Financial and Work Management Analysis for Residential Construction: a Case Study

Abdul Aziz, Sanjeet Kumar

Abstract: ***The traditional construction process has never been into the scheduling the time and cost management. As a result, there are lost of time, materials, cost and poor quality of construction. In recent years, software's play vital role in resolving such problems in construction industry, which benefit financial and work management. Primavera is one such software which helps in planning the work to its maximum extent and help in improving the quality and productivity of work. It also helps in efficiently manipulating the project cost. The present study analyses the comparison of financial and work management of a traditionally constructed building (G+4 building, Osmania University, Hyderabad) and implementing the scheduled work and financial management using primavera to the same building and compares the results. The study discusses the pros and cons of the analysis of the above results. Thisstudy relieved that the primavera helps in optimization the construction project in scheduling and improves the productivity. The results will project the earned value graph which show the cost performance index and scheduled performance index of resources.***

Index terms: Construction, Management, Primavera, Quality

I. INTRODUCTION

Estimation of cost is a key factor in construction industry these days because of schedule delay and increase in construction cost at the completion of the project. The success and quality of the project is mainly depending on the project accurate estimation and schedule. Estimation and scheduling help to plan and organize the construction process accurately throughout the time. The estimate is the best source of information about deciding on a price for a project. Cost estimation can be done manually or by using software and manual cost estimation method is depends upon the expertise and also it includes an expert who is familiar with this type of projects.

Analysis of the structure and the quantity of the materials, labours, equipment's etc, plant requirements and overhead costs will depend on the person. The estimation models with minimum project information will give a rough estimation of the project and it can be divided the estimation into different parts, like structure, finishing etc. Improved cost estimation project technique which is available to the project managers will facilitate more effectual control of time and cost in construction projects.

The model for cost estimation remains unclear and unexploited mainly in terms of easy methods and also introduces stream lining procedures from project work breakdown structure. This evaluates the duration process of the project and either the input costs hour or the fixed cost of the project and that measure are made with hypothesis testing over the responsibility assignment matrix called (RAM). The cost methodology approaches offer a simplified decision tool for measuring the construction cost on the project manger's decision [1].

The proper planning and scheduling are very important in any of the construction projects like metro rail project, dams, bridges, high rise buildings etc. It is used for reducing cost and controlling delays of the project. He says that substantial amount of time, money and many resources are wasted every year in a construction industry due to improper planning and scheduling, with all over the globalization construction industry has become vast and very complex compared to all. Planning of all such requirements it requires huge amount of paper work, which can be reduced by using project planning software and also he says that providing a good planning to the project and sufficient flow of resources can achieve automatically desired result and this deals with the some high potential parameters in primavera software which significantly after the project result [2].

The project cost is one of the governing factors in project success and project management is used to increase the productivity in terms of human resources and materials. Earned value management (EVM) is a project performance evaluation technique which has been adapted for an application in project management. This technique is used for the comparison of budgeted cost of work to actual cost. This study deals with the project management involving earned value analysis [3]. The project is a collaboration to plan and achieve the aim. Project involves several tasks to be completed from project start date to the final date and the aim of the project completion and he says that the schedule of task is developed in the planning phase by the project planning and scheduling in terms that the clearly states that the various project milestones and activation in project start to finish and the quality of the project schedule is generated from the primavera. It is the one of the mostly used software for project planning, schedule and with various standards in the western countries[4].

The cost estimation is an important task in the management of construction projects. The success and quality of the project depends on the accurate estimation of the construction cost. The cost estimation models which are in the early stage, improved cost estimation models which are available to managers will facilitate more effective control of time and cost of the project[7]. There are many problems in construction industry which are caused by improper scheduling caused by man-made.So, all barriers can be controlled of planning stage using scheduling through primavera.

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1. To prepare work scheduling and cost estimation of residential construction using primavera.
2. To compare primavera results with manmade estimation.
3. To prepare cost performance index and scheduled performance index of resources.

