COST AND TIME ANALYSIS USING EARNED VALUE METHOD IN THE CONSTRUCTION OF SPORTS FACILITIES IN KECAMATAN KEDEWAN KABUPATEN BOJONEGORO

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ABSTRACT

The implementation of construction work has the main targets in construction management, such as construction costs, quality of construction work and construction implementation time. Construction activities can be declared successful in their management if they produce work products with the quality criteria that have been determined, on time, and according to the agreed costs. Using EVM (Earned Value Method) in project management can be used to determine cost performance and implementation time during the project and the indicators used for analysis include: BCWP (Budget Cost of Work Performance), BCWS (Budget Cost of Work Schedule), ACWP (Actual Cost of Work Performance), SV (Schedule Variance), CV (Cost Variance), SPI (Schedule Performance Index), CPI (Cost Performance Index), EAS (Estimated At Schedule) and ETS (Estimated Temporary Schedule).By using this method in the Sports Facilities Construction Project, Kecamatan Kedewan, Kabupaten Bojonegoro, the ACWP (Actual Cost of Work Performed), BCWP (Budgeted Cost of Work Performed), and BCWS (Budgeted Cost of Scheduled) values were obtained. The CV value obtained <0 in weeks 1 to 7 indicates that the costs incurred were greater than the plan, but in weeks 8 to 15 the CV value >0 means that in that week the costs incurred were less than the plan. Meanwhile, the SV value for the 15th week is SV<0, meaning the project is experiencing a delay from plan. The estimated of the completion budget requirement obtained from the ETC (Estimate to Compile) value is IDR. 3,345,105,521.28, while the estimated final total project cost obtained from the EAC (Estimate at Complete) value is IDR. 5,680,868,593.22. The results of the TE (Time Estimate) value in week 15 show 33 calendar days, so it takes 243 (Two hundred and forty three) calendar days to complete the project from week 15 to completion or 33 days later than the contract time of 210 calendar days.

Keywords: earned value method, cost, time performance

INTRODUCTION

The implementation of construction work has the main targets in construction management, namely construction costs, quality of construction work and construction implementation time.

Construction activities can be declared successful in their management if they produce work products with the quality criteria that have been determined, on time, and according to the agreed costs.

In the development of construction with large costs, it will affect the complexity of the work and the materials used, so it is necessary to improve the project management system in terms of techniques or appropriate scheduling planning methods, control and management of project costs as well as efficient work methods so that it can help manage the implementation of construction projects. effectively.

A very important thing in planning or implementing construction is the management of the project itself. A project requires planning (planning consultant), implementing (contractor), and construction management (supervising consultant). Consultant services are usually required for large projects with high costs. Currently there are many consulting offices for construction projects, in the field of planning or supervision. Consultants have a very important role in coordinating the work of project participants at the planning and monitoring stages. Even though it cannot be separated from the support of the project owner (owner) as funder and contractor as implementer in the field, consultants really help project owners in improving the performance of construction project implementation, so that the total costs obtained are optimum and project implementation is on time. Consultants offer services in the form of expertise and skills in planning and supervising the progress of construction projects. Criteria and standards for measuring consultant qualifications are not easy to determine. This is also supported by Mrs(2003), who believes that some criteria in selecting consultants are intangible. The process of selecting consultants for privately owned construction projects does not yet have standard guidelines, this really depends on the policies of the company concerned. This is different from the process of selecting consultants for government projects. Service providers on government projects require more competitive procedures than on private projects (Cheung & Rensvold, 2002)

In implementing a construction project, the time for completing work can be influenced in terms of the method used, the distribution of human resources, as well as the accuracy of the estimated material stock scheduling during implementation. In solving this problem, a project control method is very necessary, one of which can be using the Earned Value Analysis (EVA) method. Earned Value Analysis is a tool used in project management that integrates cost and time. The earned value concept presents three dimensions, namely the physical completion of the project (the percent complete) which reflects the planned cost absorption (budgeted cost), the actual costs that have been incurred or what is called actual cost and what is obtained from the costs that have been incurred or what is called earned value. Of these three dimensions, with the concept of earned value, cost and time performance can be linked which comes from calculating the variance of cost and time(Fleming & Koppelman, 1994)

