International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072

PROJECT SCHEDULING AND EARN VALUE MANAGEMENT IN CONSTRUCTION PROJECT USING PRIMAVERA

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KEYWORDS

Primavera P6

Project Scheduling

CPM

MSP

EVM

Project Monitoring

ABSTRACT

We all know that the construction industry is most leading industry all over the world. The Construction industry includes major activities and their sub-activities. So projects are delayed due to overrunning of time, improper planning, and project resources. To avoid the problems many methods are implied to reduce the issue. For example, critical chain project management, resource optimization etc. In this article, the method is used for CPM and CCPM for critical activity by primavera. In primavera, it schedules the plan and optimizes the irregular activity and reduces the project completion. Hence, the advantages of the computer application is to achieve the project carefully and for fast output from application for better performance to complete project on time and save the cost. While in the market, there are so many software's available for project management scheduling but primavera includes earn vale for project and entire structure. Primavera easily shows the planned work and actual work, As MSP cannot works on Evm analysis. Primavera p6 is Project management software, which define collecting, recording, monitoring, controlling and reporting function. In this project, we study project controlling and monitoring can be done and cause of delay can be found out for 4 levels commercial building located in Bhuj region. Situated at near Mahila College - Mirjapar Bhuj Kutch.

1. Introduction

As per the national GDP of India Construction industry has the contribution of 20% in 2013-14. At the national level and worldwide level Construction industry has an played the huge role. In industry, construction projects faces many problem generally of cost overrun and time overrun because of major problems and undefined lack in scheduling. To achieve the better goal and to achieve the milestones, project team must have proper calendar and estimated targeted cost. We can increase the assets profit by using Project management terms by proper implementation of resources and activities in project. EVM stands for Earn value management. EVM is the method used to accomplish the work for better utilization of task performed as according to time. We can calculate the base line planes and check the progress report of project. The assessment of changing the report of project, EVM techniques helps in achieving the project, with better output by dealing project within time and budget. it gives

The great output that fulfills the project needs and give great out look to complete project within budget in proper manner. Earn Value improves cost tracking for the entire projects, which gives the best, while of actual cost an estimated cost of work. Earn value shows the possible recent sign of ventures requirement of the remedial deal. Generally, the estimated cost is defined by calculating dissimilarity between actual cost & planned cost required in a project. Earn value helps the project manager to control the Cost and complete project within budget. To predict the high risky activities and define the exact project cost. The cost varies upon the usage of planned cost and absolute cost. It remains the project managers either project is under budget or over budget, managers has to recognize before they turn out the project impossible to achiever. In many construction is has been seen that if Earn Value Evaluation instruction implied successfully it provides you a profitable achievement and achieve project goals. It can take care of cost overrunning, helps industry organization, by skipping the project scope and quality standards. Likewise, if there should arise an occurrence of time all over, EVM arranges unlimited activities and can quickly track the programs. By applying EVM, project goals can be accomplish in suitable way.

1.1 Objectives of Study

The important vital objectives to construction team are they can complete the project as determined in record. Team can work in the considerable estimated assets like budgets, labor, resources, equipments and more to deliver the project with quality in given time. While defining to fundamentals of project planning.

By using primavera p6, it can track and monitor the projects, analyze the cost

To complete the project within time and in financial profit proper planning is done to evaluate.

On base of work progress base line was created and estimated using primavera.

While studying primavera p6 software we can execute the ongoing project.

Completing the ongoing project, management should take the strict action against the team for proper execution and to complete work on time, baselines, activities in due dates.

1.2 Scope of the Study

Scheduling: while scheduling we can fill the activity details appropriately, primavera array feature alerts scheduling and tools for reporting. Gave outcomes to keep the project in schedule within budget.

Opportunity and Risk Management: the failure in the project is generally occur in project baseline and schedule. So, Project manager can identify the risk occur. Because of these risks project can delay or mislead the activities. So opportunity analysis should do within scheduling period.

Resource management: primavera p6 includes resource management so closely; we can monitor incomes outcomes of material and can change resource avaibility. By primavera, project manager can identify which resources can be diverted. Primavera creates the chart which can easily under stable and can take advantage or visualization tool.

