ISSN: 2963-2536 (media online)
Proceedings of Malikussaleh International Conference on Multidisciplinary Studies (MICoMS)
Organized by center of Excellence of Technology Natural Polymer and Recycle Plastics

International Conference Proceedings 00039 (2024) DOI: https://doi.org/10.29103/micoms.v4.2024

Evaluation Implementation Project With Use Earned Value Method (Object Case: Construction Project of the IAIN Lhoksemawe Laboratory Center Building)

M. Fauzan[1]*, Nura Usrina[2], T. Mudi Hafli[3] , Syibral Malasyi[4], David Sarana[5], Muhammad[6] , and Gofirli Saumah[7]

[1] Department of Civil engineering, Faculty of Engineering, malikussaleh university, Bukit Indah, Lhokseumawe, 24353, Indonesia, mfauzan@unimal.ac.id

[2] Department of Civil engineering, Faculty of Engineering, malikussaleh university, Bukit Indah, Lhokseumawe, 24353, Indonesia, nura.usrina@unimal.ac.id

[3] Department of Civil engineering, Faculty of Engineering, malikussaleh university, Bukit Indah, Lhokseumawe, 24353, Indonesia, teukumudi@unimal.ac.id

[4] Department of Civil engineering, Faculty of Engineering, malikussaleh university, Bukit Indah, Lhokseumawe, 24353, Indonesia, syibral@unimal.ac.id

[5] Department of Civil engineering, Faculty of Engineering, malikussaleh university, Bukit Indah, Lhokseumawe, 24353, Indonesia, davidsarana@unimal.ac.id

[6] Department of Civil engineering, Faculty of Engineering, malikussaleh university, Bukit Indah, Lhokseumawe, 24353, Indonesia, muhammad@mhs.unimal.ac.id

[7] Department of Civil engineering, Faculty of Engineering, malikussaleh university, Bukit Indah, Lhokseumawe, 24353, Indonesia, gofirli.200110152@mhs.unimal.ac.id

* Correspondence: gofirli.200110152@mhs.unimal.ac.id

Abstract: This study applies EVM to the IAIN Lhokseumawe Laboratory Center Building Construction Project to evaluate its cost and schedule performance. The primary objective of the study is to assess how well the project adheres to its planned budget and timeline. Data was collected from project documents over the first 24 weeks, including progress reports and cost records. Key performance indicators (KPIs) such as Schedule Variance (SV), Schedule Performance Index (SPI), Cost Variance (CV), and Cost Performance Index (CPI) were calculated. The results show that by the 24th week, the Schedule Variance (SV) is Rp 0 and the SPI is 1, indicating that the project is on schedule. Regarding cost, from Week 1 to Week 21, the project has incurred costs lower than planned, with a positive Cost Variance (CV) of Rp 12,927,390,000, and a Cost Performance Index (CPI) greater than 1 (1.11), indicating strong cost control and efficiency. Overall, the project is progressing as planned with excellent cost and time performance. The findings suggest that EVM is an effective tool for monitoring and controlling construction projects.

Keywords: Earned Value Method, Cost Performance, Schedule Performance, Project Monitoring, Construction Management

1. Introduction

Construction projects are complex endeavors involving various interconnected tasks aimed at delivering a unique product or service within a specified timeframe. The success of a construction project depends significantly on the effective management of three primary elements: cost, quality, and time [1]. During project execution, these elements must be managed systematically to ensure the project is completed on schedule, within budget, and meets the specified quality standards. Several factors, such as material delays, labor mobilization issues, and adverse weather conditions, can lead to cost overruns and project delays. Therefore, it is essential to use effective methods for monitoring and controlling project performance.

One such method is the Earned Value Method (EVM), an advanced technique that integrates cost and time analysis simultaneously. The EVM allows project managers to track project performance against the original plan and predict future project performance based on current trends. This method is widely used to evaluate whether projects are progressing as planned and helps identify deviations early on, enabling corrective actions. This study aims to evaluate the performance of the IAIN Lhokseumawe Laboratory Center Building Construction Project using the EVM approach. By analyzing the project's performance in terms of cost and schedule, this research aims to offer insights into the effectiveness of project management and provide recommendations for improving future project management practices.

2. Literature Review

This section presents relevant theories and previous research that support the methodology and analysis used in this study.

