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PROJECT COST ANALYSIS THROUGH EARNED VALUE METHOD ON THE INSTALLATION OF BAGGAGE HANDLING SYSTEM (BHS) PPUPG (PROJECT CASE STUDY AT SULTAN HASANUDIN INTERNATIONAL AIRPORT MAKASSAR)

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ABSTRACT
This research is aimed at analyzing the cost performance of the Ppupg Baggage Handling System (BHS) Installation project at Sultan Hasanudin Makassar International Airport. This research focuses on two key questions: (1) how to assess cost performance during monitoring using indicators such as Cost Variance and Cost Performance Index, and (2) what the estimated total project cost will be upon completion, specifically through the Estimated All Completion (EAC). The research is conducted from October Week 2 to the field in January 2025 which began in stages from research preparation, initial survey, literature review, data collection, proposal preparation, data analysis, and thesis preparation. The research was conducted in the form of observations, namely, the PPUPG baggage handling system installation project. The study was conducted using a multidisciplinary approach. The analysis of the EAC serves to enhance understanding of projected total project costs, allowing for better financial forecasting and budget management. The findings from this study can help practitioners optimize budgeting processes and improve project outcomes, thereby advancing the overall understanding of cost management in infrastructure projects. Future research can contribute to more effective cost management strategies and improved project performance outcomes by integrating findings from both CPM analysis and comprehensive literature.

Keywords: cost, cost variance analysis, cost performance index, earned value

INTRODUCTION

Air travel has revolutionized the tourism industry, making it easier for people to explore new destinations and experience different cultures that now allow people to explore new places and experience different cultures. With millions of people traveling to different parts of the world every year, air travel has greatly influenced tourism and business travel (Atmojo & Fridayani, 2021; Cretu et al., 2021; Orîndaru et al., 2021; Rodrigues et al., 2021; Ullah et al., 2024). This has led to a thriving tourism industry around the world, which contributes greatly to the economies of many countries.

Baggage handling systems are needed to support airport operations, along with the growth of flight movements (passengers and aircraft) for now the technology applied to passenger baggage handling is developing rapidly (Agarwal et al., 2023; Dias & Silva, 2024; Kovynyov & Mikut, 2019; Rekiek, 2023; Singh, 2023). Some modern airports have implemented Automatic Baggage Handling Systems (BHS) as an efficient and effective passenger baggage handling solution. PT Angkasa Pura I plans to use automatic BHS with 5 levels of security at Sultan Hasanuddin Airport - Makassar. 5.1.1 General Features of BHS.

This system is expected to have the ability to identify and at the same time make corrections / improvements automatically to all conditions of Oversize Baggage, Over Height

Detection c. Over Length Check Window reservation, Queeing system, Scanning system, Screening system, Sortation system Redundant system, Baggage Tracking System and other features needed during the operational process The system offered includes handling "Oversize and Overweight Bags" at the check-in area. The capacity of the BHS is designed to meet the needs of both normal operations and peak hour and peak season operations with a capacity of 4800 to 6000 bags per hour. Environmental Conditions The system must have several indicators and controls of environmental conditions. Limitation of operational conditions can be assumed to be 0°C to +40°C Temperature range, 0% to 95% Relative Humidity, No other unusual conditions.

The BHS equipment to be procured has a 5-level screening system equipped with a Baggage Reconciliation Room (level 4) and a conveyor system to the Bomb Cointainer (outside the BHS package). BHS equipment is required to be able to work in redundancy when one or part of the system does not work then it will not interfere with overall operations. BHS has the ability to track baggage and allocate baggage according to predetermined destinations.

The PPUPG Baggage Handling System (BHS) Installation Project at Sultan Hasanudin International Airport Makassar with a ceiling of Rp. 366,500,000,000 (three hundred and sixty-six billion five hundred million rupiah) is planned to be completed during 546 calendar days with the basis for implementing the work Number: AP.I.3730/Pl.02/2023-B. For this reason, it is necessary to control the time so that the project can be completed in accordance with the planned time and the building can also be utilized in accordance with the initial planning.

The successful implementation of a construction project is inseparable from the aspects of good cost, quality and time control, therefore construction work is required to always pay attention to the quality and provisions for the completion of a project. Project management is a series of activities carried out to plan, schedule, and control projects to ensure the results of project implementation are on target in terms of time, quality, and cost (Ika & Pinto, 2022; Irfan et al., 2021; Lalmi et al., 2021; Shaqour, 2022; Xing et al., 2021).

