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COST AND TIME PERFORMANCE ANALYSIS OF THE RU GUEST HOUSE AND MAIN HOUSE CONSTRUCTION PROJECT USING THE EARNED VALUE METHOD

Komang Gede Triska Bayu Wedananta[1], Hanie Teki Tjendani[2], Budi Witjaksana[3]
University of August 17, 1945 Surabaya, Indonesia
Email: bayuwedananta66@gmail.com[1], hanie@untag-sby.ac.id[2], budiwitjaksana@untag-sby.ac.id[3]

Abstrak
The construction project of Rumah Ru Guest House and Main House experienced delays due to a lack of careful initial planning and narrow access roads that hampered the delivery of materials. These obstacles affected the overall construction progress. To overcome these problems, the Earned Value Method (EVM) was used to analyze project performance in terms of cost and time. EVM uses three main indicators, namely Actual Cost of Work Performed (ACWP), Budgeted Cost of Work Performed (BCWP), and Budgeted Cost of Work Scheduled (BCWS). The research data was obtained from the executing contractor, CV. Cipta Karya Utama. The results of the analysis show that the project performance in week 15 to week 21 experienced problems, indicated by negative values in Schedule Variance (SV) and Cost Variance (CV). This reflects the delay of work from the planned schedule and cost overruns. In addition, the Schedule Performance Index (SPI) and Cost Performance Index (CPI) values of less than 1 also confirm that the project's time and cost performance is not optimal. These findings emphasize the need for improvement in future project planning, particularly in anticipating logistical barriers and managing resources for more efficient project performance.

Keywords: Earned Value, Cost Performance, Time Performance.

INTRODUCTION
Villa construction is one of the property business opportunities that has great profit potential, especially if managed with good and correct management. The success of a construction project is highly dependent on structured and well-planned management from the planning stage to implementation. One important element in this process is the implementation of optimal project management during the development phase. In every construction project, there are various aspects that need serious attention, including quality, cost and project implementation time. Good quality must be achieved without exceeding the predetermined budget and in time according to the planned schedule. Therefore, planning and controlling costs and time is not only an important part of project management, but also a key factor in determining the overall success of the project (Witjaksana & Reresi, 2012). In this study, it focuses on analyzing cost and time during project implementation. Cost management includes budget planning, monitoring expenditures, as well as controlling costs to stay in line with the initial plan. Meanwhile, time management involves preparing schedules, monitoring work progress and controlling project activities to ensure that work is completed on time. As the level of complexity of a project increases, the need for close supervision and purposeful control

becomes increasingly important. Delays in schedule or cost overruns can result in major losses for the parties involved (Imron, Tjendani, & Witjaksana, 2022).

A clear example of this challenge can be seen in the RU Guest House and Main House Construction project located in Seseh, Cemagi Village, Mengwi District. Badung Regency, Bali. The implementing contractor for the construction of the villa is CV. Cipta Karya Utama. This project has a contract value of Rp. 12,657,090,235.00 (Twelve Billion Six Hundred Fifty Seven Million Ninety Thousand Two Hundred Thirty Five Rupiah). The construction of this villa was carried out within a period of 34 (thirty-four) weeks. During the implementation of the work of the RU Guest House and Main House construction project, there was less careful planning, this caused changes in the allocation of time and costs, thus affecting the time performance and cost performance of CV. Cipta Karya Utama as the implementing contractor. These problems caused the work progress in week 21 to experience a delay of -27.99% from the predetermined schedule. If not addressed immediately, this delay has the potential to cause project completion to exceed the agreed contract time.

Therefore, a management method is needed that can help identify, monitor, and control these constraints. One method that can be used is the Earned Value Method (EVM). Earned Value Method (EVM) is an approach used to analyze and measure overall project performance, both in terms of cost and time (Rizkianto, 2022). By using this approach, project managers can more easily monitor project progress accurately, identify potential problems early, and take corrective action to ensure the project stays on track. The application of Earned Value Method (EVM) is expected to reduce the risk of delays and losses, so that the project can be completed in accordance with the predetermined targets.

Based on the background that has been explained, this research will discuss the application of the Earned Value Method (EVM) to the RU Guest House and Main House Construction project. The evaluation will be conducted on project performance using three main indicators in EVM, namely Actual Cost of Work Performed (ACWP), which shows the total actual costs that have been incurred. The second indicator is the Budgeted Cost of Work Performed (BCWP), which reflects the value of work completed within the planned budget. Finally, the Budgeted Cost of Work Scheduled (BCWS) is used to show the planned cost of work that should have been completed by a certain time. By utilizing these three indicators, various important factors in the project, such as work progress and cost performance efficiency, can be measured objectively. The results of this analysis are expected to provide a clear picture of the status and progress of the project, so that better decisions can be made to support the completion of the project within the set targets. Through this approach, project managers can identify potential risks and take corrective actions more effectively, so that project objectives can be achieved optimally.