2.1. Research Location

The study was conducted at the IAIN Lhokseumawe Laboratory Center Building Construction Project in Lhokseumawe City, Aceh, Indonesia. This location provides a practical case study for evaluating the application of the Earned Value Method in real-world construction projects.

2.2. Data Collection

Data collection is a critical step in research, as it determines the accuracy and reliability of the findings. In this study, secondary data were collected from project documents provided by the contractor. These documents included the project's Budgeted Cost, Planned Schedule, Actual Cost Records, and Progress Reports. The data covered the first 24 weeks of the project, allowing for an in-depth analysis of the project's performance during this period.

2.3. Earned Value Method

Draft Mark Results refers to the method of calculating the magnitude of costs according to the budget based on the work that has been completed. When reviewing the work completed, this method measures the size of the work units finished up to a certain point in time, based on the allocated budget for that work. This calculation helps establish the connection between the actual progress achieved and the budget that has been expended. Through this approach, the performance of the project can be evaluated, and corrective actions can be taken if deviations from the original plan are identified [2].

As the complexity and scale of a project grow, delays and cost overruns often occur. Typically, management systems for construction projects treat the cost accounting system and project scheduling systems separately. The cost accounting system generates performance reports and cost predictions, while the scheduling system produces reports on the project's completion status. While these systems each provide valuable information, they may offer differing views of the project's status. Therefore, an integrated system is needed to merge information from both the cost and time aspects. For this purpose, the Earned Value concept can be used as a tool for

measuring the integrated performance of both cost and time aspects [3]. The Earned Value concept is used to determine the magnitude of costs according to the budget, based on the work that has been completed. This method allows for a clear understanding of the relationship between actual achievements (physically completed work) and the budget spent. There are several insights that can be gained by using the Earned Value Method [4].

The Earned Value Method (EVM) integrates cost and time management into a single framework, enabling project managers to assess project performance in a comprehensive manner. EVM compares the Budgeted Cost of Work Scheduled (BCWS), Budgeted Cost of Work Performed (BCWP), and Actual Cost of Work Performed (ACWP) to provide key performance indicators such as Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI). These indicators are calculated as follows:

Cost Variance (CV): Measures the difference between the budgeted cost of the work performed and the actual cost incurred:

$$CV=BCWP-ACWP \quad (1)$$

Schedule Variance (SV): Measures the difference between the budgeted cost of work performed and the planned cost for the work:

$$SV = BCWP - BCWS \quad (2)$$

Cost Performance Index (CPI): Measures cost efficiency and indicates how well the project is staying within budget:

$$CPI = BCWP / ACWP \quad (3)$$

Schedule Performance Index (SPI): Measures schedule efficiency and indicates whether the project is ahead or behind schedule:

$$SPI = BCWP / BCWS \quad (4)$$

These indices help project managers assess whether corrective actions are needed to bring the project back in line with its original plan.

2.4. Data Analysis and Processing

Data analysis was performed by calculating the Budgeted Cost of Work Scheduled (BCWS), Budgeted Cost of Work Performed (BCWP), and Actual Cost of Work Performed (ACWP) for each week of the project. The performance variances and indices were then computed to assess the project's progress and efficiency. A linear regression analysis was also performed to predict the project's future performance based on current trends.

2.5. Conclusion

The application of the Earned Value Method provides a comprehensive overview of the IAIN Lhokseumawe Laboratory Center Building Construction Project's performance. By evaluating both cost and schedule, this method enables effective project monitoring and helps in identifying potential risks early. The results of this study demonstrate the effectiveness of EVM in ensuring that construction projects adhere to their planned budget and schedule, offering valuable insights for improving future project management strategies.

3. Results and Discussion

3.1 General Description

The Earned Value Method (EVM) is a significant project management technique that integrates cost and time to evaluate the current status and predict future project progress. This study applies the EVM to assess the performance of the IAIN Lhokseumawe Laboratory Center Building Construction Project located in Alue Awe Village, Lhokseumawe City. The primary goal of this research is to use the Earned Value Method to evaluate project performance in terms of

cost and time. The findings are expected to provide valuable insights into the effectiveness of project management and offer recommendations for improving overall project performance.

