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Re-planning schedule and costs on the Balimed Denpasar hospital building development project

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ABSTRACT

In this study, a re-planning of schedules and costs will be carried out on the Balimed Denpasar Hospital Building Development Project which aims to be a basis for decision making so that the project runs according to plan. The calculation results obtained a Schedule Performance Index (SPI) of 0,683 and a Cost Performance Index (CPI) of 1 which shows that the project implementation was completed late with the budget as planned. If the project performance at the time of reporting remains the same until the rest of the work is completed, then the amount of the Estimate All Cost (EAC) is IDR. 46.881.134.933,39, which is the same amount as planned. This shows that there is no additional cost, so the total cost of remaining work is IDR. 40.249.362.635,43. The implementation time increased by 183 days because the Estimate All Schedule (EAS) was longer, which was 723 days from the original plan of 540 days.

Keywords: cost, project, schedule, time.

1. Introduction

Project are temporary activities that are limited bay time, cost, and quality[1]. With these limitations, careful planning is needed to achieve the expected project objectives. But in its implementation, it is extremely rare to find a project that goes according to plan. Generally, the construction of construction projects always experiences obstacles that result in irregularities such as delays in completing work increasing project cost budgets.

Project control is needed so that project implementation continues as planned. The earned value management method is one of the methods that can be used in cost and time control. Based on performance in indicators at the time reporting, this method provides information on the status of project performance in the reporting period and information on the prediction of costs and time required to complete the entire work [2]. By applying this method to a project will be able to visualize the status of the project throughout the project life cycle, thus enabling good project management [3]. Rescheduling is needed as a basis for making decisions from the result of the earned value analysis.

The Balimed Denpasar Hospital Building Development Project, located on Mahendradata no. 57X Padangsambian Village, West Denpasar District, Denpasar City experienced delays in the implementation of work. Based on the data obtained, this project experienced a delay of 6,55% in the 21st week. This project is scheduled to be completed within 540 calendar days from June 2nd, 2021 to November 23rd, 2022 with a budget cost of IDR. 51.569.200.000,00 (fifty-one billion five hundred and sixty-nine million two hundred thousand rupiah).

2. Data and Methods

This research takes a case study on the Balimed Denpasar Hospital Building Project. The project location is at Mahendradata Street No. 57X West Denpasar District, Denpasar City.

The types and sources of data used in this study are secondary data. Secondary data is data that was first collected and reported by a person or institution other than the researcher, even though the data is actually original data. The types and sources of data used such as: time schedule, budget plan (RAB), project weekly report, and realization. The data obtained from PT. Sastra Mas Estetika.

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Research methodology is a way of collecting data, then processing the data and analyzing the data to produce answers that can solve research problems studied. The descriptive research method with a quantitative approach is used because the author wants to know an overview of the time and costs that have been used during the research, then a calculation analysis is carried out with the earned value management method so as to get a forecast of the time and costs needed for project completion and achieve optimal performance. Creation of an implementation schedule using PDM method and bar chart.

The steps in re-planning the schedule and costs of the project include:

2.1 Calculate the variables earned value

There are three variables in the concept of earned value, namely BCWS, BCWP, and ACWP[3]. These variables are calculated based on project data in the form of time schedules, cost budget plans (RAB), and project progress reports. In the RAB used is the real cost value, which is IDR. 46.881.134.9333,39, this is because, for the contract value IDR. 51.569.200.000,00 has been added VAT by 10%.

Budgeted Cost of Work Schedule (BCWS) can be calculated by multiplying the percentage of plan progress a week by the BAC value[4]. The Budgeted at Completion (BAC) value is the overall value of the contract obtained from the cost budget plan (RAB), while the percentage of work plan progress is obtained from the time schedule in which there is a job description, weight percentage, and plan progress percentage. The results of the calculation of the BCWS for each week can be seen in table 1.

Budgeted Cost of Work Performed (BCWP) can be calculated by multiplying the percentage of realization progress by the amount of the cost budget plan (RAB)[4]. The percentage of realization progress is a project achievement that has been achieved in one week. The percentage of realization progress is obtained from the project progress report every week. The results of the calculation of BCWP each week can be seen in table 2.

Actual Coat of Work Performed (ACWP) is calculated based on the RAB value, not taking into account direct and indirect costs. ACWP is assumed to be the same as BCWP presented in table 3.

2.2 Calculate the indicators earned value

There are 2 earned value indicators, namely Cost Variance (CV) and Schedule Variance (SV). Cost Variance (CV) is the difference between the value obtained after completing the work packages (BCWP) and the actual costs incurred during project implementation (ACWP), with the possible values achieved as follows[5]:

a. $CV > 0$, meaning that the work is running at a cost that is more efficient than the budget and is called a cost underrun.
b. $CV = 0$, meaning that the work is running at a cost that is in accordance with the budget and is called on budget.
c. $CV < 0$, meaning that the work is running at a cost that is greater than the budget and is called a cost overrun.

Schedule Variance (SV) is used to calculate the deviation between BCWS and BCWP, with the possible values achieved as follows[5]:

a. $SV > 0$, meaning that the work is completed on a faster schedule than planned and is called schedule underrun.
b. $SV = 0$, meaning that the work is completed according to the schedule according to the plan and is called on schedule.
c. $SV < 0$, meaning that the work is completed on a slower schedule than planned and is called a schedule overrun.

2.3 Calculate the index earned value

The earned value method can calculate the project performance index, which consist of the Cost Performance Index (CPI) and the Schedule Performance Index (SPI). CPI is the comparison between the value received from completing the work (BCWP) and the actual costs incurred to complete the work (ACWP). The interpretation of the acquisition of the CPI value can be explained as follows[1]:

a. $CPI = 1$, meaning that the project costs are within the budget.
b. $CPI > 1$, meaning that the project cost is more efficient than the budget.
c. $CPI < 1$, meaning that the project cost is more extravagant than the budget.