If the project is delayed, the cost will increase. In order to calculate the total cost required to complete the project, monitoring of cost achievements must be done. This monitoring is used to avoid cost overruns, and can be done using the Earned Value Analysis method. Earned Value method is a method to calculate the real cost for work that has been completed in accordance with the project budget (Christy et al., 2023). This research is expected to analyze the costs required to evaluate losses or delays when the project is completed by estimating construction costs using earned value analysis.

Earned Value method is one of the tools used in project management. The Earned Value method presents three dimensions, namely the physical completion of the project (the percent complete) which reflects the planned absorption of costs (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. It is expected that by using the Earned Value Method researchers predict the amount of costs incurred until the project ends.

This research addresses two key questions: how to assess cost performance during monitoring using indicators like Cost Variance and Cost Performance Index, and what the

estimated total project cost will be at completion through Estimated All Completion (EAC) calculations. By systematically analyzing these financial metrics, the study provides valuable insights into the effectiveness of cost management during project monitoring and enhances understanding of projected total costs. This dual focus not only assists project managers in making informed decisions but also contributes to the broader discourse on effective cost management strategies in project execution. Ultimately, the findings can help practitioners optimize budgeting processes and improve project outcomes, advancing the overall understanding of cost management in infrastructure projects.

RESEARCH METHOD

The object of this research is the Sultan Hasanudin Makassar Airport project on the Ppupg Baggage Handling System (BHS) Installation project at Sultan Hasanudin Makassar International Airport. The research was conducted from October Week 2 to the field in January 2025.

The types of data in this study include primary data and secondary data. Primary data in this study is in the form of observations, namely the PPUPG Baggage Handling System (BHS) Installation project at Makassar Sultan Hasanudin International Airport. The secondary data in supporting this research includes the Cost Budget Plan, Weekly Project Progress Report, Actual Costs which include direct and indirect costs of the company.

The data analysis technique involves several key components for evaluating project costs. BCWP (Budgeted Cost of Work Performed) quantifies the costs incurred for completed work by multiplying the percentage of progress by the budgeted value. ACWP (Actual Cost of Work Performed) reflects actual expenditures up to a specific date, derived from accounting data of direct and other costs. Cost Variance (CV) is calculated as the difference between BCWP and ACWP, highlighting limitations of simple variance analysis by integrating cost and schedule aspects. The Cost Performance Index (CPI) compares BCWP to ACWP to assess productivity. Finally, the Estimated At Completion (EAC) provides a forecast of total project costs based on these indicators, calculated to indicate the project's financial outcome at completion.

RESULT AND DISCUSSION

Budgeted Cost of Work Performance (BCWP) Analysis

Budgeted Cost Of Work Performance (BCWP) or Earned Value is obtained from multiplying the percentage of progress realization by the total project cost budget. Where the analysis for the 66th week of the period October 09, 2024 - October 15, 2024 according to the weekly report is as follows:

BCWP = % (Realization Weight) x Contract Value (RAB)
= 2.262% x IDR 366,500,000,000
= Rp. 8,289,869,356.17

While the cumulative BCWP value is:

BCWP = % (Realization Weight) x Contract Value (RAB)
= 89.482% x Rp. 366,500,000,000
= IDR 327,951,395,193.47