In implementing a construction project, planning and control are the most important functions in realizing project success. The problem that arises is how to achieve an optimum solution with limited resource conditions. How to apply a method to a project to control costs and time, as well as control the implementation of a construction project against deviations, and evaluate completion projections for deviations on the project. To increase effectiveness in monitoring and controlling

projects, it is necessary to use methods that integrate schedule and costs so as to reveal activity performance.(Browning, 1998) One method that meets this goal is the Earned Value Concept, which consists of three indicators, namely BCWS, BCWP, and ACWP. Meanwhile, existing data variances are emphasized to investigate deviations in costs or implementation schedules that have been planned or determined. If the performance figures are reviewed further, then the performance index figure is less than one (<1), and (>1), which means that the deviation from the basic plan or budget is greater, or the work implementation performance is very good, an assessment needs to be carried out to see whether the planning may be unrealistic. The concept of Result Value can be applied to this case study for control purposes where based on the analysis, the control carried out has many deviations from the scheduling side when reporting. Based on the calculated ETC and EAC values, if performance is not updated there will be a shift(Sihombing & Christin, 2023)

Often rework or variation orders are inevitable. This can happen with several possibilities, such as: contractor negligence, changes in the owner or architect, obstacles in the field, and so on. Control analysis of a project using the Earned Value method which integrates aspects of implementation methods, costs and time is needed as an indicator of project achievement based on costs and time to take preventive measures so that project implementation goes according to plan. The basis of control in construction projects is that every work carried out must be thoroughly inspected and checked by a supervisory consultant in the field, whether it is in accordance with specifications or not, with good control over the implementation of existing activities,

then schedule delays resulting in project cost overruns can be avoided. avoided, anticipating changes in uncertain field conditions and overcoming the constraints of limited time in controlling all elements of project work, an effective control concept is needed, namely by comparing planning with project parameters that can be measured at any time.(Peña-Mora & Li, 2001)

In implementing a project, it is very rare to find a project that goes exactly as planned. Generally, there are planned delays, both in time and work progress, but there are also projects that experience acceleration from the initial planned schedule. Kusjadmikahadi,(Maria et al., 2022) that delays in construction projects mean an increase in the implementation time for project completion that has been planned and stated in the contract documents. Completion of work not on time is a deficiency in the level of productivity and of course all of this will result in waste in financing, both in the form of direct financing spent on government projects, and in the form of investment overruns and losses on private projects. Management's active role is one of the main keys to successful project management. Problems like these can cause delays in project work, so that the project cannot proceed according to the predetermined plan.(Han et al., 2009) Project delays are often a source of disputes and demands between the owner and contractor, so that it will be very expensive from both the contractor and owner's perspective. The contractor will be subject to penalties according to the contract, apart from that the contractor will also experience additional overhead costs while the project is still ongoing. From the owner's side, project delays will have the

Sanda Praja Riduwan, Budi Witjaksana, Hanie Teki Tjendani

impact of reducing income due to delays in operating the facilities. This happens because in the field there are often and even always differences in perception between contractors as implementers and consultants as supervisors and planners, especially if planners are not involved during the project implementation period. As a result of these differences, two things arise, namely increased project costs and delays in project completion from the planned schedule. To avoid losses in projects, we can forecast the costs of completing the project using the Earned Value Analysis concept.

OnConstruction of Sports Facilities in Kedewan District, Bojonegoro RegencyIn the construction process there are several obstacles in terms of cost and time. In this work there is a delay in progress which can lead to cost overruns and if the work is not completed on time it will result in late fines therefore the author will use the Earned Value Analysis method in evaluating time performance and cost performance, to 3 (three) indicators are used, namely, ACWP (actual cost of work performed), BCWP (budgeted cost of work performed), and BCWS (budgeted cost of scheduled). ACWP is the actual cost of work that has been carried out. These costs are obtained from project accounting or financial data at the reporting date (for example the end of the month), namely records of all actual cost expenditures from work packages or accounting codes including overhead calculations and others.(Rasdorf & Abudayyeh, 1991) So, ACWP is the actual amount of expenditure or funds used to carry out work in a certain period of time. BCWP shows the value of results from the perspective of the value of the work that has been completed against the budget provided to carry out the work. If the ACWP