Schedule Performance Index (SPI) is a comparison between the completion of work in the field (BCWP) with a work plan for a certain period of time (BCWS). The interpretation of the acquisition of SPI value can be explained as follows[1]:

a. $SPI = 1$, meaning the project is completed on time.
b. $SPI > 1$, meaning that the project is completed faster than planned.
c. $SPI < 1$, meaning that the project is finished later than planned.

2.4 Calculate estimated cost and project completion time

According to the cost estimate or project completion schedule based on the results of the indicator analysis obtained at the time of reporting, it will provide an indication of the estimated cost for the remaining work (Estimate Temporary Cost – ETC) and the estimated total project cost (Estimate All Cost – EAC) and the amount the estimated time for remaining workers (Estimate Temporary Schedule – ETS) and the amount of estimated total project time (Estimate All Schedule – EAS) at the end of the project[6]. Forecasts cannot provide answer with precise numbers, because they are based on various

assumptions, so it depends on the accuracy of the assumptions used.

2.5 Rescheduling of execution time

There are two methods used, namely the bar chart method and the PDM method. Bar chart method is a set of activity lists arranged in vertical direction columns, while horizontal direction columns show time scales[7]. PDM method is a network included in the classification of activities on nodes that has the advantage of being able to show dependency relationship between activities clearly and more simply[8].

2.6 Planning a budget plan

The ways that can be done are as follows:

a. Calculate the remaining costs against the overall project cost budget.
b. Calculate the additional cost of work due to the magnitude of the total project cost.
c. Calculate the total cost required.
d. Calculate the total cost of work.
e. Implementation cost plan (RBP).

3. Results and Discussion

The evaluation results in week 21st were Budgeted Cost of Work Schedule (BCWS) of IDR. 9.705845.981,82, Budgeted Cost of Work Performed (BCWP) of IDR. 6.631.772.297,96, and Actual Cost of Work Performed (ACWP) of IDR. 6.631.772.297,96. The performance of project implementation in terms of running costs in accordance with planning is seen from the value of the Cost Performance Index (CPI) = 1, while in terms of time it experiences delays seen from the value of the Schedule Performance Index (SPI) = 0,683 < 1. If the performance of the project implementation in the reporting week 21st runs remains the same until the end of project, then the estimated total project cost required is IDR. 46.881.134.933,39 where this cost equal to the project budget, while the estimated time required for project completion is 723 days which means it has a delay from the plan time of 183 days.

Budgeted Cost of Work Schedule (BCWS) calculation results for each week can be seen in the following table 1:

Table 1. BCWS values for every week

Week	Cumulative Plan (%)	BCWS (IDR.)
1	0,07	33.947.333,33
2	0,18	86.647.120,64
3	0,30	139.346.907,95
4	0,42	195.604.269,87
5	0,58	272.205.683,80
6	0,83	389.408.521,13
7	1,21	565.145.901,93
8	2,21	1.033.957.251,26
9	3,31	1.549.649.735,53
10	4,41	2.065.342.219,80
11	5,76	2.698.237.541,40
12	7,47	3.500.480.897,88
13	7,77	3.641.124.302,68
14	9,78	4.583.435.114,84
15	11,66	5.468.190.269,68
16	12,96	6.077.645.023,82
17	14,56	6.828.211.994,10
18	15,93	7.469.895.712,53
19	16,93	7.938.707.061,86
20	18,23	8.548.161.816,00
21	20,70	9.705.845.981,82

Budgeted Cost of Work Performance (BCWP) calculation results for each week can be seen in the following table 2:

Table 2. BCWP values for every week

Week	Cumulative Realization (%)	BCWP (IDR.)
1	0,10	46.338.110,00
2	0,23	109.164.618,68
3	0,36	169.812.778,66
4	0,61	285.241.550,43
5	0,84	395.167.428,89
6	1,07	501.945.851,43
7	2,16	1.010.771.133,64
8	3,28	1.536.096.484,99
9	3,54	1.659.686.543,71
10	4,29	2.010.926.074,60
11	5,06	2.369.885.041,98
12	5,77	2.703.420.975,85
13	6,02	2.824.184.472,32
14	7,87	3.688.644.648,74
15	8,72	4.088.225.161,76
16	9,29	4.357.514.941,89
17	9,48	4.444.243.793,00
18	10,62	4.978.834.793,90
19	10,68	5.005.212.552,41
20	10,90	5.108.348.161,44
21	14,15	6.631.715.025,75

ACWP is assumed to be the same as BCWP, so the actual total cost of the project is presented in the following table 3:

Table 3. ACWP values for every week

Week	ACWP (IDR.)
1	46.338.110,00
2	109.164.618,68
3	169.812.778,66
4	285.241.550,43
5	395.167.428,89
6	501.945.851,43
7	1.010.771.133,64
8	1.536.096.484,99
9	1.659.686.543,71
10	2.010.926.074,60
11	2.369.885.041,98
12	2.703.420.975,85
13	2.824.184.472,32
14	3.688.644.648,74
15	4.088.225.161,76

Week	ACWP (IDR.)
16	4.357.514.941,89
17	4.444.243.793,00
18	4.978.834.793,90
19	5.005.212.552,41
20	5.108.348.161,44
21	6.631.715.025,75

The performance of project implementation in each week can be seen in terms of costs and implementation schedules. The results of calculating project performance analysis every week are presented in table 4.