Contract Management: contract is well depend upon the organization; It can keep control over multiples of project. Primavera creates enterprise project structure for whole organization. Project managers can copy information from its database while starting new projects.

2. EARN VALUE MANAGEMENT

Earn value management is the method that indicates the project progressing compare to what was planned, develop the project in eventual cost and actual time will forecasted to complete the project.

Earn value analysis is a method also known as earn value management. Is a technique planned has been done in particular stage to access the project progress by comparing the amount of actual cost of work planned.

Earn value analysis plans carries out on the weekly basis to make up the project. Many individual companies use the cost to measure the work. Their actual outputs against its planned output.

Every company has an estimate to price a tender. So, key point of any project is to measure actual resource used to develop and which resourced are planned.

Earn value analysis get the contractor a wellbeing accurate financial package and investigation opportunity where they can take the remedial action where necessary. Provides early report shows warning sign if shortage og resources or inefficient.

- Total no. of hours per week.
- Total no. of labor per week.
- Volume of Work per person per week.
- Fixed units per person per weeks

The item are plotted weekly to investigate causes happening in output, it alerts the user provide him a overall picture where the productivity is being hold. Monitor the operation by measuring the labor productivity.

Evaluating the project planning it require sort analysis, breakdown into packages and supplies the information to the contractor to draft documentation for tender.

2.1 The Concept of EVM

Planned Value (PV); planned value is also called a budgeted cost of work scheduled. It is the cost scheduled to total planned value of project in given time. Is also called as budgeted at completion (BAC).

Earned Value (EV): Earned Value is the value that will show you the completed work according to time.

Simply, you can say that earn value shows the progress value is project has achieved the milestones. While if the project terminated. It is also called as budgeted cost of work performed (BCWP).

Actual Cost (AC): Actual Cost is the total money spent till to date. Track the outcomes form project according to intervals of time. Actual costs the easiest elements to identify in earn value.

Variances :-

Earn value management has mainly two variances first is schedule variance and second is cost variance, which you can track project performance in rupees.

Schedule Variance(SV): Schedule variance shows that if the project is behind the schedule or ahead the schedule in relate to time. SV is difference between earn value and plan value.

Schedule Variance = Earn Value – Plan Value

SV = EV – PV

If the schedule variance is negative project is behind schedule if it is positive the project is ahead the schedule. If variance shows zero the project is on time.

Cost Variance (CV): Cost Variance is the outgoing in the budget. Spend for the project according to time, is is difference between earn value and actual cost.

Cost Variance = Earn Value – Actual Cost

CV = EV – AC

If cost variance is negative the project is over budget and if it is positive you are under budget. And if it shows zero you are on budget.

Schedule Performance Index (SPI)

Schedule performance index shows that if the value is greater than one you have to perform more work than planned at that due time .if value shows greater the performed work can get less in period of time, if it is equal to one you are on schedule neither behind the schedule or ahead the schedule. is the ratio of Earn Value and Plan Value.

SPI = EV / PV

Cost Performance Index

Cost performance index shows the spending on the project according to time, if cost performance index is less than one the earning from the project is less. If it is greater than one the project is under budget and earnings will be more. If value is equal to zero the project is on budget. This is the ratio between the Earn Value and Actual Cost.

CPI = EV / AC

Earned Value Management help you to evaluate the following:

- Estimate to Complete
- Estimate at Completion
- Variance at Completion
- To Complete Performance Index
- The tools serve an early warn sign.
- Estimate at Completion
- Total estimated budget is Estimate at Completion.

Estimate to Complete

Estimate to complete term shows that what will be the required amount to complete the rest of remaining work.

You can calculate the Estimate to Complete in three different methods.

Variance at Completion

Variance at Completion shows you the difference at the end of project that project is under budget or over budget. This is difference between the Budget at Completion to Estimate at Completion.

VAC = BAC – EAC

If the project has spent more than the planned value variance at completion is negative. If the value is positive the project is completed within time and cost.