II. MATERIALS AND METHODS

A. Description of Site

The study area is located in OU Hyderabad, TS. It is a G+4 building consisting of 250rooms which accommodates 500 people. The project started in dec2017 and is expected to be finished by jun2019.The present status of the project:external and internal brick work competed. Terrace parapet wall construction in process. Inside and outside plastering work, plumbing work, tile work, paint work,electrical work, carpentry work, and flooring are pending

B. Descriptionof work

The methodology adopted/ involved in this research work is comparison of the two processes of sequential steps, as per objectives set for his study, and that runs parallel throughout the research until the analysis and comparison of the project outcomes of both the processes are done to conclude on the research work as shown detail in the flowchart and it was shown in Figure I.

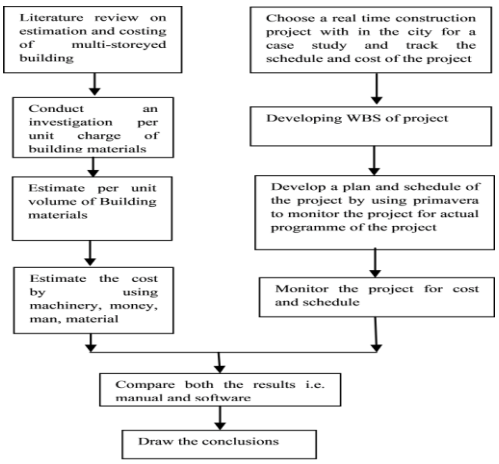

Fig I: Research work methodology

C. Selection of A Live Project to Track the Project Parameters Like Project Scheduling and Cost

A 500 bedded hostel building of Osmania university of Hyderabad is selected and this project consists of G+4 floors. Table I explains the detail of the project.

Table I: Details of the project

S.No	Title	Details
1	Project cost	21Crores
2	Total area of the project	10942.30 Sq.mt
3	Ground floor area	2506.82 Sq.mts
4	First floor area	1903.84Sq.mts
5	Second floor area	2256.00 Sq.mts
6	Third floor area	2256.00 Sq.mts
7	Fourth floor area	2019.64 Sq.mts
8	Ground floor	43rooms – 86persons
9	First floor	49rooms – 98persons
10	Second floor	52rooms – 104persons
11	Third floor	52rooms – 104persons
12	Fourth floor	54rooms – 108persons

D. Primavera description

Project management using primavera (p6) software to plan, monitor, schedule, and update the progress of the project can be done effectively in terms of cost and time.

Steps involved in implementing the project in primavera

Enterprise project structure (EPS): EPS is a hierarchical arrangement of projects in an organization. The EPS is available to all existing and future projects in the Enterprise[6].

Organizational breakdown structure (OBS): After Creating EPS the main step involved in the software is to create OBS which shows that the persons responsible for the project in the enterprise.

Interlinking: link both enterprise project structure (EPS) and organizational breakdown structure(OBS).

Create a project: After linking the EPS and the OBS the project has been created. A project is a collection of both activities and tasks that all together result in the creation of the structure or product.

Creating a Calendar: The project calendars form a very important part in the project schedule and mainly calendar is created to calculate the start and finish dates of the project. Figure II shows the calendar in primavera

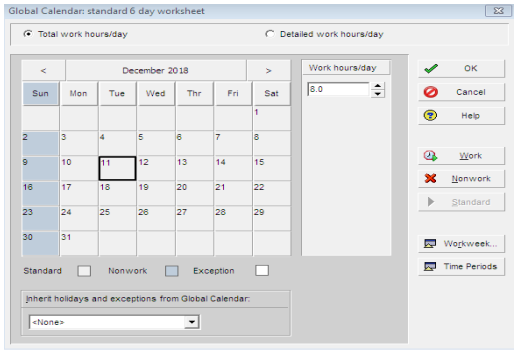

Fig II: Calendar in primavera

Creating a work breakdown structure: It is one of the following steps in the project management and it break down the project into major deliverables i.e. project components and it is called work break down structure (WBS). Focusing on the deliverables it is small enough to work activities can be clearly defined and assigned to that element.

