, Gujarat, India.
- [9] Naik G. M., Kumar M., (2013). "Project Cost And Duration Optimization Using Soft Computing Techniques" Journal Of Advanced Management Science Volume No. 1, Issue No. 3, P.P.299-303.
- [10] Zheng Daisy X.M., Ng S. Thomas, Kumaraswamy M. M., (2002) "Applying Genetic Algorithm Techniques For Time-Cost Optimization" 18th Annual Arcom Conference, University Of Northumbria, P.P.801-810.