Table 1. BCWP Recapitulation

Week	**Realization Weight %**		**Value**	**BCWP (Rp)**	
to-	***Weekly***	***Cumulative***	**Contract**	***Weekly***	***Cumulative***
1	0.000	0.000	366.500.000.000	-	-
2	0.000	0.000	366.500.000.000	-	-
3	0.000	0.000	366.500.000.000	-	-
4	0.000	0.000	366.500.000.000	-	-
5	0.000	0.000	366.500.000.000	-	-
6	0.000	0.000	366.500.000.000	-	-
7	0.000	0.000	366.500.000.000	-	-
8	0.000	0.000	366.500.000.000	-	-
9	0.000	0.000	366.500.000.000	-	-
10	0.000	0.000	366.500.000.000	-	-
11	0.000	0.000	366.500.000.000	-	-
12	0.000	0.000	366.500.000.000	-	-
13	0.000	0.000	366.500.000.000	-	-
14	0.000	0.000	366.500.000.000	-	-
15	0.000	0.000	366.500.000.000	-	-
16	0.000	0.000	366.500.000.000	-	-
17	0.000	0.000	366.500.000.000	-	-
18	0.000	0.000	366.500.000.000	-	-
19	0.000	0.000	366.500.000.000	-	-
20	0.000	0.000	366.500.000.000	-	-
21	0.000	0.000	366.500.000.000	-	-
22	0.034	0.034	366.500.000.000	125.588.571,43	125.588.571,43
23	0.013	0.047	366.500.000.000	48.219.209,73	173.807.781,15
24	0.020	0.067	366.500.000.000	73.263.355,81	247.071.136,96
25	0.006	0.073	366.500.000.000	21.432.203,24	268.503.340,20
26	0.120	0.193	366.500.000.000	438.570.878,01	707.074.218,21
27	0.008	0.201	366.500.000.000	29.723.802,02	736.798.020,24
28	0.087	0.288	366.500.000.000	319.549.048,88	1.056.347.069,12
29	0.008	0.296	366.500.000.000	29.723.802,02	1.086.070.871,14
30	0.008	0.304	366.500.000.000	29.723.802,02	1.115.794.673,17
31	0.531	0.835	366.500.000.000	1.945.649.851,46	3.061.444.524,63
32	1.238	2.073	366.500.000.000	4.536.788.173,32	7.598.232.697,94
33	0.008	2.081	366.500.000.000	29.723.802,02	7.627.956.499,97
34	1.946	4.027	366.500.000.000	7.131.007.623,91	14.758.964.123,87
35	1.378	5.405	366.500.000.000	5.051.723.366,67	19.810.687.490,55
36	2.130	7.536	366.500.000.000	7.807.023.666,86	27.617.711.157,41
37	23.577	31.113	366.500.000.000	86.409.740.023,59	114.027.451.181,00
38	0.008	31.121	366.500.000.000	29.723.802,02	114.057.174.983,03
39	0.000	31.121	366.500.000.000	-	114.057.174.983,03
40	0.000	31.121	366.500.000.000	-	114.057.174.983,03
41	0.008	31.129	366.500.000.000	29.723.802,02	114.086.898.785,05
42	0.008	31.137	366.500.000.000	29.723.802,02	114.116.622.587,07
43	0.008	31.145	366.500.000.000	29.723.802,02	114.146.346.389,10

44	0.008	31.153	366.500.000.000	29.723.802,02	114.176.070.191,12
45	0.018	31.171	366.500.000.000	64.712.209,70	114.240.782.400,83
46	4.836	36.007	366.500.000.000	17.725.474.524,65	131.966.256.925,48
47	0.008	36.015	366.500.000.000	29.723.802,02	131.995.980.727,50
48	1.594	37.610	366.500.000.000	5.843.756.467,26	137.839.737.194,76
49	0.031	37.640	366.500.000.000	112.400.484,31	137.952.137.679,07
50	0.083	37.723	366.500.000.000	303.373.361,55	138.255.511.040,62
51	0.008	37.731	366.500.000.000	29.723.802,02	138.285.234.842,64
52	5.063	42.795	366.500.000.000	18.557.449.487,48	156.842.684.330,12
53	0.008	42.803	366.500.000.000	29.723.802,02	156.872.408.132,14
54	7.059	49.862	366.500.000.000	25.870.419.987,45	182.742.828.119,60
55	0.008	49.870	366.500.000.000	29.723.802,02	182.772.551.921,62
56	0.000	49.870	366.500.000.000	-	182.772.551.921,62
57	0.000	49.870	366.500.000.000	-	182.772.551.921,62
58	0.000	49.870	366.500.000.000	-	182.772.551.921,62
59	0.000	49.870	366.500.000.000	-	182.772.551.921,62
60	13.230	63.100	366.500.000.000	48.489.626.188,	231.262.178.110,52
61	1.708	64.808	366.500.000.000	6.260.067.065,95	237.522.245.176,48
62	5.848	70.656	366.500.000.000	21.431.207.292,27	258.953.452.468,75
63	10.710	81.365	366.500.000.000	39.250.522.984,30	298.203.975.453,04
64	5.456	86.821	366.500.000.000	19.995.337.669,84	318.199.313.122,88
65	0.399	87.220	366.500.000.000	1.462.212.714,42	319.661.525.837,30
66	**2.262**	**89.482**	**366.500.000.000**	**8.289.869.356,17**	**327.951.395.193,47**

Based on Table 1, the BCWP value or cost budget for work that has been realized up to the 66th week data collection is Rp. 327,951,395,193.47.