The work breakdown structure of our project comprises of 18 stages, namely 1) Pre-Construction Activities 2) Foundation 3) Sub Structure 4) Underground Water Sump 5) Compound Walls 6) First Floor 7)Second Floor 8) Third Floor 9) Fourth Floor 10) First Floor MEP 11) Second Floor MEP 12) Third Floor MEP 13) Fourth Floor MEP 14) Lawn Work 15) Glass Work 16) Solar Power System 17) Home Theatre System 18) External Works. Figure III shows the creating work break down structure in primavera

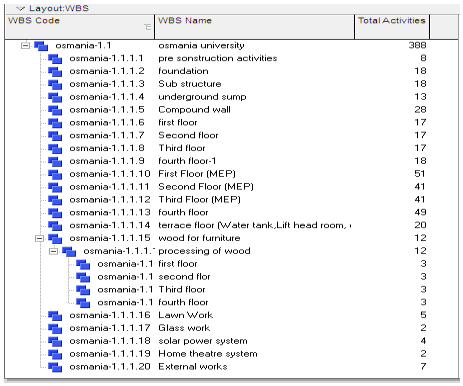

Fig III: Creating Work Break Down Structure in primavera

Listing of project activities*:* after creating the work break down structure, we have to define the activities i.e. to break down the components into sub components. It is known that each activity has its own duration, start and finish dates and logical relationship which helps in scheduling the project. And all the stages of activities consist of 485 activities. Fig IV shows the project activities

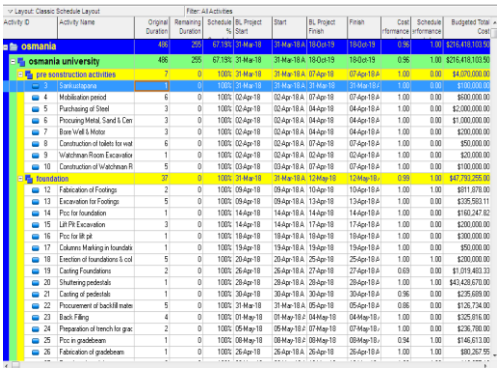

Fig IV: Projects Activities

Assigning relationships among activities

After entering all the task, the next step is to assign the relationships. Assigning logical links is nothing but assigning interdependency of each activity.

***Predecessor*:** The preceding activity for a specific activity is called Predecessor.

Successor: The succeeding activity for a specific activity is called Successor.

There are four types of relationships available. They are as follows:

1. **Finish to start (FS):** It is a default relationship followed in primavera; here the activity starts the completion of the previous activity.
2. **Start to start (SS):** It indicates that the current activity and its predecessor will start on the same date.
3. **Finish to finish (FF):**It indicates that the current activity and its predecessor will finish on the same date.
4. **Start to finish (SF):** It indicates that the current activity and its predecessor activity start date will be same.

Project scheduling: It is the main step to analyses the project is to schedule the overall project. If any changes are made in project during the execution, primavera software enables us to reschedule the project for cost and other parameters and project scheduling is used to know the total duration and cost of the project from the assigned baseline.

Bar chart / Gantt chart: It was originally developed by Henry Gantt in 1917 which was used in project management and it helps in how the project will run and also it provides a project illustration of schedule which has start and finish dates of the project and it helps to manage the relationships between the tasks. Gantt chart has revolutionized the project management field. It provides undeniable graphical presentation of schedule activities and their relationships over time. In this we can view clearly see the duration of activities and their sequential placement on the calendar. Figure V shows the project scheduling