Table 4. Recapitulation of project performance analysis results

Week	BCWS (IDR.)	BCWP (IDR.)	ACWP (IDR.)	CV (IDR.)	SV (IDR.)	CPI	SPI
1	33.947.333,33	46.338.110,00	46.338.110,00	0	12.390.776,67	1,00	1,365
2	86.647.120,64	109.164.618,68	109.164.618,68	0	22.517.498,04	1,00	1,260
3	139.346.907,95	169.812.778,66	169.812.778,66	0	30.465.870,71	1,00	1,219
4	195.604.269,87	285.241.550,43	285.241.550,43	0	89.637.280,56	1,00	1,458
5	272.205.683,80	395.167.428,89	395.167.428,89	0	122.961.745,09	1,00	1,452
6	389.408.521,13	501.945.851,43	501.945.851,43	0	112.537.330,30	1,00	1,289
7	565.145.901,93	1.010.771.133,64	1.010.771.133,64	0	445.625.231,71	1,00	1,789
8	1.033.957.251,26	1.536.096.484,99	1.536.096.484,99	0	502.139.233,72	1,00	1,486
9	1.549.649.735,53	1.659.686.543,71	1.659.686.543,71	0	110.036.808,18	1,00	1,071
10	2.065.342.219,80	2.010.926.074,60	2.010.926.074,60	0	-54.416.145,20	1,00	0,974
11	2.698.237.541,40	2.369.885.041,98	2.369.885.041,98	0	-328.352.499,42	1,00	0,878
12	3.500.480.897,88	2.703.420.975,85	2.703.420.975,85	0	-797.059.922,02	1,00	0,772
13	3.641.124.302,68	2.824.184.472,32	2.824.184.472,32	0	-816.939.830,36	1,00	0,776
14	4.583.435.114,84	3.688.644.648,74	3.688.644.648,74	0	-894.790.466,09	1,00	0,805
15	5.468.190.269,68	4.088.225.161,76	4.088.225.161,76	0	-1.379.935.107,92	1,00	0,748
16	6.077.645.023,82	4.357.514.941,89	4.357.514.941,89	0	-1.720.130.081,93	1,00	0,717
17	6.828.211.994,10	4.444.243.793,00	4.444.243.793,00	0	-2.383.968.201,10	1,00	0,651
18	7.469.895.712,53	4.978.834.793,90	4.978.834.793,90	0	-2.491.060.918,63	1,00	0,667
19	7.938.707.061,86	5.005.212.552,41	5.005.212.552,41	0	-2.933.494.509,45	1,00	0,630
20	8.548.161.816,00	5.108.348.161,44	5.108.348.161,44	0	-3.439.813.654,56	1,00	0,598
21	9.705.845.981,82	6.631.715.025,75	6.631.715.025,75	0	-3.074.130.956,07	1,00	0,683

The results of calculating the estimated schedule and estimated costs of the project are presented in table 5.

Table 5. Recapitulation of estimated time and cost of project completion

Week	ETS (day)	EAS (day)	ETC (IDR.)	EAC (IDR.)
21	578,1	723,1	40.249.362.635,43	46.881.134.933,39

The result of calculating the remaining weight and remaining duration for each job are presented in the table 6.

Table 6. Remaining duration and weights for each job

NO	JOB DESCRIPTION	DURATION (DAY)			WEIGHT (%)		
		PLAN	REALIZATION	AVAILABLE	PLAN	REALIZATION	AVAILABLE
I	PREPARATORY WORK						
1	Preparatory Work	19	12	7	0,22	0,21	0,01
II	STRUCTURAL WORK						
1	Land Work	28	28	0	0,24	0,24	0,00
2	Substructure Work	28	28	0	0,73	0,73	0,00
3	Basement Floor Structural Work	42	35	7	5,72	5,44	0,28
4	1st Floor Structural Work	35	28	7	4,73	4,50	0,23
5	2nd Floor Structural Work	35	7	28	4,29	1,07	3,22
6	3rd Floor Structural Work	35	0	35	4,17	0,00	4,17
7	4th Floor Structural Work	35	0	35	4,09	0,00	4,09
8	Roof floor Structure Work	35	0	35	2,05	0,00	2,05
9	Steel Structure Work	35	0	35	1,97	0,00	1,97
III	ARCHITECTURAL WORK						
1	Basement Finishing	77	49	28	2,07	0,52	1,55
2	1st Floor Finishing	77	0	77	4,13	0,00	4,13
3	2nd Floor Finishing	77	0	77	2,91	0,00	2,91
4	3rd Floor Finishing	77	0	77	4,67	0,00	4,67
5	4th Floor Finishing	77	0	77	1,00	0,00	1,00
6	Top Floor Finishing	77	0	77	1,74	0,00	1,74
7	Facade Finishing	70	0	70	1,89	0,00	1,89

NO	JOB DESCRIPTION	DURATION (DAY)			WEIGHT (%)		
		PLAN	REALIZATION	AVAILABLE	PLAN	REALIZATION	AVAILABLE
IV	MEP's WORK						
1	Electrical	224	7	217	3,46	0,01	3,45
2	Electronic	224	0	224	2,52	0,00	2,52
3	Air Conditioning	224	0	224	3,01	0,00	3,01
4	Plumbing	224	42	182	0,75	0,09	0,66
5	Water Sanitation	224	0	224	0,88	0,00	0,88
6	Medical Gases	224	0	224	2,42	0,00	2,42
7	Infrastructure	224	7	217	5,63	0,19	5,43
V	EXTERNAL WORK						
1	Ground Tank Work 50 m3	56	49	7	0,50	0,49	0,01
2	Home Bio Septic Tank Work 50 m3	56	14	42	0,46	0,45	0,01
3	Landscape Work	28	0	28	0,05	0,00	0,05
VI	OPTIONAL WORK						
1	Corridor Connecting the Ex. to the New Building	112	0	112	2,45	0,00	2,45
2	Poly Added	112	0	112	1,01	0,00	1,01
3	OK 4th Floor Finishing	77	0	77	20,04	0,00	20,04
4	Overall interior	70	0	70	4,75	0,00	4,75
5	Changing Poly Ex. to Hospitalization	56	0	56	2,15	0,00	2,15
6	Change HD Ex. to Lounge	56	0	56	1,06	0,00	1,06
7	Electric Development	224	0	224	1,67	0,00	1,67
8	Mortuary Work on The Basement	56	42	14	0,21	0,20	0,01
9	Work of Employee Cooperatives and Narcotics Warehouse	53	0	53	0,36	0,00	0,36
	TOTAL				100,00	14,15	85,85

The result of the calculation of the remaining cost work against BAC are presented in the following table 7.