figure is compared with the BCWP, you will see a comparison between the costs that have been incurred for the work that has been carried out and the costs that should have been incurred for that purpose. BCWS is a budget for a work package, but is prepared and linked to the implementation schedule. So here there is a combination of cost, schedule and scope of work, where each element of the work has been allocated a cost and schedule which can be used as a benchmark for implementing the work. so that construction implementation can be in accordance with the time targets and cost targets stated in the contract. By using the 3 indicators above, various factors can be calculated that show the progress and performance of project implementation such as: integrated cost (CV) and schedule (SV) variances; monitor changes in variance against standard figures; productivity and performance index; estimated project completion costs. So in this case the Earned Value Analysis (EVA) method is a tool that can be used in project management which integrates costs, time and project implementation achievements so as to know the extent of the relationship between cost and time performance as well as estimates of the costs and time required for project completion by carrying out controlling costs and time so that delays in the final implementation time can be prevented. Apart from that, additional costs due to delays can be optimized.

The aims of this research are:

Analyzing the value of cost variance (CV) and schedule variance (SV) for the construction of sports facilities in Kedewan District, Bojonegoro Regency.

Determine the estimated cost of ETC (estimate to complete) and EAC (estimate at complete) until the Sports Facilities

Development project for Kedewan District, Bojonegoro Regency is completed.

Calculate the length of TE (time estimate) of time needed to complete the Sports Facilities Development project for Kedewan District, Bojonegoro Regency.

RESEARCH METHODS

The method used is Earned Value Management (EVM) to analyze project performance. EVM is a method used in project management to measure project physical performance and cost performance over the entire period. Some of the methods used in this research include:

Analysis of Project Progress or Delay Factors:

1) Interviews with implementing contractors (Site Engineer Manager, supervisors and logistics) and direct daily observations of project performance.
2) Checking material delivery whether it is in accordance with the material arrival schedule.
3) Check weekly reports to find out the percentage of work that has been done during the week.
4) Check daily reports to determine patterns of labor use, tool use, material use, weather conditions and field work hours.

Earned Value Analysis Method:

1) Calculate the ACWP (Actual Cost of Work Performance), BCWS (Budgeted Cost Work Schedule), BCWP (Budgeted Cost for Work Performed) values.
2) Calculations based on cost aspects:
   CV (Cost Variance) = BCWP - ACWP
   CPI (Cost Performance Index) = BCWP / ACWP

ETC (Estimate to Complete) = (BAC - BCWP) / CPI
EAC (Estimate at Complete) = ACWP + ETC

Calculations based on time aspects:
Calculate SV (Schedule Variance), SPI (Schedule Performance Index), TE (Time Estimate) values.
SPI = BCWP / BCWS
SV = BCWP - BCWS
TE = ATE + (OD - (DATE x SPI) / SPI)
ETS = (remaining time) / SPI
EAS = Finish time + ETS

In this research, the data collected includes types of secondary data as well as literature studies, such as the planned time schedule and realization time schedule for the Kedewan District Sports Hall construction project, S curve, contract cost budget plan, monthly, weekly and daily project reports from the implementing contractor, as well as reports on the realization of project costs.(Lu et al., 2014)

RESULTS AND DISCUSSION

Calculation of BCWS, BCWP and ACWP

Using the Earned Value Method in this project produces a Planned Value (PV) or Budgeted Cost Work Schedule (BCWS), Earned Value (EV) or *Budgeted Cost Work Performed*(BCWP), Actual Cost (AC) or *Actual Cost of Work Performed* (ACWP), then compared continuously in each phase of the project until completion. Information on cost use and value obtained quickly throughout the project life cycle is very helpful for a fast and integrated project control and supervision system.

The method used to control costs and time in the field is to use a Time Schedule. This method is often used in construction projects and the percentage of project plans and the percentage of realization are

Sanda Praja Riduwan, Budi Witjaksana, Hanie Teki Tjendani

depicted in an S-curve graph. Based on the S-curve graph of project planning and realization, the percentage of work until the 15th week, because in the 15th week there was an increase in the percentage of work volume . The actual physical percentage (realization) of the project tends to be smaller or later than planned. Earned value analysis was carried out in the 15th week.