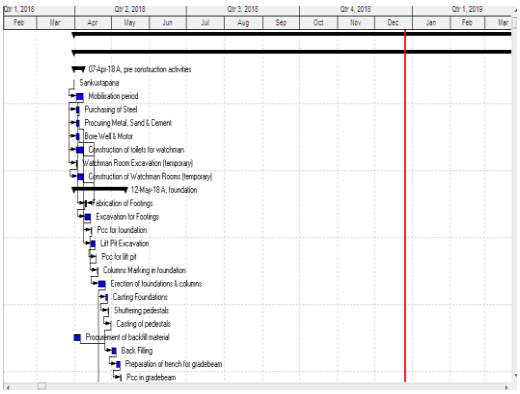

Fig V: Project Scheduling

Network diagram: It clearly defines the relationship between the tasks when compared to Gantt chart. The network diagram depicts the cycle of activities by showing activities as terminal elements and their relationships as connecting arrows. In this way the network diagram highlights the relationships between activities. It also displays, similar to the Gantt chart, activities performed in series or parallel. The network diagram is not a substitute for the Gantt chart, but a valued complement.

Assigning the resources: Resources like men, machinery, money and materials are to be assigned to the activities as needed by them. Project success will mainly depend upon the proper utilization of resources which in turn will be resulting to the cost optimization of the project. Figure VI explains the assigning the resources in primavera

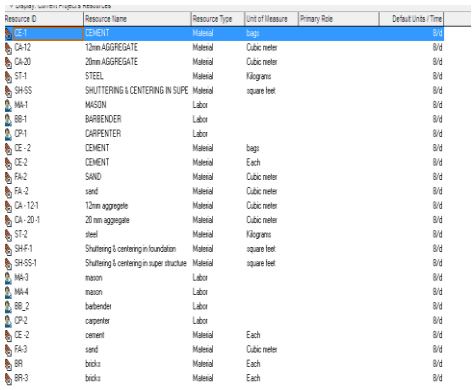

Fig VI: Assigning the Resources in primavera

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Fixing the Base Line & Updating the project: After completing the above steps it is necessary to make a base line of the project and it refers to the copy of the original schedule, while updating the project it allows you to display where the project is diverting from the original schedule.

Tracking the project progress: It is the important step in the primavera. It helps to track the project against the original schedule by EVA (Earned Value Analysis). It is one of the most popular and standard method of measuring the project progress at any given time and also used to analyses variances of the actual cost of the project from the baseline cost during the progress of the project. EVA requires three parameters namely

1. **Planned value (PV):**It is referred to the budgeted cost for the work schedule for the project.
2. **Earned value (EV):**It is referred to the budgeted cost for the work schedule for the evaluation of the progress of the project in terms of schedule and cost.
3. **Actual cost (AC):** It is referred to the actual amount spent on the work performed**.**

Budget at completion (BAC) is referred to the budget scheduled to complete the project. Schedule performance index (SPI) is the ratio of earned value to the planned value. Cost performance index (CPI) is the ratio of earned value to actual cost.

III. RESULTS AND DISCUSSION

The earned value management is a program evaluation approach which is evaluated and tracks the project in an effective manner. The project is tracked in one time i.e. from March 31-03-2018 to 26-12-2018 in all that we obtained Plan Value (PV), Earn Value (EV) & Actual Cost (AC) from these 3 basic specifications the Earned Value Performance measurement indices obtained. The Earned Value Performance index shows the performance of a project. Figure VII shows the cost analysis of project

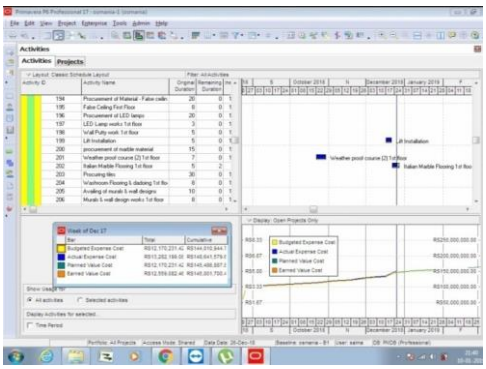

Fig VII: Cost Analysis of project

As on tracking 255 days are remaining to complete the activities, the schedule performing 100% (SPI (1)) as planned value under 1 show the project is running from planned schedule value. And cost performing 88% (CPI 0.88) as budgeted cost, it shows the project cost is overrunning.67.19% of the project is completed up to December 26 2018. To complete the project in time the schedule has to perform 1-2% of speed than the planned schedule. Figure 8 shows the cost performance index and schedule performance indexgraph