Table 7. Remaining costs to BAC and additional cost due to the amount of the projected total project costs (EAC).

NO	JOB DESCRIPTION	BUDGET (IDR.)	WEIGHT (%)	PROGRESS		EAC (IDR.)	BCWP (IDR.)	REMAINING CHARGES ON BAC (IDR.)	ADDITIONAL COSTS DUE TO EAC (IDR.)
				PLAN (%)	REAL. (%)				
I	PREPARATORY WORK								
1	Preparatory Work	101.842.000,00	0,22	0,22	0,21	101.842.000,00	99.306.136.134,20	2.535.865,80	-
II	STRUCTURAL WORK								
1	Land Work	114.106.321,88	0,24	0,24	0,24	114.106.321,88	114.106.321,88	-	-
2	Substructure Work	344.509.466,56	0,73	0,73	0,73	344.509.466,56	344.509.466,56	-	-
3	Basement Floor Structural Work	2.682.176.867,31	5,72	5,72	5,44	2.682.176.867,31	2.550.386.020,17	131.790.847,14	-
4	1st Floor Structural Work	2.216.179.386,95	4,73	4,73	4,50	2.216.179.386,95	2.107.586.596,99	108.592.789,96	-
5	2nd Floor Structural Work	2.010.144.047,13	4,29	4,29	1,07	2.010.144.047,13	502.133.982,92	1.508.010.064,16	-
6	3rd Floor Structural Work	1.955.601.082,39	4,17	4,17	0,00	1.955.601.082,39	-	1.955.601.082,39	-
7	4th Floor Structural Work	1.918.950.596,03	4,09	0,60	0,00	1.918.950.596,03	-	1.918.950.596,03	-
8	Roof floor Structure Work	962.783.067,24	2,05	0,00	0,00	962.783.067,24	-	962.783.067,24	-
9	Steel Structure Work	924.826.416,80	1,97	0,00	0,00	924.826.416,80	-	924.826.416,80	-
III	ARCHITECTURAL WORK								
1	Basement Finishing	970.303.333,84	2,07	0,00	0,52	970.303.333,84	244.661.985,63	725.641.348,21	-
2	1st Floor Finishing	1.936.396.773,95	4,13	0,00	0,00	1.936.396.773,95	-	1.936.396.773,95	-
3	2nd Floor Finishing	1.363.443.361,38	2,91	0,00	0,00	1.363.443.361,38	-	1.363.443.361,38	-
4	3rd Floor Finishing	2.187.823.178,92	4,67	0,00	0,00	2.187.823.178,92	-	2.187.823.178,92	-
5	4th Floor Finishing	469.148.648,02	1,00	0,00	0,00	469.148.648,02	-	469.148.648,02	-
6	Top Floor Finishing	816.604.480,51	1,74	0,00	0,00	816.604.480,51	-	816.604.480,51	-
7	Facade Finishing	885.124.058,99	1,89	0,00	0,00	885.124.058,99	-	885.124.058,99	-
IV	MEP's WORK								
1	Electrical	1.621.264.890,00	3,46	0,00	0,01	1.621.264.890,00	2.756.150,31	1.618.508.739,69	-
2	Electronic	1.180.466.040,00	2,52	0,00	0,00	1.180.466.040,00	-	1.180.466.040,00	-
3	Air Conditioning	1.409.840.700,00	3,01	0,00	0,00	1.409.840.700,00	-	1.409.840.700,00	-
4	Plumbing	352.116.115,00	0,75	0,00	0,09	352.116.115,00	43.908.879,54	308.207.235,46	-
5	Water Sanitation	412.754.160,00	0,88	0,00	0,00	412.754.160,00	-	412.754.160,00	-
6	Medical Gases	1.132.199.084,00	2,42	0,00	0,00	1.132.199.084,00	-	1.132.199.084,00	-
7	Infrastructure	2.637.486.800,00	5,63	0,00	0,19	2.637.486.800,00	89.674.551,20	2.547.812.248,80	-
V	EXTERNAL WORK								
1	Ground Tank Work 50 m3	232.422.790,84	0,50	0,01	0,49	232.422.790,84	229.894.030,88	2.528.759,96	-
2	Home Bio Septic Tank Work 50 m3	214.916.665,84	0,46	0,01	0,45	214.916.665,84	210.596.840,86	4.319.824,98	-
3	Landscape Work	25.427.268,75	0,05	0,00	0,00	25.427.268,75	-	25.427.268,75	-
VI	OPTIONAL WORK								
1	Corridor Connecting the Ex. to the New Building	1.149.959.057,58	2,45	0,00	0,00	1.149.959.057,58	-	1.149.959.057,58	-
2	Poly Added	475.527.806,09	1,01	0,00	0,00	475.527.806,09	-	475.527.806,09	-
3	OK 4th Floor Finishing	9.392.677.720,09	20,04	0,00	0,00	9.392.677.720,09	-	9.392.677.720,09	-
4	Overall interior	2.226.403.662,50	4,75	0,00	0,00	2.226.403.662,50	-	2.226.403.662,50	-
5	Changing Poly Ex. to Hospitalization	1.008.166.765,56	2,15	0,00	0,00	1.008.166.765,56	-	1.008.166.765,56	-
6	Change HD Ex. to Lounge	495.306.112,30	1,06	0,00	0,00	495.306.112,30	-	495.306.112,30	-