Calculation of Planned Value (PV) or Budgeted Cost Work Schedule (BCWS)

In this project, the contract value for the 1st amendment does not include VAT, IDR. 5,683,390,775.00 and to calculate PV or BCWS this is obtained from progress data and project budget using the following formula;
PV or BCWS = (% plan progress) x (Budget)
Calculation

PV or BCWS at week 1
PV or BCWS = (% plan) x (Total project budget)
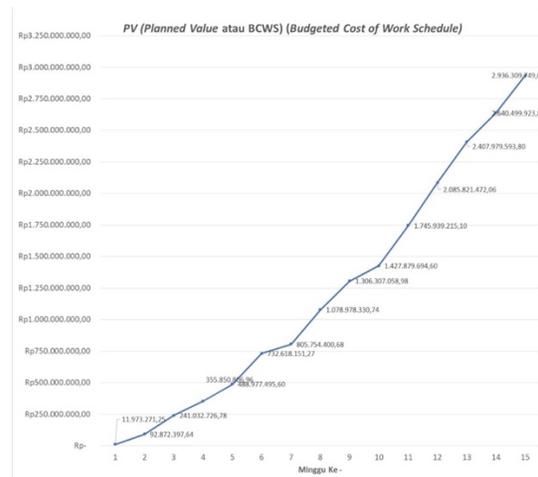PV or BCWS = (0.21%) x (IDR. 5,683,390,775.00)
PV or BCWS = IDR 11,973,271.24

From the calculations obtained at week 15,
PV or BCWS = (% plan) x (Total project budget)
PV or BCWS = (51.66%) x (IDR. 5,683,390,775.00)
PV or BCWS = IDR 295,809,825.25

Figure 1. Planned Value (PV) or Budgeted Cost of Work Schedule BCWS graph
Source: Secondary data PT. Unedo Phazippo Utama (Weekly Report and Project Schedule) 2023
Description: Planned Value (PV) / Budgeted Cost of Work Schedule (BCWS) graph and table can be seen for weekly cost expenditure according to the contract.

Calculation of Earned Value (EV) or Budgeted Work Cost Performed (BCWP)

In this project Earned Value (EV) or Budgeted Cost of Work Schedule BCWP is the budgeted cost for work that has been completed, obtained by multiplying the percentage of progress that has been implemented by the budget;
EV or BCWP = (% actual progress) x (Budget)
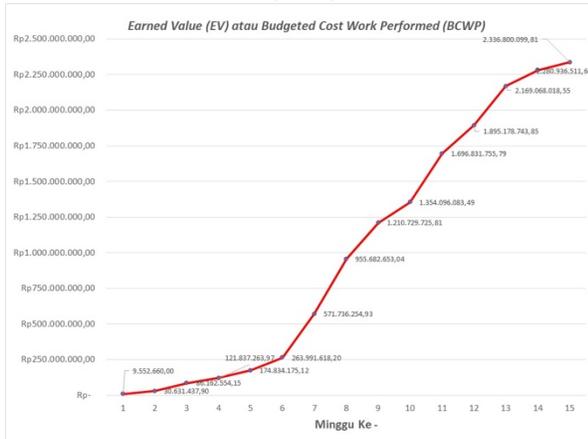Calculation
EV or BCWP in week 1
EV or BCWP = (% actual) x (Total project budget)
EV or BCWP = (0.17%) x (IDR. 5,683,390,775.00)
EV or BCWP = IDR 9,575,506.91

From the calculation, EV or BCWP is obtained in the 15th week, with the formula EV or BCWP = (% actual) x (Total project budget)

EV or BCWP = (0.41.12%) x (IDR. 5,683,390,775.00)
EV or BCWP = IDR 55,863,588.17

Figure 2. Earned Value (EV) or Budgeted Work Cost Performed (BCWP) graph

Note: graph and table of Earned Value (EV) / Budgeted Cost of Work Performance (BCWP) when compared with the graph and table of Planned Value (PV) / Budgeted Cost of Work Schedule (BCWS), it can be seen that there is a delay from the 1st week to -15 seen from the costs of weeks 1 to 15 far from plan.

Calculation of Actual Cost (AC) or Actual Cost of Work Performed (ACWP)

In this project the Actual Cost (AC) or also called the Actual Cost of Work Performed (ACWP) is the actual cost used (Real Cost);

Actual Cost, the week consists of the following costs:

Direct cost:
- Material Costs
- Labor costs

Indirect Costs
- Office overhead: Staff salaries, Office equipment
- Field Overhead: Fencing, Directors Kit, Security, Transportation/Fuel

In this research, the author's assumptions for indirect costs are based on previous research. The indirect costs made have been detailed so that they are close to what is being done.