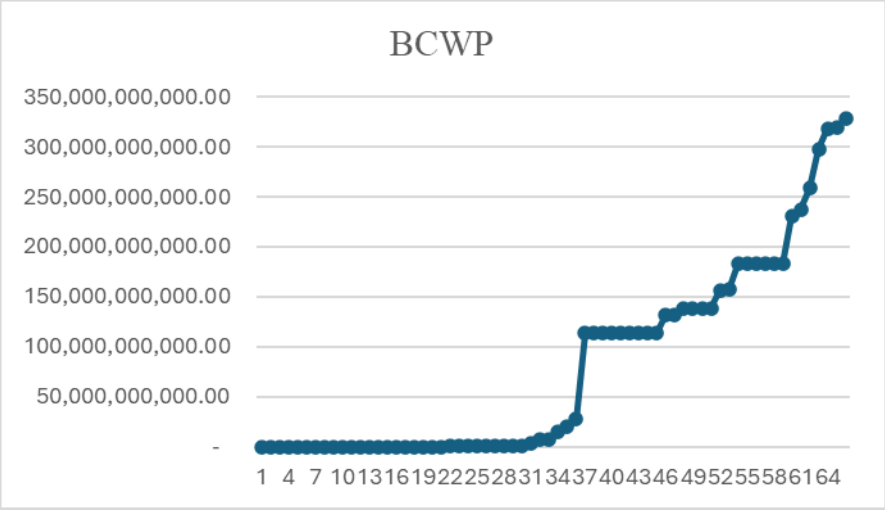

Figure 1. Cumulative BCWP Chart
Source: Processed by researchers, 2024

The graph above illustrates that as the project progresses, the weight of the work progress increases, which is illustrated by costs that increase proportionally to the weight of

the work. This reflects an increase in the cost budget incurred as the weight of work completed increases.

Analysis of Actual Cost of Work Performance (ACWP)

The data used to calculate the Actual Cost of PPUPG Baggage Handling System (BHS) Procurement and Installation at Sultan Hasanuddin International Airport Makassar includes direct and indirect costs obtained by researchers from PT Dexter Wika Synergy. In the period October 09, 2024 to October 15, 2024 or in the first week to week 66, while the cost estimate for week 67 to the end of the project week 78 uses the progress estimate multiplied by the cost plan.

Table 2. Project Expenditure Cost

Week	ACWP	
	Weekly (Rp.)	***Cumulative (Rp.)***
M-01	335.952.896	335.952.896
M-06	266.614.693	602.567.589
M-11	79.398.712	681.966.301
M-16	19.440.065.697	20.122.031.998
M-21	8.751.343.049	28.873.375.046
M-26	17.419.272.604	46.292.647.650
M-31	30.577.607.372	76.870.255.022
M-36	1.823.839.034	78.694.094.055
M-41	50.756.169.728	129.450.263.783
M-46	1.764.152.642	131.214.416.425
M-51	1.590.923.968	132.805.340.393
M-56	70.924.412.006	203.729.752.399
M-61	91.654.575.650	295.384.328.049
M-66	**9.532.960.584**	**304.917.288.633**
M-67	570.857.142,86	305.488.145.775,56
M-68	570.857.142,86	306.059.002.918,42
M-69	570.857.142,86	306.629.860.061,27
M-70	570.857.142,86	307.200.717.204,13
M-71	570.857.142,86	307.771.574.346,99
M-72	570.857.142,86	308.342.431.489,84
M-73	570.857.142,86	308.913.288.632,70
M-74	570.857.142,86	309.484.145.775,56
M-75	570.857.142,86	310.055.002.918,41
M-76	570.857.142,86	310.625.860.061,27
M-77	570.857.142,86	311.196.717.204,13
M-78	1.141.714.285,71	**312.338.431.489,84**

Source: Processed by Researchers, 2024

According to the statement of the Project Manager of the implementing contractor, the calculation of costs incurred is not calculated weekly. However, the calculation of the actual

cost value is carried out according to the needs and adjusts when a meeting will be held. From the data above, a graph can be displayed