NO	JOB DESCRIPTION	BUDGET (IDR.)	WEIGHT (%)	PROGRESS		EAC (IDR.)	BCWP (IDR.)	REMAINING CHARGES ON BAC (IDR.)	ADDITIONAL COSTS DUE TO EAC (IDR.)
				PLAN (%)	REAL. (%)				
7	Electric Development	785.180.000,00	1,67	0,00	0,00	785.180.000,00	-	785.180.000,00	-
8	Mortuary Work on The Basement	98.753.779,37	0,21	0,00	0,20	98.753.779,37	92.251.336,76	6.502.442,60	-
9	Work of Employee Cooperatives and Narcotics Warehouse	170.302.427,57	0,36	0,00	0,00	170.302.427,57	-	170.302.427,57	-
	TOTAL	46.881.134.933,39	100,00	20,70	14,15	46.881.134.933,39	6.631.772.297,96	40.249.362.635,43	-

The following is a table of RBP remaining work.

Table 8. Implementation cost plan (RBP)

NO	JOB DESCRIPTION	SYMBOL	REMAINING CHARGE AGAINTS BAC (IDR.)	ADDITIONAL COSTS DUE TO EAC (IDR.)	TOTAL JOB COST (IDR.)
I	PREPARATORY WORK				
1	Preparatory Work	A	2.535.865,80	-	2.535.865,80
II	STRUCTURAL WORK				
1	Land Work	B	-	-	-
2	Substructure Work	C	-	-	-
3	Basement Floor Structural Work	D	131.790.847,14	-	131.790.847,14
4	1st Floor Structural Work	E	108.592.789,96	-	108.592.789,96
5	2nd Floor Structural Work	F	1.508.010.064,16	-	1.508.010.064,16
6	3rd Floor Structural Work	G	1.955.601.082,39	-	1.955.601.082,39
7	4th Floor Structural Work	H	1.918.950.596,03	-	1.918.950.596,03
8	Roof Floor Structure Work	I	962.783.067,24	-	962.783.067,24
9	Steel Structure Work	J	924.826.416,80	-	924.826.416,80
III	ARCHITECTURAL WORK				
1	Basement Finishing	K	725.641.348,21	-	725.641.348,21
2	1st Floor Finishing	L	1.936.396.773,95	-	1.936.396.773,95
3	2nd Floor Finishing	M	1.363.443.361,38	-	1.363.443.361,38
4	3rd Floor Finishing	N	2.187.823.178,92	-	2.187.823.178,92
5	4th Floor Finishing	O	469.148.648,02	-	469.148.648,02
6	Top Floor Finishing	P	816.604.480,51	-	816.604.480,51
7	Facade Finishing	Q	885.124.058,99	-	885.124.058,99
IV	MEP's WORK				
1	Electrical	R	1.618.508.739,69	-	1.618.508.739,69
2	Electronic	S	1.180.466.040,00	-	1.180.466.040,00
3	Air Conditioning	T	1.409.840.700,00	-	1.409.840.700,00
4	Plumbing	U	308.207.235,46	-	308.207.235,46
5	Water Sanitation	V	412.754.160,00	-	412.754.160,00
6	Medical Gases	W	1.132.199.084,00	-	1.132.199.084,00
7	Infrastructure	X	2.547.812.248,80	-	2.547.812.248,80
V	EXTERNAL WORK				
1	Ground Tank Work 50 m3	Y	2.528.759,96	-	2.528.759,96
2	Home Bio Septic Tank Work 50 m3	Z	4.319.824,98	-	4.319.824,98
3	Landscape Work	AA	25.427.268,75	-	25.427.268,75
VI	OPTIONAL WORK				
1	Corridor Connecting the Ex. to the New Building	AB	1.149.959.057,58	-	1.149.959.057,58
2	Poly Added	AC	475.527.806,09	-	475.527.806,09
3	OK 4th Floor Finishing	AD	9.392.677.720,09	-	9.392.677.720,09
4	Overall Interior	AE	2.226.403.662,50	-	2.226.403.662,50
5	Changing Poly Ex. to Hospitalization	AF	1.008.166.765,56	-	1.008.166.765,56
6	Change HD Ex. to Lounge	AG	495.306.112,30	-	495.306.112,30
7	Electric Development	AH	785.180.000,00	-	785.180.000,00
8	Mortuary Work on The Basement	AI	6.502.442,60	-	6.502.442,60
9	Work of Employee Cooperatives and Narcotics Warehouse	AJ	170.302.427,57	-	170.302.427,57
	TOTAL		40.249.362.635,43	-	40.249.362.635,43

From the table of calculation of the earned value variable, a graph can be made. A recapitulation of the results of the project performance analysis from the first week to the 21st week is presented by the following chart:

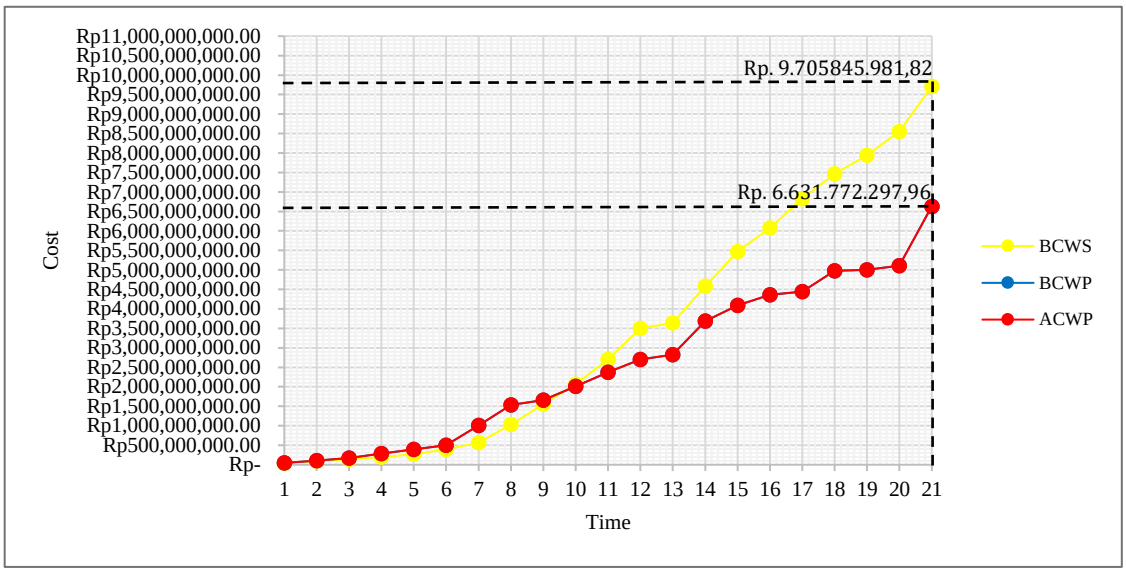

Figure 1. Project performance analysis graph

The bar chart method can be used to reschedule the execution time to complete the remaining weight based on the duration calculated above. The bar chart can be seen in figure 2.

The PDM method can be used to reschedule execution time to complete remaining weights based on a pre-calculated duration, as presented in figure 4. Figure 3 shows that the initial implementation time is 540 days and the remaining implementation time is 395 days, after the evaluation is completed in the 21st week (145th day). The implementation time is 723 days, meaning that the time increases by 723 days – 540 days = 183 days. So the total remaining overall execution time = 395 + 183 = 578 days. The PDM method can be seen in figure 3.