In this study, the evaluation of project implementation will be carried out by analyzing performance at week 21 using the Earned Value Method (EVM). This analysis aims to identify potential delays and develop solutions that allow the project to be completed in accordance with the planned time of 34 weeks. The results of this evaluation will be taken into consideration for the project leader in deciding the strategic steps that need to be taken in the following weeks. Thus, corrective actions can be taken immediately to accelerate project completion and minimize the risk of greater delays in the future. Based on these problems, the research questions in this study are stated as follows.

1. What is the value of project time and cost performance measured through Cost Variance (CV) and Schedule Variance (SV)?
2. What is the value of the project time and cost performance index measured by the Cost Performance Index and Schedule Performance Index?.

RESEARCH METHOD

Implementation and Timing of Research

The research was conducted at the Ru Guest House and Main House Seseh Construction Project, Cemagi Village, Mengwi District. Badung Regency, Bali. Research time is part of the research procedure that includes data collection to support research that will be conducted in 2024.

Data Collection Procedure

This research was conducted on the Ru Guest House and Main House Seseh Construction project, Badung Regency, Bali, with research data collection sourced from the implementing contractor. The type of data collected is secondary data and the results of literature studies. The data used includes:

1. Cost Budget Plan (RAB) for the construction project of Ru Guest House and Main House Seseh, Badung Regency, Bali.
2. Project implementation schedule (schedule) for the construction of the building.
3. Weekly project reports, which cover the progress of activities during project implementation.
4. Data on actual costs incurred during project implementation.

Data Analysis Technique

a. BCWS/BCWP

BCWS/BCWP is the budget allocated for the planned work in a certain period according to the schedule. This value is obtained by calculating the percentage of planned progress on the implementation schedule (time schedule) multiplied by the project implementation cost listed in the Budget Plan Cost (RAB).

b. ACWP (Actual Cost of Work Performed)

ACWP is obtained from the project finance department and is an estimate of the actual costs that have been used during project implementation. This actual cost is calculated by multiplying the amount of use of materials and labor by the unit price of materials and wages prevailing in the field (real unit price).

c. Integrated Cost and Schedule Variance

Simple variance analysis is often considered insufficient because it does not integrate cost and schedule aspects together. Therefore, indicators such as BCWS, BCWP (Budgeted Cost of Work Performed), and ACWP are used to measure cost variance and schedule variance in an integrated manner in order to analyze project progress.

d. Productivity and Performance Index

Project managers often require information on the efficiency of resource utilization, which is expressed through productivity indices or performance indices. These indices consist of the Cost Performance Index (CPI) and Schedule Performance Index (SPI), which provide an overview of the effectiveness of project resource management.

RESULTS AND DISCUSSION

Earned Value Calculation Analysis Project

The Earned Value calculation analysis in this study includes Planned Value (PV), Earned Value (EV), and Actual Cost (AC). The analyzed data is from week 15 to week 21.

Table 1. Project Data

Week 21	
Plan Progress	72,52%
Progress Realization	43,670%
Project Cost Budget	IDR 12,657,090,235

(Source: CV. Cipta Karya Utama)

Week 15 Planned Value (PV) Calculation

The Planned Value (PV) value for this week period can be calculated by multiplying the planned cumulative percentage at week 15, obtained from the S-Curve, by the total project budget or contract value listed in Table 2 The PV calculation for week 15 is as follows.

In the earned value method, monitoring or evaluation is required at a time to determine the performance of a project. In the implementation of the construction of Villa Kandya House Ubud Bali, the method used in controlling costs and time in the field is to use a Time Schedule. Earned value analysis is carried out in week 29.

Table 2. Planned value

Week 1	PV (BCWS)
15	IDR 6,429,322,015
16	IDR 6,936,464,022
17	IDR 7,348,725,331
18	IDR 7,802,427,669
19	IDR 8,256,130,007
20	IDR 8,694,607,417
21	IDR 9,070,600,480

(Source: Processed by Researchers, 2024)

Week 15 Earned Value Calculation

The Earned Value (EV) for the week 15 period can be calculated by multiplying the cumulative percentage of realized progress at week 15, listed in the project weekly report, by the total project cost budget or contract value. The EV calculation for week 15 is as follows.