The ACWP value for the 15th week is IDR 223,088,102.96, then accumulated in the previous week, so that the ACWP value up to the 15th week is IDR 2,335,763,071.93.
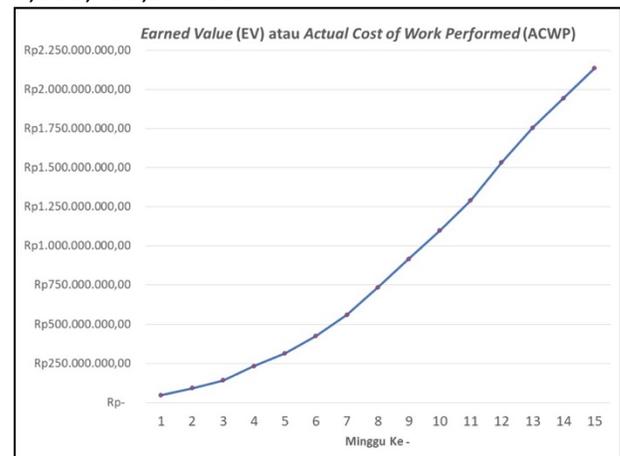
Figure 3. Actual Cost (AC) graph orActual Cost of Work Performed(ACWP)

Description: graphs and tables*Actual Cost*(AIR CONDITIONING)/ Actual Cost od Work ACWP can be seen actual tactical expenditure.

Of the three indicators that have been calculated, namely Budgeted Cost of Work Schedule (BCWS), Budgeted Cost of Work Performed (BCWP), and Actual Cost of Work Performed (ACWP) provide an overview of the cumulative cost and time achieved each week.

From the table in week 15, it can be seen that the PV value is IDR. 2,936,309,749.06, the EV value is IDR. 2,336,800,099.81 and AC value IDR. 2,335,763,071.94

Sanda Praja Riduwan, Budi Witjaksana, Hanie Teki Tjendani
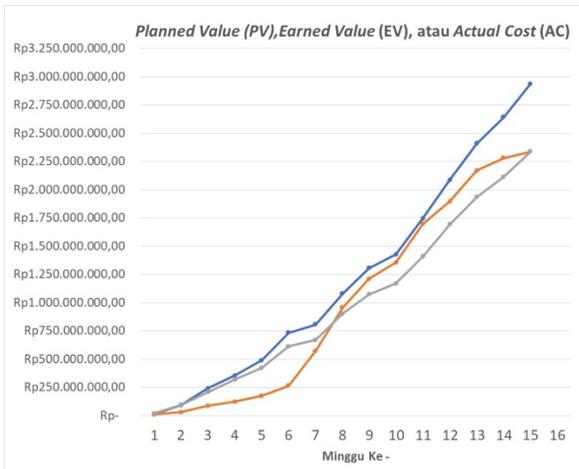
Figure 4. Relationship GraphPlanned Value (PV) or BCWS, Earned Value (EV) or BCWP, and Actual Cost (AC) or ACWP

Description: The graph shows a comparison of BCWS (PV) and BCWP (EV) values. Weeks 1 to 15 show that the BCWP (EV) value is smaller than BCWS (PV). This shows that the work has not been carried out according to the planned schedule.

The project experienced work delays, this was indicated by the BCWP (EV) value being smaller than the BCWS (PV) value.

For the actual costs or ACWP in the first week to the 15th week, the expenditure is smaller than the plan with the ACWP graph being marked as lower than the BCWP (EV).

Calculations Based on Cost Aspects

The EV method is used in this project. Earned Value Analysis is seen from the cost aspect, using Cost Variance (CV), Cost Performance Index (CPI), Estimate at Complete (EAC). Details of the calculation of these parameters are as follows:

Calculation of Cost Variance (CV) or Calculation of Costs

Cost variance is the difference between the value of the project performance results (BCWP) Budgeted Cost Work Performed and the planned budget (BCWS) Budgeted Cost of Work Schedule

Review of CV cost variance calculations in the 15th week, obtained from the reduction in Earned Value and Actual Cost in the 15th week.

CV = EV or BCWP – AC or ACWP
CV = IDR 2,336,800,099.81– IDR 2,335,763,071.94= IDR 1,037,027.87

A negative value or means that the CV value is greater than 0 (CV > 0) indicates that the costs incurred are less than the planned budget.