Figure 1. Research Location Source : Google Earth Pro

3.2 Planned Budget Cost

The object of this study is the construction of the IAIN Laboratory Center Building in Lhokseumawe, with the following project data:

- Project name : Construction of the IAIN laboratory center building lhokseumawe .
- Contract value : Rp. 14,774,160,000.00 (excluding 10 % VAT)
- Project address : Village The Beauty of Lhokseumawe City .
- Plan budget cost in a way overall Building Construction Project

The overall planned budget for the construction of the Lhokseumawe Laboratory Center Building amounts to Rp. 14,774,160,000. Details of the respective budgets for each work category are shown in Table 1.

Table 1. Planned Budget Cost

No	Description Work	Total Price of Work
I.	PREPARATORY WORK	Rp. 158,725,000.00
II.	STRUCTURAL WORK	Rp. 7,103,687,937.69
A	ARCHITECTURAL WORK	Rp. 6,194,020,397.88
B	ELECTRICAL & PLUMBING WORKS	Rp. 1,028,841,062.77
C	GARDEN LANDSCAPE WORK	Rp. 288,885,954.08
	Contract value	Rp. 14,774,160,000.00

Source: Project Data 2018

3.3 Components of the Earned Value Method

The Earned Value Method (EVM) is utilized as a base for reporting project development. These reports can be generated weekly or monthly, depending on the agreement between the Project Manager and the Project Sponsor [5]. EVM is an effective method for controlling project cost and time during implementation. Additionally, this method integrates time and cost, which allows for tracking a project's progress in relation to the schedule and budget. The required data includes:

3.3.1 BCWS (Budget Cost of Work Scheduled)

BCWS (Budget Cost of Work Schedule) represents the planned costs based on the project's schedule. The BCWS value per week can be obtained by multiplying the planned work weight in the Time Schedule by the project budget.

Table 2. Summary of BCWS Analysis Results

Sunday To	Mark Budget Project	Weight Plan (%)	Weight Cumative (%)	BCWS (RP)	BCWS Cumulative
(1)	(2)	(3)	(4)	(5) = (3)x(2)	(6)
1	13,431,054,545	0.35	0.35	47,008,691	47,008,691
2	13,431,054,545	2.13	2.47	286,081,462	333.090.153
3	13,431,054,545	5.14	7.61	690.356.204	1,023,446,356
4	13,431,054,545	5.02	12.63	674.238.938	1,697,685,294
5	13,431,054,545	3.91	16.54	525.154.233	2,222,839,527
6	13,431,054,545	4.64	21.17	623.200.931	2,846,040,458
7	13,431,054,545	4.4	25.57	590,966,400	3,437,006,858
8	13,431,054,545	4.26	29.84	572.162.924	4,009,169,782
9	13,431,054,545	3.52	33.35	472,773,120	4,481,942,902
10	13,431,054,545	3.93	37.28	527,840,444	5,009,783,345
11	13,431,054,545	4.18	41.46	561,418,080	5,571,201,425
12	13,431,054,545	4.74	46.20	636,631,985	6,207,833,411
13	13,431,054,545	5.91	52.11	793,775,324	7,001,608,734
14	13,431,054,545	4.74	56.85	636,631,985	7,638,240,720
15	13,431,054,545	6.43	63.28	863,616,807	8,501,857,527
16	13,431,054,545	6.4	69.68	859,587,491	9,361,445,018
17	13,431,054,545	6.4	76.09	859,587,491	10,221,032,509
18	13,431,054,545	4.3	80.38	577,535,345	10,798,567,854
19	13,431,054,545	6.1	86.48	819.294.327	11,617,862,181
20	13,431,054,545	3.76	90.23	505,007,651	12,122,869,832
21	13,431,054,545	3.76	93.99	505,007,651	12,627,877,483
22	13,431,054,545	3.71	97.70	498.292.124	13.126.169.607
23	13,431,054,545	1.11	98.82	149,084,705	13.275.254.312
24	13,431,054,545	1.18	100.00	158,486,444	13,431,054,545

Source: Project Data 2018

BCWS values from week 1 to this is the 24th week use mark contract amounting to Rp. 13,431,054,545. For Get results from cost budgeted work , value budget project This times with weight plan work and produce cost timetable Work .

3.3.2 BCWP (Budget Cost of Work Performed)

BCWP represents the value of work completed, based on the actual percentage of work done. BCWP is calculated by multiplying the weight of completed work by the project's budget value.