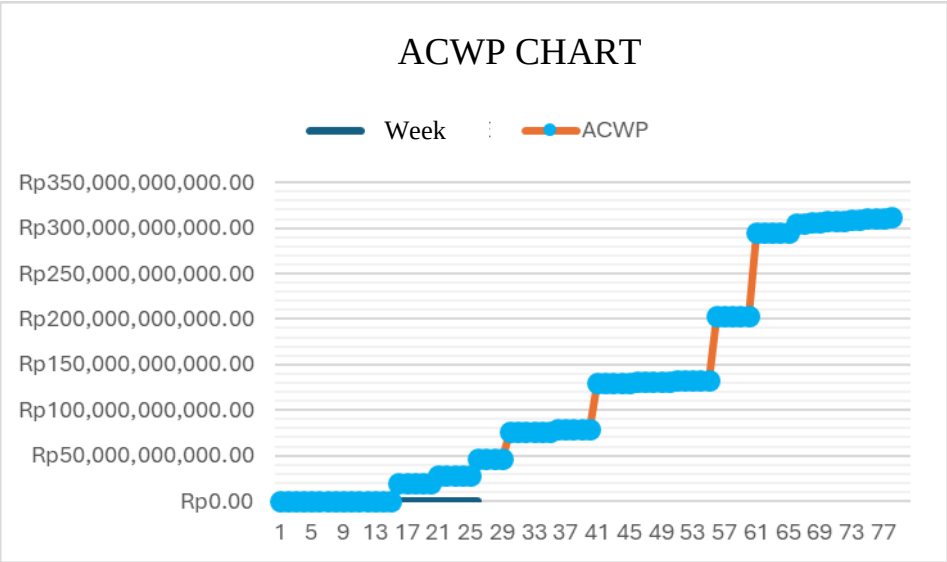

Figure 2. Cumulative BCWP Chart
Source: Processed by researchers, 2024

From the graph above, it can be seen that the project cost is getting longer and longer in balance with the progress that continues to grow. The costs incurred up to week 66 are worth Rp. 304,917,288,633 while for the prediction of week 67 to week 78 assuming progress is the same as the progress plan and expenses are also in accordance with the progress plan so that the cost to the end of the project is assumed to be Rp. 312,338,431,489.84.

After knowing the results of the BCWP, and ACWP calculations. Then the cumulative value can be displayed in the following table:

Table 3. Recapitulation of BCWS, BCWP, and ACWP calculation results

Week	BCWP	ACWP	Week	BCWP	ACWP
1	-	335.952.896,00	34	14.758.964.123,87	76.870.255.021,74
2	-	335.952.896,00	35	19.810.687.490,55	76.870.255.021,74
3	-	335.952.896,00	36	27.617.711.157,41	78.694.094.055,44
4	-	335.952.896,00	37	114.027.451.181,00	78.694.094.055,44
5	-	335.952.896,00	38	114.057.174.983,03	78.694.094.055,44
6	-	602.567.589,00	39	114.057.174.983,03	78.694.094.055,44
7	-	602.567.589,00	40	114.057.174.983,03	78.694.094.055,44
8	-	602.567.589,00	41	114.086.898.785,05	129.450.263.782,94
9	-	602.567.589,00	42	114.116.622.587,07	129.450.263.782,94
10	-	602.567.589,00	43	114.146.346.389,10	129.450.263.782,94
11	-	681.966.301,00	44	114.176.070.191,12	129.450.263.782,94
12	-	681.966.301,00	45	114.240.782.400,83	129.450.263.782,94
13	-	681.966.301,00	46	131.966.256.925,48	131.214.416.424,54
14	-	681.966.301,00	47	131.995.980.727,50	131.214.416.424,54
15	-	681.966.301,00	48	137.839.737.194,76	131.214.416.424,54

16	-	20.122.031.997,57	49	137.952.137.679,07	131.214.416.424,54
17	-	20.122.031.997,57	50	138.255.511.040,62	131.214.416.424,54
18	-	20.122.031.997,57	51	138.285.234.842,64	132.805.340.392,94
19	-	20.122.031.997,57	52	156.842.684.330,12	132.805.340.392,94
20	-	20.122.031.997,57	53	156.872.408.132,14	132.805.340.392,94
21	-	28.873.375.046,35	54	182.742.828.119,60	132.805.340.392,94
22	125.588.571,43	28.873.375.046,35	55	182.772.551.921,62	132.805.340.392,94
23	173.807.781,15	28.873.375.046,35	56	182.772.551.921,62	203.729.752.398,94
24	247.071.136,96	28.873.375.046,35	57	182.772.551.921,62	203.729.752.398,94
25	268.503.340,20	28.873.375.046,35	58	182.772.551.921,62	203.729.752.398,94
26	707.074.218,21	46.292.647.650,05	59	182.772.551.921,62	203.729.752.398,94
27	736.798.020,24	46.292.647.650,05	60	231.262.178.110,52	203.729.752.398,94
28	1.056.347.069,12	46.292.647.650,05	61	237.522.245.176,48	295.384.328.048,94
29	1.086.070.871,14	46.292.647.650,05	62	258.953.452.468,75	295.384.328.048,94
30	1.115.794.673,17	76.870.255.021,74	63	298.203.975.453,04	295.384.328.048,94
31	3.061.444.524,63	76.870.255.021,74	64	318.199.313.122,88	295.384.328.048,94
32	7.598.232.697,94	76.870.255.021,74	65	319.661.525.837,30	295.384.328.048,94
33	7.627.956.499,97	76.870.255.021,74	**66**	**327.951.395.193,47**	**304.917.288.632,70**

From the table above, a graph can be made to see an overview of the budgeted costs, planned costs, costs that have been incurred up to week 66.