3. Literature Review

M.L. Zalmai, O.H. Turk akin and O. Giran "Performance Evaluation of Construction Projects by EVM Method, Using Primavera P6" (1) In this research paper the article shows that to reduce the potential risk ate the earlier stage while the project s planned using primavera. Where we can control the project by giving the proper details and control every single activity. After analysis project managers can make the future decision to achieve the goal to complete the project in time and in budget. Primavera shows result faster and easy to evaluate and understand.

This study also demonstrated that earn value management has considerable benefits to client, industry, consultant.

Chiranjeevi D , Dr. G. Narayana, Rajeeva S "Analysis On Cost, Schedule And Tracking Of Residential Project By Earn Value Management Method Using Primavera P6" (2) the following research paper define that the project is tracked in three duration 1june 2015 to 1 January 2016, 1 January 2016 to 1 august 2016, and 1 august 2016 to 4 April 2017. The scenario were discovered retake to earn value management like earn value, actual cost , BAC, BCWS, ETC, EAV…etc and performance chart was prepared.

Kunal B Badgujar, B A Konnur, "EVM Analysis with Primavera" (3) Earned value technique improve better productivity and gave constant feedback for cost and schedule to project managers. Control in project for better assessment of activity on time in required budgets. To work in the problem areas to better project control but it isn't enough , it is the effective way to measure by its systematic procedure to ensure its by good cost and system to control schedule.

T. Subramani, D. S. Stephan Jabasingh, J. Jayalakshmi "Analysis of Cost Controlling In Construction Industries by Earned Value Method Using Primavera" (4) the following research paper define that , whilw in terms of monitoring and evaluating the whole project cost was undertaken by organization earn value analysis is the most easiest way. It can rapidly appliedto control a project cost performed by builders as well as contractors. under following circumstances, contractor and client have the different prospective, relate to project cost and designed terms.

Mullapudi Durga Sruthi, Achuthan Aravindan "Performance measurement of schedule and cost analysis by using earned value management for a residential building"(5) The earn value parameters are mainly work on the both manually and using primavera. In this research paper the project estimated time to complete the project is 2.5 crore that is much more less than the estimated at completion. The remaining activity to be re-estimated by manual method all remaining work re-assessed to reach ETC called management ETC. The results were while estimation by manual and primavera EVM method there are lots of variances while calculating manually and in software

Krystyna Araszkiewicz and Magdalen Bochenek "Control of construction projects using the Earned Value Method" (6) In this paper, in this case study the projects where external supplier and sub contractors are involved, the actual cost varies where the work can be calculated based on actual work performed, sub-contractor issue the work and in given settlement period. However, the contractors in the large construction projects it is more difficult to determine the cost. They work on their own work force and planning to complete. For example, financial data and cash flow are advised. The result can be obtained where reliable accurate determination and progress of work prepared properly based on plans.

Sagar K. Bhosekar, Gayatri Vyas "Cost Controlling Using Earned Value Analysis in Construction Industries" (7) In the following research paper two Projects were analyzed by earn value analysis method. By using the software are primavera p6 and MS Project 2007.project CPI, AC, EV, PD, AD, SPI variable detailed result shows good relation between software's. Result is much accurate about 95%. While in ters of schedule variance the MSP doesn't have the feature. Relate primavera have 100% accuracy.

4. METHODOLOGY

Implementing earn value management in large complex construction projects. It require practice to register the accurate time and cost to update the detail on weekly bases. It help in indicating in terms of cost performance and schedule weather the project is ahead scheduled or behind schedule. The data required accurate to perform the software. The accurate information gets the actual cost; work performed and what is the planned value for the construction. While updating the detail regularly earn value values are accurately what project has obtained. The values are well define before the work start based on all activity. The cost plan is prepared of following work.