This CV value can indicate that the project is experiencing delays or is running faster than planned and the costs incurred are greater than or smaller than the planned budget. The calculation for the next week can be done in the same way as the calculation above, seen in the following table.

Table 1. Table of Cumulative Cost Variance (CV) Values Each Week

No	Sunday Period	BCWP	ACWP	CV
a	b	d	e	g
1	Number 1	Rp. 9,552,659.99	Rp. 19,477,294.20	- Rp. 9,924,634.20
2	2nd	Rp. 30,631,437.89	Rp. 95,098,090.63	- Rp. 644.66.652.73
3	The 3rd	Rp. 86,162,554.14	Rp. 208,056,224.45	- Rp. 121,893,670.31
4	To 4	Rp. 121,837,263.97	Rp. 319,260,202.35	- Rp. 197,422,938.38
5	5th	Rp. 174,834,175.12	Rp. 422,388,924.62	- Rp. 247,554,749.50
6	6th	Rp. 263,991,618.19	Rp. 611,377,327.27	- Rp. 347,385,709.07
7	7th	Rp. 571,736,254.92	Rp. 669,877,620.00	- Rp. 98,141,365.07
8	8th	Rp. 955,682,653.03	Rp. 901,423,780.77	Rp. 54,258,872.26
9	9th	IDR 1,210,729,725.80	Rp. 916,301,238.37	Rp. 136,097,904.43
10	10th	IDR 1,354,096,083.48	Rp. 1,169,165,186.65	Rp. 184,930,896.83

11	11th	IDR 1,696,831,755.78	Rp. 1,409,870,195.46	Rp. 286,961,560.32
12	The 12th	Rp. 1,895,178,743.84	Rp. 1,692,359,698.78	Rp. 202,819,045.06
13	13th	Rp. 2,169,068,018.55	Rp. 1,934,759,262.38	Rp. 234,308,756.16
14	14th	Rp. 2,280,936,511.64	Rp. 2,112,674,968.96	Rp. 168,261,542.67
15	15th	Rp. 2,336,800,099.81	Rp. 2,335,763,071.94	Rp. 1,037,027.87
Source: Author's Processed Results for 2023				

Calculation of Cost Performance Index (CPI)

Cost variance is the difference between the value of the project performance results (BCWP) Budgeted Cost Work Performed and the planned budget (BCWS) Budgeted Cost of Work Schedule
The calculation of the CPI value in the 15th week is as follows:
CPI = BCWP / ACWP
CPI = Rp.2,336,800,099.81/ Rp2,335,763,071.94
CPI = 1.0004
Obtained CPI value > 0, namely 1.0004
A CPI value greater than 1 indicates that cost performance is still good because the costs incurred (AC) are smaller than the value obtained (EV).

Estimate To Complete (ETC) Calculation

It is an estimation tool and is used with earned value calculations to develop performance reports
ETC = (BAC – BCWP) / CPI
ETC = (IDR. 5,683,390,775.00 – Rp.2,336,800,099.81) / 1.004
ETC = IDR. 3,345,105,521.28

Estimate At Complete (EAC) Calculation

It is a total cost estimate at the end of the project obtained from actual costs (AC) plus ETC
EAC = ACWP + ETC
EAC = IDR. 2,335,763,071.94+ IDR. 3,345,105,521.28
EAC = IDR. 5,680,868,593.22

Calculations Based on Time Aspects

The EV method is used in this project. Earned Value Analysis is seen from the time aspect, using Schedule Variance (SV), Schedule Performance Index (SPI), Estimate To Complete (ETC). Details of the calculation of these parameters are as follows:

Calculation of Schedule Variance (SV) or Calculation of Time

Cost variance is the difference between the value of the project performance results (BCWP) Budgeted Cost Work Performed and the planned budget (BCWS) Budgeted Cost of Work Schedule
SV = BCWP - BCWS