Table 3. Summary of BCWP Analysis Results

Sunday To	Budget Value Project	Weight Realization i (%)	Weight Cumulative (%)	BCWP (RP)	BCWP Cumulative
(1)	(2)	(3)	(4)	(5) = (3)x(2)	(6)
1	13,431,054,545	1.54	1.54	206,838,240	206,838,240
2	13,431,054,545	2.02	3.56	271.307.302	478.145.542
3	13,431,054,545	3.72	7.28	499,635,229	977.780.771
4	13,431,054,545	4.64	11.92	623.200.931	1,600,981,702
5	13,431,054,545	5.67	17.59	761,540,793	2,362,522,494
6	13,431,054,545	2.47	20.06	331,747,047	2,694,269,542
7	13,431,054,545	2.65	22.71	355,922,945	3,050,192,487
8	13,431,054,545	5.04	27.75	676,925,149	3,727,117,636
9	13,431,054,545	3.83	31.58	514,409,389	4,241,527,025
10	13,431,054,545	7.29	38.87	979.123.876	5,220,650,902
11	13,431,054,545	6.76	45,634	908,476,529	6.129.127.431
12	13,431,054,545	6.43	52,064	863,616,807	6,992,744,238
13	13,431,054,545	2.06	54.12	276,142,481	7,268,886,720

Sunday To	Budget Value Project	Weight Realization i (%)	Weight Cumulative (%)	BCWP (RP)	BCWP Cumulative
(1)	(2)	(3)	(4)	(5) = (3)x(2)	(6)
14	13,431,054,545	0.76	54.88	102,076,015	7,370,962,734
15	13,431,054,545	2.1	56.98	282.052.145	7,653,014,880
16	13,431,054,545	0.59	57,568	78,974,601	7,731,989,480
17	13,431,054,545	2.8	60,394	379,561,601	8,111,551,082
18	13,431,054,545	3.97	64,368	533,750,108	8,645,301,190
19	13,431,054,545	1.59	65,955	213,150,836	8,858,452,025
20	13,431,054,545	7.90	73,856	1,061,187,620	9,919,639,645
22	13,431,054,545	15.35	97,268	2,061,398,252	13.064.118.135
23	13,431,054,545	1.82	99,089	244,579,503	13,308,697,638
24	13,431,054,545	0.91	100	122,356,907	13,431,054,545

Source: 2024 Analysis Data

The BCWP is determined by using the cost realization to the budget issued every month for the physical work completed. To calculate the BCWP value, multiply the weight of the realization by the project's budget value.

3.3.3 ACWP (Actual Cost of Work Performed)

ACWP reflects the actual costs incurred for the work completed.

Table 4. Summary of ACWP Analysis Results

Sunday To	Budget Value Project	Weight Realization %	ACWP (RP)	ACWP Cumulative
(1)	(2)	(3)	(4) = (3)x(2)	(5)
1	12,087,949,090	1.54	186.154.416	186.154.416
2	12,087,949,090	2.02	244,176,572	430,330,988
3	12,087,949,090	3.72	449,671,706	880,002,694
4	12,087,949,090	4.64	560,880,838	1,440,883,532
5	12,087,949,090	5.67	685,386,713	2.126.270.245
6	12,087,949,090	2.47	298,572,343	2,424,842,587
7	12,087,949,090	2.65	320,330,651	2,745,173,238
8	12,087,949,090	5.04	609.232.634	3,354,405,872
9	12,087,949,090	3.83	462,968,450	3,817,374,323
10	12,087,949,090	7.29	881.211.489	4,698,585,811
11	12,087,949,090	6.76	817,628,876	5,516,214,688
12	12,087,949,090	6.43	777.255.126	6,293,469,814
13	12,087,949,090	2.06	248,528,233	6,541,998,048
14	12,087,949,090	0.76	91,868,413	6,633,866,461
15	12,087,949,090	2.1	253,846,931	6,887,713,391
16	12,087,949,090	0.588	71,077,141	6,958,790,532
17	12,087,949,090	2,826	338,462,575	7.297.253.107
18	12,087,949,090	3,974	480,375,097	7,777,628,203
19	12,087,949,090	1.59	191,835,752	7,969,463,956
20	12,087,949,090	7.90	955,068,858	8,924,532,813
21	12,087,949,090	8.06	974.772.215	9,899,305,028
22	12,087,949,090	16.7	1,855,258,426	11,754,563,454
23	12,087,949,090	1,821	220,000,673	11,974,564,128
24	12,087,949,090	0.911	113,384,962	12,087,949,090

Source: 2024 Analysis Data

The total actual costs incurred up to the 24th week amounted to Rp. 12,087,949,090, corresponding to 100% of the project's budget. The costs generally increased every month, with the highest cost incurred in week 22, amounting to Rp. 1,855,258,426.