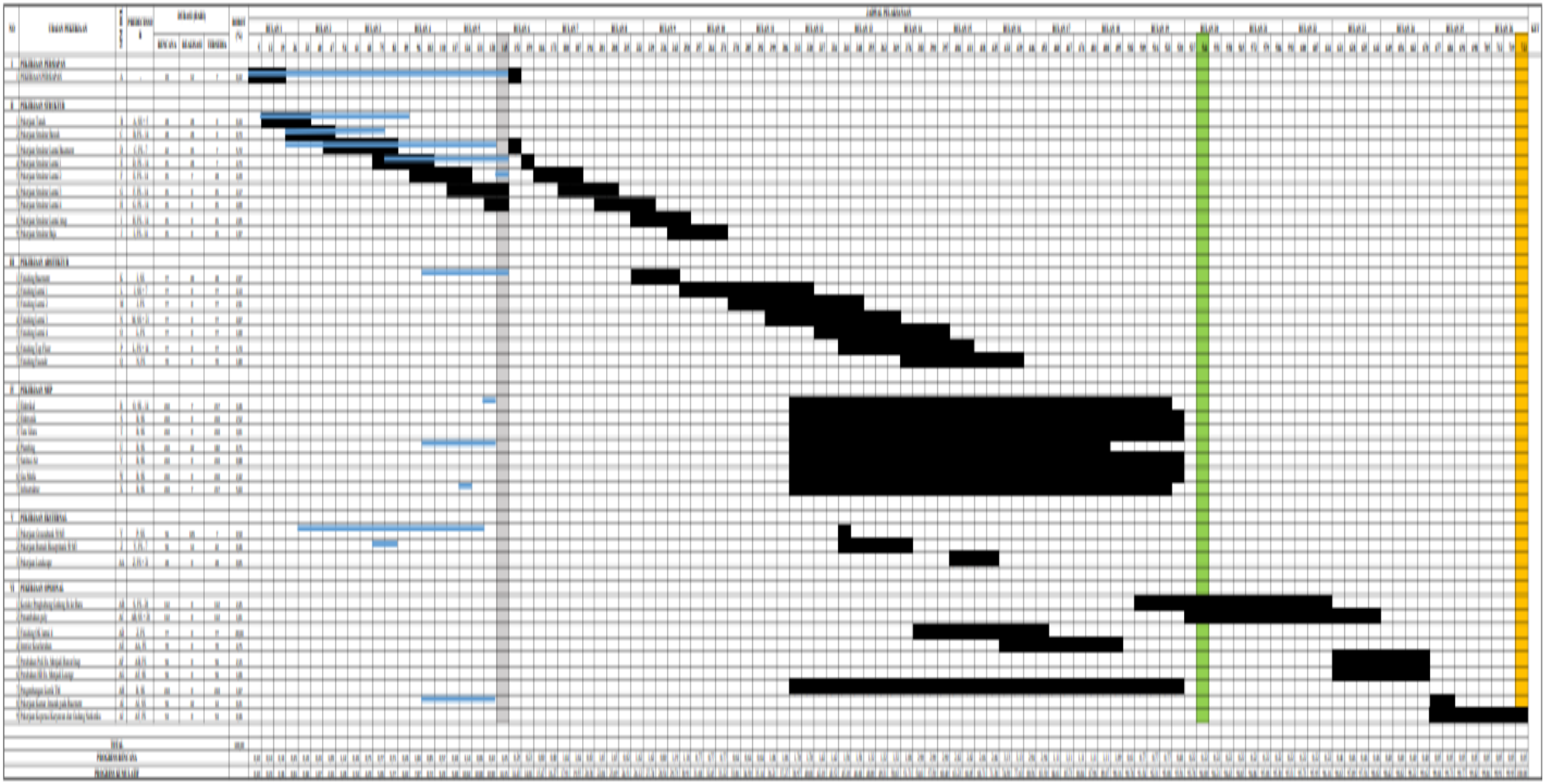

Figure 2. Implementation time schedule with the bar chart method

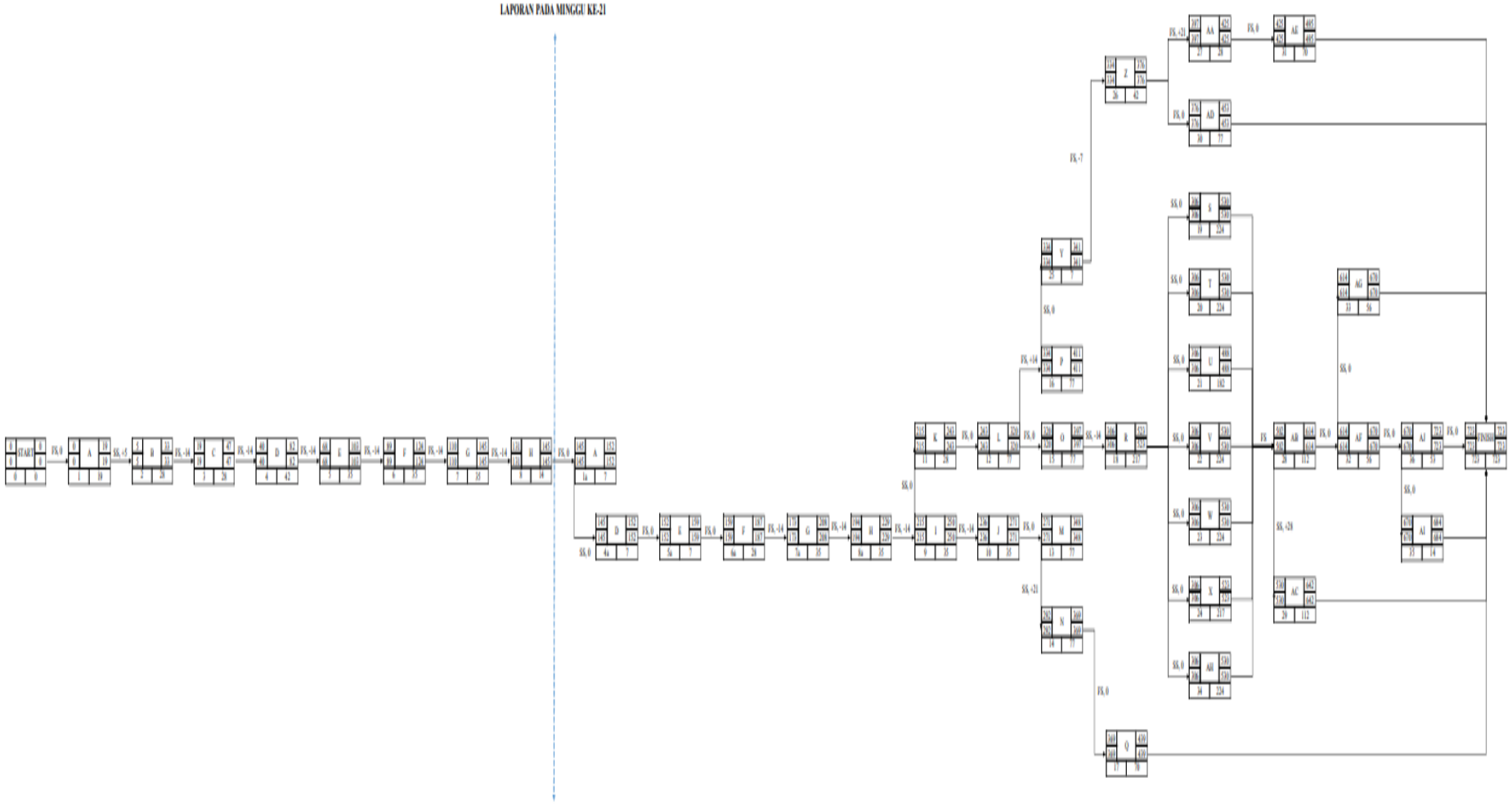

Figure 4. Network planning with PDM method

The calculation of the Budgeted Cost of Work Schedule (BCWS) for the first week is a follows[9]:

$$BCWS = percentage\ progress\ plan \times RAB \quad (1)$$

$$BCWS = 0{,}07\% \times IDR.46.881.134.933{,}39$$

$$BCWS = IDR.33.947.333{,}33$$

The Budgeted of Work Schedule (BCWS) for the next week can be calculated in the same way as the calculation above. The results are presented by the following table 1.

The calculation of the Budgeted Cost of Work Performed (BCWP) for the first week is a follows[9]:

$$BCWP = percentage\ progress\ plan \times RAB \quad (2)$$

$$BCWP = 0{,}10\% \times IDR.46.881.134.933{,}39$$

$$BCWP = IDR.46.338.110{,}00$$

The Budgeted of Work Performed (BCWP) for the next week can be calculated in the same way as the calculation above. The results are presented by the following table 2.