Table 3. Earned Value

Week 1	EV (BCWP)
15	IDR 3,913,158,482

16	IDR 4,509,307,432
17	IDR 4,961,545,266
18	IDR 5,103,304,676
19	IDR 5,242,532,669
20	IDR 5,385,557,789
21	IDR 5,527,317,199

(Source: Processed by Researchers, 2024)

Week 15 Actual Cost Calculation

Actual Cost (AC) is obtained from the monthly report of the Rumah Ru Guest House and Main House project prepared by CV. Cipta Karya Utama. This actual cost is a payment made by the owner to CV. Cipta Karya Utama, based on the composition of the work agreed in the initial contract. Payment is made in accordance with the progress of work that has been achieved by the contractor. Details of work progress and payments have been recapitulated in Table 4.

Table 4. Actual Cost Value

Week 1	Monthly Actual Cost	Weekly Fee	AC (ACWP)
15	IDR 1,471,859,866	IDR 294,371,973	IDR 5,159,733,068
16		IDR 294,371,973	IDR 5,454,105,042
17		IDR 294,371,973	IDR 5,748,477,015
18	IDR 857,886,560	IDR 214,471,640	IDR 5,962,948,655
19		IDR 214,471,640	IDR 6,177,420,295
20		IDR 214,471,640	IDR 6,391,891,935
21		IDR 214,471,640	IDR 6,606,363,575

(Source: Processed by Researchers, 2024)

Time Performance Calculation

The time performance of a project in the Earned Value method can be analyzed by comparing the Earned Value (EV) and Planned Value (PV) values.

Calculation of Schedule Variance (SV) in Week 15

The Schedule Variance (SV) value is obtained by calculating the difference between Earned Value (EV) and Planned Value (PV).

SV = Earned Value (EV)- Planned Value (PV)
= Rp.3,913,158,482- Rp.6,429,322,015
=- Rp.2,516,163,533

The calculation of Schedule Variance (SV) for the following weeks is done with the same method as the previous calculation. The results of the SV value for each week can be seen in Table 5.

Table 5. Schedule Variance Value

Week 1	PV (BCWS)	EV (BCWP)	SV (BCWP - BCWS)
15	IDR 6,429,322,015	IDR 3,913,158,482	- IDR 2,516,163,533
16	IDR 6,936,464,022	IDR 4,509,307,432	- IDR 2,427,156,590

Week 1	PV (BCWS)	EV (BCWP)	SV (BCWP - BCWS)
17	IDR 7,348,725,331	IDR 4,961,545,266	- IDR 2,387,180,065
18	IDR 7,802,427,669	IDR 5,103,304,676	- IDR 2,699,122,992
19	IDR 8,256,130,007	IDR 5,242,532,669	- IDR 3,013,597,338
20	IDR 8,694,607,417	IDR5,385,557,789	- IDR 3,309,049,628
21	IDR 9,070,600,480	IDR 5,527,317,199	- IDR 3,543,283,280

(Source: Processed by Researchers, 2024)

Schedule Performance Index (SPI) calculation

The Schedule Performance Index (SPI) value is obtained by comparing the Earned Value (EV) value with the Planned Value (PV). The study was conducted in week 15.

SPI = (Earned Value (EV))/(Planned Value (PV))
= (Rp.3,913,158,482)/(Rp.6,429,322,015)
=0,61

The calculation of the Schedule Performance Index (SPI) for the following weeks is done with the same method as the previous calculation. The results of the SPI value for each week can be seen in Table 6.

Table 6. Schedule Performance Index Value

Week 1	PV (BCWS)	EV (BCWP)	SPI (BCWP/BCWS)
15	IDR 6,429,322,015	IDR 3,913,158,482	0,61
16	IDR 6,936,464,022	IDR 4,509,307,432	0,65
17	IDR 7,348,725,331	IDR 4,961,545,266	0,68
18	IDR 7,802,427,669	IDR 5,103,304,676	0,65
19	IDR 8,256,130,007	IDR 5,242,532,669	0,63
20	IDR 8,694,607,417	IDR 5,385,557,789	0,62
21	IDR 9,070,600,480	IDR 5,527,317,199	0,61

(Source: Processed by Researchers, 2024)

Cost Performance Calculation

The cost performance of a project in the Earned Value method can be analyzed by comparing the Earned Value (EV) and Actual Cost (AC) values.

Cost Variance Calculation

The Cost Variance (CV) value is calculated by subtracting the Earned Value (EV) value from the Actual Cost (AC). The study was conducted in week 15

CV = Earned Value (EV)-Actual Cost AC
= Rp.3.913.158.482- Rp.5.159.733.068
= -Rp.1,246,574,587

The calculation of Cost Variance (CV) for the following weeks is done with the same method as the previous calculation. The results of the CV value for each week can be seen in Table 7.