Table 2. Table of Cumulative Schedule Variance (SV) Values Each Week

No	Sunday Period	BCWP	BCWS	SV
a	b	c	d	e = cd
1	Number 1	Rp. 9,552,659.99	Rp. 11,973,271.24	- Rp. 2,420,611.24
2	2nd	Rp. 30,631,437.89	Rp. 92,872,397.64	- Rp. 62,240,959.74
3	The 3rd	Rp. 86,162,554.14	Rp. 241,032,726.78	- Rp. 154,870,172.63
4	To 4	Rp. 121,837,263.97	Rp. 355,850,806.96	- Rp. 234,013,542.98
5	5th	Rp. 174,834,175.12	Rp. 488,977,495.59	- Rp. 314,143,320.47
6	6th	Rp. 263,991,618.19	Rp. 732,618,151.27	- Rp. 468,626,533.07
7	7th	Rp. 571,736,254.92	Rp. 805,754,400.67	- Rp. 234,018,145.75

8	8th	Rp. 955,682,653.03	Rp. 1,078,978,330.73	- Rp. 123,295,677.70
9	9th	IDR 1,210,729,725.80	IDR 1,306,307,058.98	- Rp. 95,577,333.17
10	10th	IDR 1,354,096,083.48	IDR 1,427,879,694.60	- Rp. 73,783,611.11
11	11th	IDR 1,696,831,755.78	Rp. 1,745,939,215.09	- Rp. 49,107,459.30
12	The 12th	Rp. 1,895,178,743.84	Rp. 2,085,821,472.06	- Rp. 190,642,728.21
13	13th	Rp. 2,169,068,018.55	Rp. 2,407,979,593.80	- Rp. 238,911,575.24
14	14th	Rp. 2,280,936,511.64	Rp. 2,640,499,923.81	- Rp. 359,563,412.17
15	15th	Rp. 2,336,800,099.81	Rp. 2,936,309,749.06	- Rp. 599,509,649.25

Source: Author's Processed Results for 2023

The calculation of the SV value at week 15 is as follows:

SV = BCWP – BCWS
= IDR 2,336,800,099.81 – IDR 2,936,309,749.06
= - IDR. 599,509,649.25

From the results of these calculations, the SV value is obtained at - IDR 599,509,649.25. SV has a negative value indicating that the project is experiencing a delay from the planned schedule, fewer work items are being carried out than planned.

Calculation of Schedule Performance Index (SPI)

Project managers often want to know resource utilization, which can be expressed as a productivity index or performance index. schedule performance index (Schedule Performance Index = SPI). The schedule productivity index is the efficiency value of resource use at the time the evaluation is carried out.

SPI = BCWP / BCWS

Table 3. Table of Cumulative Schedule Performance Index (SPI) Values for Each Week

No	Sunday Period	BCWS	BCWP	SPI
a	b	c	d	e = c / d
1	Number 1	Rp. 11,973,271.24	Rp. 9,552,659.99	0.80
2	2nd	Rp. 92,872,397.64	Rp. 30,631,437.89	0.33
3	The 3rd	Rp. 241,032,726.78	Rp. 86,162,554.14	0.36
4	To 4	Rp. 355,850,806.96	Rp. 121,837,263.97	0.34
5	5th	Rp. 488,977,495.59	Rp. 174,834,175.12	0.36
6	6th	Rp. 732,618,151.27	Rp. 263,991,618.19	0.36
7	7th	Rp. 805,754,400.67	Rp. 571,736,254.92	0.71
8	8th	Rp. 1,078,978,330.73	Rp. 955,682,653.03	0.89
9	9th	IDR 1,306,307,058.98	IDR 1,210,729,725.80	0.93
10	10th	IDR 1,427,879,694.60	IDR 1,354,096,083.48	0.95
11	11th	Rp. 1,745,939,215.09	IDR 1,696,831,755.78	0.97
12	The 12th	Rp. 2,085,821,472.06	Rp. 1,895,178,743.84	0.91
13	13th	Rp. 2,407,979,593.80	Rp. 2,169,068,018.55	0.90
14	14th	Rp. 2,640,499,923.81	Rp. 2,280,936,511.64	0.86
15	15th	Rp. 2,936,309,749.06	Rp. 2,336,800,099.81	0.80

Source: Author's Processed Results for 2023

The calculation of the SPI value in the 15th week is as follows:
SPI = BCWP / BCWS
= IDR 2,336,800,099.81 / IDR 2,936,309,749.06
= 0.80
From the results of these calculations, an SPI value of 0.80 was obtained.

An SPI value of less than 1 indicates that the project is experiencing delays.