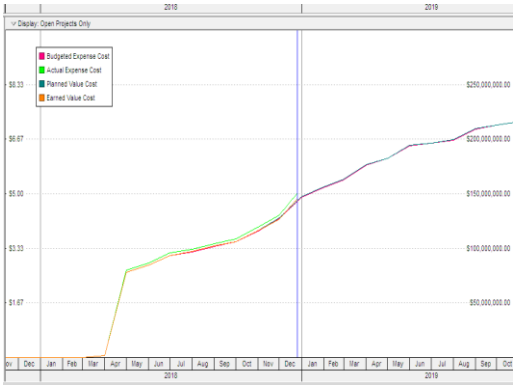

Fig 8: Cost Performance Index and Schedule Performance Index Graph

Blue line in the graph shows that the project has been updated in the December month.As, mentioned in the objectives the comparison of manmade estimate and the primavera 215039633 and 216418103.50. The difference between manmade estimate and the primavera is 1378470.5. It seems that the primavera software is estimating high cost than the manmade estimate it results that software includes all the taxes and accurate and perfect result. Primavera software reduces the time of the estimate. While manmade estimate is the time-consuming process. So now days all companies prefer primavera software and its demand is very high in the market.

IV. CONCLUSIONS

Financial and work management of any project decided its successfulness. The present study aimed to know difference between the manmade and primavera software, inestimation of scheduling of financial and work management of a project with the aid e.g. literature references and the unique methodology in monitoring and control with the help of primavera software. The estimated project completion time for G+4 building, Osmania University, Hyderabadis formed 560 days by the contractor, which is approximately equal to 18months, but the same project, precise planning, controlling implementation and monitoringof every activity using primavera tool,the expected time of the project completion is estimated to be 486 days only. Theplanning of various activities throughout the project run would be optimum, then financial and work management can be done properly. The primavera software P6 is a perfect and efficient tool for the project management and for the purpose of monitoring and controlling of the various construction projects.

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REFERENCES

1. Sergio Sequeira, and Euricolopes, "Simple method proposal for cost estimation from work breakdown structure", *International Conference on Project management , Elsevier, Procedia Computer Science*, 2015,64,pp. 537 – 544.
2. T.SivaNagaraju and Srilakshamana Kumar, "schedule and resources optimization using primavera in metro rail project", *International Journal of Mechanical and Production Engineering*, 2016, 4(7), pp.86-90.
3. RohanGhadge and GajananKanade., "Earn Value Analysis using Primavera for Construction Industry – A Review", *Imperial Journal of Interdisciplinary Research*, 2017, 3(7), PP. 376-379.
4. SatinderChopra and ArvindDewangan., "Developing an Efficient Schedule in Primavera P6: Significance of Activity ID & Descriptions", *International Journal of Innovative Research in Science, Engineering and Technology*, 2014, 3(7), pp. 15022-15027.
5. Piotr, Chwastyk and Mariusz, Kolosowski, "Estimating the cost of the new product in development*", ElsevierProcedia Engineering*, 2014, 69, pp.351 – 360.
6. Shah Harsh, MamataRajgor, and Jayesh Kumar Pitroda, "Planning, Scheduling and Tracking of Industrial Project using Primavera P6 Software", *International Journal of Innovative Research in Technology*, 2018, 4(12), pp. 241-247.
7. M.V. Montes R.M. Falcon and A. Ramirez-de-are llano, "Estimating Building Construction Costs by Production Processes", *The Open Construction and Building Technology journal*, 2014, 8(1), pp. 171-181.
8. Callahan, Michael T., Daniel G. Quackenbush, and James E. Rowings "Construction Project Scheduling". *New York: McGraw- Hill. E-book*, 1992.
9. T. Subramani et al - "Planning and Scheduling of High-Rise Building Using Primavera", *International Journal of Engineering Research and Applications*, 2014, 4(6), pp.134-144.