Table 7. Cost Variance Value

Week 1	EV	AC	CV
	(BCWP)	(ACWP)	(BCWP-ACWP)
15	IDR 3,913,158,482	IDR 5,159,733,068	- IDR 1,246,574,587
16	IDR 4,509,307,432	IDR 5,454,105,042	- IDR 944,797,610
17	IDR 4,961,545,266	IDR 5,748,477,015	- IDR 786,931,749
18	IDR 5,103,304,676	IDR 5,962,948,655	- IDR 859,643,978
19	IDR 5,242,532,669	IDR 6,177,420,295	- IDR 934,887,626
20	IDR 5,385,557,789	IDR 6,391,891,935	-IDR 1,006,334,146
21	IDR 5,527,317,199	IDR 6,606,363,575	-IDR 1,079,046,375

(Source: Processed by Researchers, 2024)

Calculation of Cost Performance Index

The Cost Performance Index (CPI) value is calculated by comparing the Earned Value (EV) value with the Actual Cost (AC). The study was conducted in week 15.

CPI =(Earned Value (EV))/(Actual Cost (AC))
= (Rp.3,913,158,482)/(Rp.5,159,733,068)
=0,76

The calculation of the Cost Performance Index (CPI) for the following weeks is carried out using the same method as the previous calculation. The results of the CPI value for each week can be seen in Table 8.

Table 8. Cost Performance Index Value

Week 1	EV	AC	CPI
	(BCWP)	(ACWP)	(BCWP/ACWP)
15	IDR 3,913,158,482	IDR 5,159,733,068	0,76
16	IDR 4,509,307,432	IDR 5,454,105,042	0,83
17	IDR 4,961,545,266	IDR 5,748,477,015	0,86
18	IDR 5,103,304,676	IDR 5,962,948,655	0,86
19	IDR 5,242,532,669	IDR 6,177,420,295	0,85
20	IDR 5,385,557,789	IDR 6,391,891,935	0,84
21	IDR 5,527,317,199	IDR 6,606,363,575	0,84

(Source: Processed by Researchers, 2024)

Discussion of Analysis of Variance Results

There are several discussion points that can be taken from the results of the calculation of the Schedule Variance (SV) and Cost Variance (CV) values, which include various important aspects related to project performance and implementation. A detailed explanation of the findings can help identify the main causes, impacts, and corrective measures that can be implemented to improve project efficiency and effectiveness in the future. The following are some discussion points that need to be considered based on the results of the SV and CV value analysis.

1. The Schedule Variance (SV) value in week 15 to week 21 shows a negative number, which indicates that the project is delayed compared to the planned schedule. In addition, it can be seen that the SV value is decreasing every week, which means that the level of project delay is increasing.

2. Furthermore, the Cost Variance (CV) value in the period from week 15 to week 17 had increased, but in week 17 week 21 it decreased again. The decrease shows that the actual costs incurred exceed the planned budget.

Discussion of Performance Index Analysis

There are several important discussion points that can be taken from the calculation of the Schedule Performance Index (SPI) and Cost Performance Index (CPI) values. Analysis of these two indicators provides a clear picture of the efficiency of project implementation in terms of schedule and cost. The SPI value helps evaluate the extent to which the project is running according to the planned schedule, while the CPI value shows the efficiency of the costs that have been used compared to the work progress achieved. The following are some discussion points that need to be considered based on the results of the analysis of SPI and CPI values.

1. At the Schedule Performance Index (SPI) value during week 15 to week 21 is below 1, which indicates that the project is experiencing delays.

Furthermore, from week 15 to week 21, the Cost Performance Index (CPI) value is below 1, which indicates that the costs incurred exceed the planned budget. However, each week, the CPI value shows an increase, which means that the expenditure is getting closer to the planned budget, as seen from the CPI value approaching 1. This shows that although actual costs are still higher than the budget, project expenditures can gradually be minimized over time

CONCLUSION

Based on the analysis in week 15, with a work progress of 30.92%, the ACWP (actual cost) value was recorded at Rp.5,159,733,068, the EV or BCWP value of the work budget in week 15 was Rp. 3,913,158,482, and the PV or BCWS value of the planned budget in week 15 was Rp.6,429,322,015. The data shows that the project is experiencing delays and cost overruns, characterized by negative Schedule Variance (SV) and Cost Variance (CV), as well as SPI and CPI <1. Up to week 21, the progress deviation reached -27.99%, with an estimated additional cost (ETC) of IDR 13,736,136,610. If performance does not improve, the project is estimated to lose Rp. 1,079,046,375 compared to the initial contract value. This condition requires immediate evaluation and mitigation actions from the contractor.

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