Based on the result of the calculation of the earned value variable in the first week of the project, it can be seen that the planned cost (BCWS) is IDR. 33.947.333,33, the result value (BCWP) is IDR. 46.338.110,00, and the actual cost (ACWP) is IDR. 46.338.110,00, so that the cost deviation that occurs Cost Variance (CV) and the Cost Performance Index (CPI) can be calculated as follows[10]:

$$CV = BCWP - ACWP \quad (3)$$

$$CV = IDR.46.338.110{,}00 - IDR.46.338.110{,}00$$
$$CV = IDR.0$$

$$CPI = BCWP/ACWP \quad (4)$$

$$CPI = IDR.46.338.110{,}00/IDR.46.338.110{,}00$$
$$CPI = 1$$

The calculation of Schedule Variance (SV) and Schedule Performance Index (SPI) occurs as follows[10]:

$$SV = BCWP - BCWS \quad (5)$$

$$SV = IDR.46.338.110{,}00 - IDR.33.947.333{,}33$$
$$SV = IDR.12.390.776{,}67$$

$$SPI = BCWP/BCWS \quad (6)$$

$$SPI = IDR.46.338.110{,}00/IDR.33.947.333{,}33$$
$$SPI = 1{,}365 > 1$$

Based on the result of Cost Variance (CV) is IDR. 0, Cost Performance Index (CPI) is 1, Schedule Variance (SV) is IDR. 12.390.776,67 > 0 and Schedule Performance Index (SPI) is 1,365 > 1, it can be concluded that the work in week 1st is completed faster than planning with a cost budget as planned. The calculation of the next week can be carried out in the same way and result is presented in table 4.

Estimate Temporary Schedule (ETS) is a time forecast for remaining work. The value of ETS in the 21st week can be calculated in the following way[11]:

$$ETS = \frac{Remaining\ time}{SPI} \quad (7)$$

$$ETS = \frac{(540-145)}{0{,}683}$$

$$ETS = 578{,}1\ days$$

Estimate All Schedule (EAS) is the total time at the end of the project. The value of EAS in week 21st can be calculated in the following way[12]:

$$EAS = Time\ to\ end + ETS \quad (8)$$

$$EAS = 145 + 578{,}1$$

$$EAS = 723{,}1\ days$$

Estimate Temporary Cost (ETC) di forecast of costs for remaining work. The Estimate Temporary Cost (ETC) value in 21st week can be calculated in the following way[13]:

$$ETC = \frac{(BAC-BCWP)}{CPI} \quad (9)$$

$$ETC = \frac{(IDR.46.881.134.933{,}39-IDR.6.631.715.025{,}75)}{1{,}00}$$

$$ETC = IDR.40.249.419.907{,}64$$

Estimate All Cost (EAC) is an estimate of the total cost to complete the entire project work. Estimate All Cost (EAC) in week 21st can be calculated in the following way[14]:

$$EAC = ACWP + ETC \quad (10)$$

$$EAC = IDR.6.631.715.025{,}75 + IDR.40.249.419.907{,}64$$

$$EAC = IDR.46.881.134.933{,}39$$

The magnitude of the remaining weight, the remaining duration at the time of reporting in the 21st week, can be calculated as follows[15]:

The rest of the weight for the preparatory work with the following data:

Plan weight = 0,22%

Realization weight up to week 21st = 0,21%

Remaining weight = 0,22% - 0,21% = 0,01%

The rest of the duration for the preparatory work with the following data:

EAS = 19 days

Duration of realization until the 21st week = 12 days

Remaining duration = 19 – 12 = 7 days

The calculation of the remaining weight and duration for the work of another, can be calculated in the same way and result is presented as figure 2.

The following steps can be used in planning an implementation cost plan (RBP) to resolve the remaining weights by using the remaining available costs:

The remaining cost of the work towards the BAC, the rest of the costs for preparatory work with the following data:

BAC preparatory work = IDR. 101.842.000,00
BCWP preparatory work = IDR. 99.306.134,20
Remaining cost = BAC – BCWP
= IDR. 101.842.000,00 – IDR. 99.306.134,20
= IDR. 2.535.865,80

Additional work costs due to EAC, additional costs for preparatory work with the following data:
BAC preparatory work = IDR. 101.842.000,00
EAC preparatory work = IDR. 101.842.000,00
Additional costs = EAC – BAC
= IDR. 101.842.000,00 - IDR. 101.842.000,00
= IDR. 0

the results of the calculation of remaining costs against the project cost budget (BAC) and additional costs due to the forecast of the final cost of the project (EAC) for the other works can be seen in figure 5.

The total costs required for preparatory work with data are as follows:
Remaining cost = IDR. 2.535.865,80
Additional fee = IDR. 0
Total charges = remaining cost + additional fee
= IDR. 2.535.865,80 + IDR. 0
= IDR. 2.535.865,80

The total implementation cost to complete the project is the sum of the remaining costs against BAC and additional costs due to EAC = IDR. 40.249.419.907,64 + IDR. 0 = IDR. 40.249.419.907,64.

4. Conclusion

Based on results of data analysis on the Balimed Denpasar Building Development Project, it can be concluded as follows:

1. Performance analysis using the earned value management method in project implementation has regressed in week 21st, this is indicated by the Schedule Performance Index (SPI) value of 0,683 which means that the project implementation was completed late and the Cost Performance Index (CPI) value of 1 which means that the project cost budget is a plan.
2. Based on the analysis of project performance, it can be made a forecast of the cost and completion time of the project. If the performance during the 21st week report remains the same until the project is completed, then the total project cost (EAC) forecast is IDR. 46.881.134.933,39 from the beginning of the plan od IDR. 46.881.134.933,39, while the estimated work completion time (EAS) is 723 days of the 540-day plan.
3. The original implementation time was 540 days, but after evaluation the implementation time increased by 183 days, so that it became 723 days, for rescheduling using the remaining implementation time, which was 578 days, while the total implementation cost to complete the remaining work was IDR. 40.249.362.635,43 and the total cost of entire work was IDR. 46.881.134.933,39.

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