Work performance is not as expected and has not been able to achieve planned work targets

Calculation of Estimate Temporary Schedule (ETS)

This is the method used to calculate the estimated remaining time
ETS = Remaining Time / SPI

Table 4. Table of Cumulative Estimate Temporary Schedule (ETS) Values for Each Week

No	Sunday Period	SPI	Plan Time	Cumulative Remaining Time	Remaining time	ETS
a	b	c	d	e	f= de	g=f/c
1	Number 1	0.80	210	2	206	260.71
2	2nd	0.33	210	8	196	612.45
3	The 3rd	0.36	210	14	190	548.29
4	To 4	0.34	210	20	184	554.93
5	5th	0.36	210	26	178	514.61
6	6th	0.36	210	32	172	493.98
7	7th	0.71	210	38	166	242.40
8	8th	0.89	210	44	160	187.42
9	9th	0.93	210	50	154	172.63
10	10th	0.95	210	56	148	162.39
11	11th	0.97	210	62	142	152.28
12	The 12th	0.91	210	68	136	156.28
13	13th	0.90	210	74	130	150.98
14	14th	0.86	210	80	124	150.49
15	15th	0.80	210	84	122	158.33

Source: Author's Processed Results for 2023

The calculation of the SPI value in the 15th week is as follows:
ETS = Remaining Time / SPI
= 122/0.80
= 158.33 rounded 159 Days

Calculation of Estimate at Schedule (EAS)

Is a method used to estimate project completion time
EAS = Finish Time + ETS

Table 5. Table of Cumulative Estimate All Schedule (EAS) Values for Each Week

No	Sunday Period	SPI	Plan Time	Cumulative Remaining Time	Remaining time	ETS	EAS	Time Difference
a	b	c	d	e	f= de	g=f/c	h=e+g	i=hd
1	Number	0.80	210	2	206	260.71	262.71	52.71

Sanda Praja Riduwan, Budi Witjaksana, Hanie Teki Tjendani

	1							
2	2nd	0.33	210	8	196	612.45	620.45	410.45
3	The 3rd	0.36	210	14	190	548.29	562.29	352.29
4	To 4	0.34	210	20	184	554.93	574.93	364.93
5	5th	0.36	210	26	178	514.61	540.61	330.61
6	6th	0.36	210	32	172	493.98	525.98	315.98
7	7th	0.71	210	38	166	242.40	280.40	70.40
8	8th	0.89	210	44	160	187.42	231.42	21.42
9	9th	0.93	210	50	154	172.63	222.63	12.63
10	10th	0.95	210	56	148	162.39	218.39	8.39
11	11th	0.97	210	62	142	152.28	214.28	4.28
12	The 12th	0.91	210	68	136	156.28	224.28	14.28
13	13th	0.90	210	74	130	150.98	224.98	14.98
14	14th	0.86	210	80	124	150.49	230.49	20.49
15	15th	0.80	210	84	122	158.33	242.33	32.33

Source: Author's Processed Results for 2023

The calculation of the EAS value at week 15 is as follows:

EAS   = Completion Time - ETS
        = 210 + 32.33
        = 242.33 rounded 243 Days

From the results of the ETS and EAS calculations, it can be concluded that the processing time was 33 days longer than the planned schedule of 210 days.

CONCLUSION

Based on the analysis that has been carried out, the following conclusions are obtained; (1) From the results of the calculation analysis, the CV and SV values are obtained. From weeks 1 to 15, the CV value <0 was obtained in weeks 1 to 7, this shows that the costs incurred were greater than planned, but in weeks 8 to 15 the CV value was> 0, so in that week the costs incurred were more. bigger than planned. Meanwhile, the SV value from the 1st week to the 15th week is SV<0, so the project is experiencing a delay from the plan. (2) calculating the ETC value (estimate to compile) shows that the estimated budget value required for completion is IDR.

3,345,105,521.28, while the EAC (estimate at complete) value obtained is an estimate of the total final project cost of Rp. 5,680,868,593.22, and (3) TE (Time Estimate) calculation, the TE value for weeks 1 to 15 is obtained of the remaining time divided by SPI. Time Estimate (TE), in week 15 shows the number 32.33 ≈ 33 calendar days, so it takes 210 calendar days to complete the project from week 15 plus the remaining time of 159 days, or total implementation time from week 1 to completion for 210 + 33 = 243 (Two hundred and forty three) calendar days or 33 days later than the contract time of 210 calendar days.

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