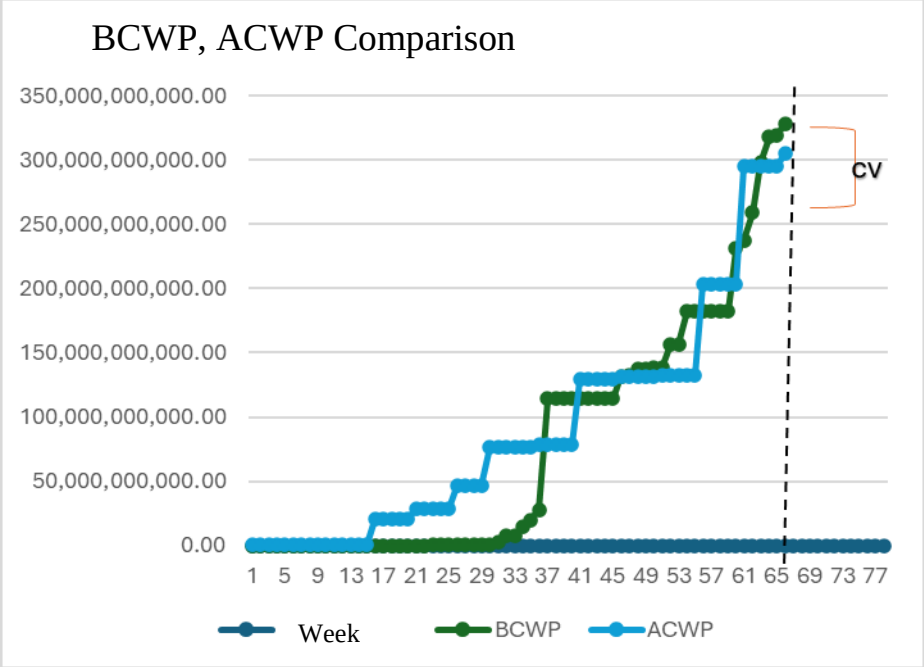

Figure 3. BCWP AND ACWP Graph
Source: Processed by researchers, 2024

Cost Variance (CV) Calculation

The calculation of the CV value of the BHS plug Baggage Handling System Development work is as follows:

CV: BCWP-ACWP
= 327,951,395,193.47 - 304.917.288.632,70
= 23.034.106.560,77

Since the CV value is positive, this means that the project cost in week 66 is cost underrun. Calculations for other weeks can be done in the same way. So that the calculation is obtained as shown in Table 4 below.

Table 4. Cost Variance Value

Week	CV	Week	CV
1	-335.952.896,00	40	35.363.080.927,59
2	-335.952.896,00	41	-15.363.364.997,89
3	-335.952.896,00	42	-15.333.641.195,87
4	-335.952.896,00	43	-15.303.917.393,84
5	-335.952.896,00	44	-15.274.193.591,82
6	-602.567.589,00	45	-15.209.481.382,12
7	-602.567.589,00	46	751.840.500,94
8	-602.567.589,00	47	781.564.302,96
9	-602.567.589,00	48	6.625.320.770,22
10	-602.567.589,00	49	6.737.721.254,53
11	-681.966.301,00	50	7.041.094.616,07
12	-681.966.301,00	51	5.479.894.449,70
13	-681.966.301,00	52	24.037.343.937,18
14	-681.966.301,00	53	24.067.067.739,20
15	-681.966.301,00	54	49.937.487.726,65
16	-20.122.031.997,57	55	49.967.211.528,68
17	-20.122.031.997,57	56	-20.957.200.477,32
18	-20.122.031.997,57	57	-20.957.200.477,32
19	-20.122.031.997,57	58	-20.957.200.477,32
20	-20.122.031.997,57	59	-20.957.200.477,32
21	-28.873.375.046,35	60	27.532.425.711,58
22	-28.747.786.474,92	61	-57.862.082.872,47
23	-28.699.567.265,19	62	-36.430.875.580,19
24	-28.626.303.909,39	63	2.819.647.404,10
25	-28.604.871.706,15	64	22.814.985.073,94
26	-45.585.573.431,84	65	24.277.197.788,36
27	-45.555.849.629,81	**66**	**23.034.106.560,77**
28	-45.236.300.580,93	67	22.468.957.989,34
29	-45.206.576.778,91	68	21.903.809.417,91
30	-75.754.460.348,57	69	21.338.660.846,48
31	-73.808.810.497,11	70	20.773.512.275,06
32	-69.272.022.323,79	71	20.208.363.703,63
33	-69.242.298.521,77	72	19.643.215.132,20
34	-62.111.290.897,86	73	19.078.066.560,77
35	-57.059.567.531,19	74	18.512.917.989,34