Steps for Monitoring and controlling activity using primavera

1) Create a new project: While creating a new project in project in primavera is requires a project name and project id. collection of activities is the project. Which enterprise project structure

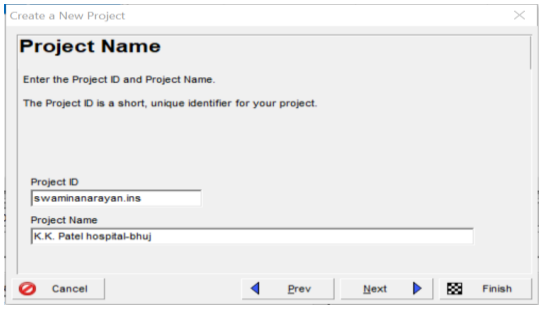


Figure 1 create a new project

Defines the project called project ID. To form a plan in product activity finish dates and start dates must given. Create a calendar based on the working days of company. Assign the calendar to the following projects

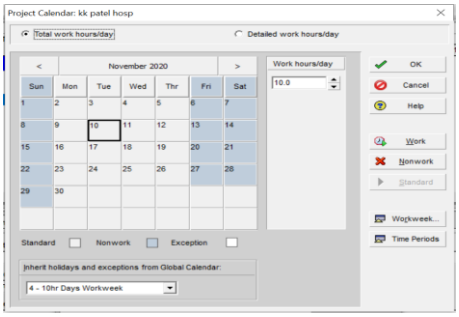


Fig 2 create a calendar

2) Work breakdown structure (WBS): WBS is a structure which has elements that include details levels into the activity and prepare a breakdown structure. Each project has its own breakdown structures depending upon the activity duration and type of project.

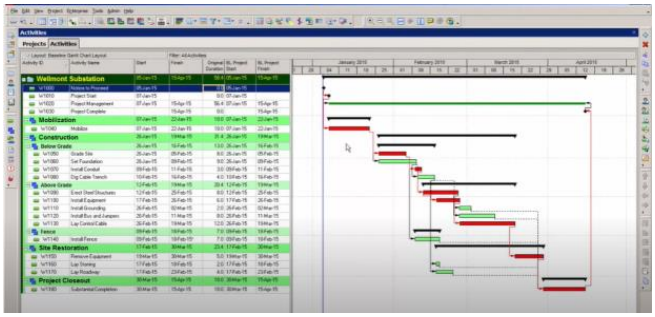


Figure 3 WBS Structure

3) Determining activities: Activities in the construction projects define the activity and sub-activities are basics of the project. Activities define following characteristics like start dates, end dates, name, type etc relationships of the activity define is succeeding, preceding, assign resources, roles as shown in, shown in figure 4.

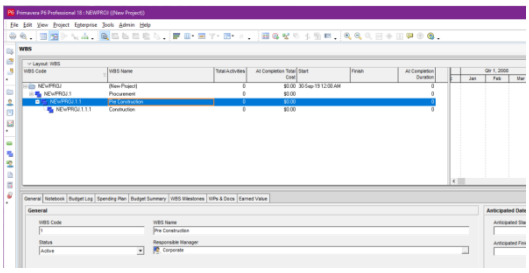


Figure 4 determining activities

4. Relations between activities: allocating the relationships to the activity by following a constitute network linking activity by each other.

- Finish to start a relationship (FS)
- Finish to finish the relationship (FF)
- Start to start relationship (SS).
- Start to finish relationship (SF).

5. Earn value analysis method

Earned Value Analysis (EVA) is a method to measure progress of project in given time. EVA compares the actual work to planned amount of work, determining the cost, schedule; calculate the amount of work and what amount of work should be completed according to plan. While the projects earn ensure what amount of work is completed and worth of completed project.

"ANSI/EIA Standard 748 defines the guideline for the evm that every management system has performance based system to measure the goals and achievements."

EVA is calculated and tracked using mathematical formula and in software. System gives you a early warning weather the team was going in wrong direction. It ensures a clear definition on the performing activity. It ensures to measure the objectives and contract status. Design

progress of the firm is relating the work to deliver on time and in reliable estimated cost.

6. DATA COLLECTION

CONSTRUCTION SITE DETAILS

The KK Patel hospital is located at opposite Kutch university, near mahila college Main Road, bhuj Kutch. It is a G +3 hospitals. Project is comprised of super specialty medical centre. The construction began in 15 dec 2019. The structural part is done in January 2020. This hospital is trust financed project. But, the various activities of the project are done by the following various consultancies.