36	-51.076.382.898,03	75	17.947.769.417,92
37	35.333.357.125,57	76	17.382.620.846,49
38	35.363.080.927,59	77	16.817.472.275,06
39	35.363.080.927,59	78	15.687.175.132,20

Description:

1. The CV (negative) value in the first week to week 36 is negative, which means that the cost performance is not in accordance with the plan or which means that the costs incurred are greater than budgeted.
2. Analysis in week 37 to week 40 CV value (Positive) which means that the costs incurred are less than budgeted.
3. The CV (negative) value in week 41 to week 45 is negative, which means that the cost performance is not in accordance with the plan or which means that the costs incurred are greater than budgeted.
4. Analysis in week 46 to week 55 CV value (Positive) which means that the costs incurred are less than budgeted.
5. Analysis in week 56 to week 62 CV value (negative) which means that the costs incurred are greater than budgeted only in week 60 with a positive value.
6. Analysis week 63 to observation week 66 CV value is positive which means the cost is below the budgeted value. It is expected that until the project ends it will still be positive so that the cost performance remains good.
7. The Cost Variance value is positive which indicates that the costs incurred are less than the budget.

From the graph above, it is known that if the value is below the 0 line, the cost performance is categorized as not as expected and vice versa if it is above the 0 value, the cost performance has reached the planned target.

Calculation of Cost Perfomance Index (CPI)

The calculation of the CPI value of the work schedule for the construction of the PPUPG Baggage Handling System (BHS) Procurement and Installation project at Sultan Hasanuddin International Airport Makassar in week 66 is as follows:

$$CPI = \frac{\text{BCWP}}{\text{ACWP}} = \frac{327,951,395,193.47}{304.917.288.632,70} = 1.0755$$

2.2097 > 1

Since the CPI value > 1, meaning that the cost incurred in week 66 is less than the budget, the project implementation performance is better than planning. 304.917.288.632,70

For the calculation of the CPI value in the following week, the same calculation is done as above, the CPI value can be seen in the following table:

Table 5. CPI Value

Week	CPI	Week	CPI
1	0,0000	40	1,4494
2	0,0000	41	0,8813
3	0,0000	42	0,8815
4	0,0000	43	0,8818
5	0,0000	44	0,8820
6	0,0000	45	0,8825
7	0,0000	46	1,0057
8	0,0000	47	1,0060
9	0,0000	48	1,0505
10	0,0000	49	1,0513
11	0,0000	50	1,0537
12	0,0000	51	1,0413
13	0,0000	52	1,1810
14	0,0000	53	1,1812
15	0,0000	54	1,3760
16	0,0000	55	1,3762
17	0,0000	56	0,8971
18	0,0000	57	0,8971
19	0,0000	58	0,8971
20	0,0000	59	0,8971
21	0,0000	60	1,1351
22	0,0043	61	0,8041
23	0,0060	62	0,8767
24	0,0086	63	1,0095
25	0,0093	64	1,0772
26	0,0153	65	1,0822
27	0,0159	**66**	**1,0755**
28	0,0228	67	1,0736
29	0,0235	68	1,0716
30	0,0145	69	1,0696
31	0,0398	70	1,0676
32	0,0988	71	1,0657
33	0,0992	72	1,0637
34	0,1920	73	1,0618
35	0,2577	74	1,0598
36	0,3510	75	1,0579
37	1,4490	76	1,0560
38	1,4494	77	1,0540
39	1,4494	78	1,0502

Project Performance Analysis

1. In week 37 to week 40, while the CPI value> 1 shows good cost performance because the costs incurred Actual Cost (AC) are smaller than the value obtained Earned Value (EV).

2. Week 66 of the study SPI value is 0.8950 this value is less than 1 performance is not in accordance with the plan, and the CPI value is 1.0755 greater than 1 indicating good cost performance.

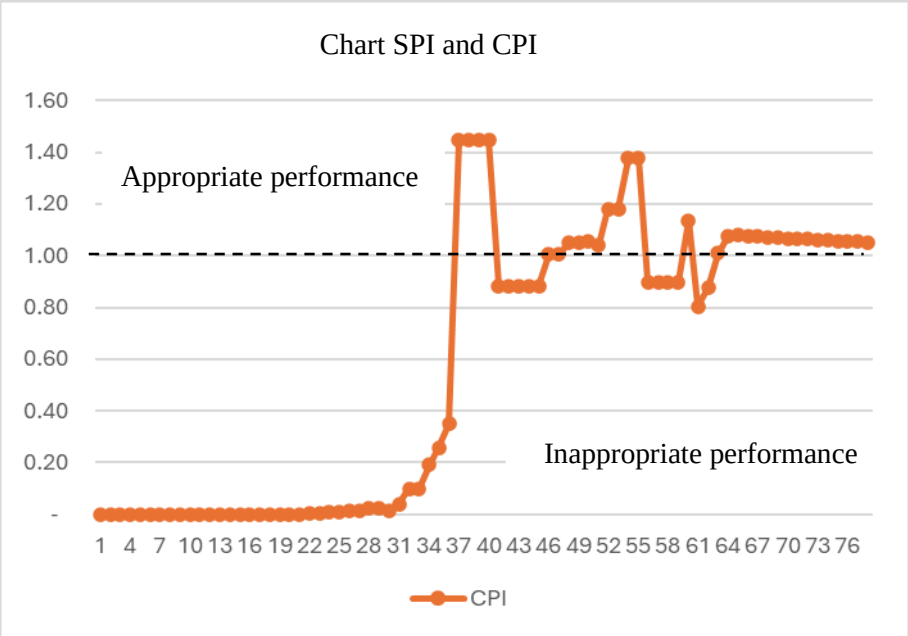

Figure 4. CPI graph
Source: Processed by researchers 2024

The graph above shows where the CPI is located if it is below the dotted line indicating poor performance and if above it indicating good performance.

Estimate to Complete (ETC) Remaining Cost Calculation

Remaining Cost or Estimate To Complete (ETC) or the total budget planned in the 66th week reporting period October 09, 2024 to October 15, 2024. Analysis to project or estimate the remaining cost of implementation carried out until completion of work (ETC) with the following calculations.

ETC = (Budget - BCWP)
= (Rp. 366,500,000,000 - 327,951,395,193.47)
= Rp. 38,548,604,806.53

The results of the calculation show that the remaining work until the end of the project is worth Rp. 38,474,393,377.96 for the final completion, it is necessary to accelerate the work on the remaining work that has been planned by other options by changing the research method so that the project can be completed on time**.**

Calculation of Total Final remaining cost Estimate at Complete (EAC)

The estimated final remaining cost or Estimate at Complete value at week 78 of January 8, 2025 is as follows:

EAC = ACWP + ETC
= Rp. 312,338,431,489.84 + Rp. 38,474,393,377.96

= Rp. 350,812,824,867.80

The final EAC project shows where in the observation week at week 66 d the ACWP value of the contractor data of PT. Dexter Wika Synergy is worth Rp. 304,917,288 rupiah while the calculation of the ETC (Estimate To Complete) value is worth Rp. 38,548,604,806.53 so that the final value (EAC) is Rp. 343,465,893. 38,548,604,806.53 so that the final value (EAC) is Rp. 343,465,893. 439,23

The estimated total final cost (ACWP) at week 78 obtained the result of Rp. 312,338,431,489.84 and the ETC value is Rp. 38,474,393,377.96 so that the estimated total final cost of the project is worth (EAC) Rp. 350,812,824,867.80.

In this calculation estimate at a project delay of 10 days with a cost value of Rp.38,474,393,377.96, the contractor should analyze the work that is left behind and causes delays in weeks 1 to week 78 so that the project can be completed until the contract deadline.

CONCLUSION

The Earned Value analysis reveals that, as of week 66, the project demonstrates positive cost performance, indicating it remains under budget, with a Cost Performance Index reflecting good performance. However, the total estimated implementation time has extended to 556 calendar days, surpassing the planned duration of 546 days, while the projected total cost is Rp. 350,812,824,867.80, below the planned amount of Rp. 366,500,000,000. To enhance accuracy in time estimation, further analysis using the Critical Path Method (CPM) is recommended, alongside expanding the literature review to deepen the understanding of cost calculation and project management methodologies. Future research should focus on utilizing CPM to identify potential bottlenecks and optimize project scheduling, ultimately leading to more effective cost management strategies and improved project outcomes.

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