Cost for project

- Number of building: 3 (main building, nursing, guest building)
- construction Cost: 57 crore construction cost (main building)
- total cost 124 crore
- Plot Area: 4.12 acreBuilt up Area: 2340sq.m

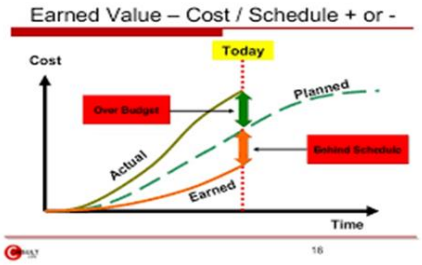
Identify type of activity

- Activities:127
- Critical Activities:77
- Number of Non Critical Activities:50
- Total Project Duration: 417Day

7. FINDINGS AND OBSERVATION

The KK Patel construction project is 484 days and 56, 47, 86,000 rupees budgeted project estimated to complete on April 2021. As per the construction team by applying proper scheduling the project must complete in 416 days the project is over budgeted project

While Appling earn value method. The project is tracked in 3 duration to know about the performance picture of project, the founded results are all listed in below tables.



Obtained results from the following case study.

- Progress of Project is 91.73% of the total work after consuming of the total estimated project duration.
- The project has a schedule variance in negative value (SV) which means that the project is behind schedule.
- Percentage of schedule variance is -11.05% therefore the project is behind schedule.

1	earn value	138843225
2	planned value	141196500
3	Actual Loc	118
4	Planned Loc	120
5	Actual Cost	131684200
6	EAC	526736800
7	BAC	564786000
8	CPI	1.054365102
9	SPI	0.983333333

Table 1 EVM by primavera

A schedule performance index of 0.90 would tell us that the project is dealing with around 89 % of the rate originally planned.

No.	description	1st tracking	2nd tracking	3rd tracking	4rd tracking2
1	earn value	134136675	128253487.5	130606762.5	132960037.5
2	work done	134136675	262390162.5	392996925	525956962.5
3	planned value	141196500	141196500	141196500	141196500
4	ACTUAL LOC	114	109	111	113
5	PLANNED LOC	120	120	120	120
6	PER DAY COST	1176637.5	1176637.5	1176637.5	1176637.5
7	atual per day cost	1155124.561	1430405.514	1422109.928	1112249.584
8	ACTUAL COST	131684200	155914201	157854202	125684203
9	ETC	395052600	467742603	473562606	377052609
10	EAC	526736800	623656804	631416808	502736812
11	BAC	564786000	564786001	564786002	564786003
12	CV	2452475	-27660713.5	-27247439.5	7275834.5
13	SV	-7059825	-12943012.5	-10589737.5	-8236462.5
14	CPI	1.018623912	0.82259016	0.82738857	1.057889809
15	SPI	0.95	0.908333333	0.925	0.941666667
16	VAC	38049200	-58870803	-66630806	62049191

Table 2 EVM Result by EVA method

- The originally estimated completion time for the project was 480 days, so the project manager now knows that if work continues at the current rate the project will take 1 month longer than originally planned as time estimate at completion is 504days.
- The project has a favorable cost variance of 62,61,048. A positive value shows that the project is over budget.
- Cost variance percentage is 4.84% therefore the project is 4.84 % below budget for the work performed till 22 may 2021, excluding penalties applicable due to delays.
- A 1.05 is the cost performance index rate shows that project is running on budget.
- Cost at estimation of completion at Rs. 56 crore is the expected cost required to finish all the remaining work.

- Monitoring the threshold when the finish date variance 68 issues in finish date reported and 24 activity issued in start date.

Earn value parameters

In this study, the case study is taken to examine the results by manual method and analysis using primavera.1 table shows EVM using primavera and table 2 shows earn value analysis by manual method the table shows the cost variance and schedule variance using the earn value parameters and the obtained results are interpreted

8. CONCLUSION

The Earn value management is a program evaluation approach which is evaluated and tracks a project in better manner. This project report indicates significance, execution and particular components of earned value management that advantages extend director &eventually brings about project achievement. The project is tracked on 3 durations from 16-dec-2019 to 14-june-2020, 12-dec-2020 to 14-may-2021 and 1-aug-2020 to 12-feb-2021 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.

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