3.3.4 Cost Variance (CV)

Cost Variance (CV) is calculated as the difference between BCWP and ACWP. A positive CV indicates that the project is under budget, while a negative CV signals that the project is exceeding its budget.

Table 5. Calculation of Cost Variance (CV)

Sunday To	BCWP (Rp)	ACWP (Rp)	CV (Rp)
(1)	(2)	(3)	(4)= (2)-(3)
1	206,838,240	186.154.416	20,683,824
2	478.145.542	430,330,988	47,814,554
3	977.780.771	880,002,694	97,778,077
4	1,600,981,702	1,440,883,532	160,098,170
5	2,362,522,494	2.126.270.245	236.252.250
6	2,694,269,542	2,424,842,587	269,426,954
7	3,050,192,487	2,745,173,238	305,019,249
8	3,727,117,636	3,354,405,872	372,711,764
9	4,241,527,025	3,817,374,323	424.152.703
10	5,220,650,902	4,698,585,811	522,065,090
11	6.129.127.431	5,516,214,688	612,912,743
12	6,992,744,238	6,293,469,814	699.274.424
13	7,268,886,720	6,541,998,048	726,888,672
14	7,370,962,734	6,633,866,461	737,096,274
15	7,653,014,880	6,887,713,391	765,301,488
16	7,731,989,480	6,958,790,532	773,198,948
17	8,111,551,082	7.297.253.107	814,297,975
18	8,645,301,190	7,777,628,203	867,672,986
19	8,858,452,025	7,969,463,956	888.988.070
20	9,919,639,645	8,924,532,813	995.106.832
21	11,002,719,883	9,899,305,028	1,103,414,855
22	13.064.118.135	11,754,563,454	1,309,554,681
23	13,308,697,638	11,974,564,128	1,334,133,511
24	13,431,054,545	12,087,949,090	1,343,105,455

Source: 2024 Analysis Data

The CV values in Table 5 indicate that the project is under budget, with positive values showing that costs are lower than planned.

3.3.5 Schedule Variance (SV)

Schedule Variance (SV) is calculated as the difference between BCWP and BCWS. A positive SV indicates that the project is ahead of schedule, while a negative SV indicates a delay.

Table 6. Schedule Variant (SV)

Sunday To	BCWP (Rp)	BCWS (Rp)	SV (Rp)
(1)	(2)	(3)	(4)= (2)-(3)
1	206,838,240	47,008,691	159,829,549
2	478.145.542	333.090.153	145,055,389
3	977.780.771	1,023,446,356	-45,665,585

Sunday To	BCWP (Rp)	BCWS (Rp)	SV (Rp)
(1)	(2)	(3)	(4)= (2)-(3)
4	1,600,981,702	1,697,685,294	-96,703,593
5	2,362,522,494	2,222,839,527	139,682,967
6	2,694,269,542	2,846,040,458	-151,770,916
7	3,050,192,487	3,437,006,858	-386,814,371
8	3,727,117,636	4,009,169,782	-282.052.145
9	4,241,527,025	4,481,942,902	-240,415,876
10	5,220,650,902	5,009,783,345	210,867,556
11	6.129.127.431	5,571,201,425	557,926,006
12	6,992,744,238	6,207,833,411	784,910,828
13	7,268,886,720	7,001,608,734	267.277.985
14	7,370,962,734	7,638,240,720	-267.277.985
15	7,653,014,880	8,501,857,527	-848,842,647
16	7,731,989,480	9,361,445,018	-1,629,455,537
17	8,111,551,082	10,221,032,509	-2,109,481,427
18	8,645,301,190	10,798,567,854	-2,153,266,665
19	8,858,452,025	11,617,862,181	-2,759,410,156
20	9,919,639,645	12,122,869,832	-2.203.230.188
21	11,002,719,883	12,627,877,483	-1,625,157,600
22	13.064.118.135	13.126.169.607	-62,051,472
23	13,308,697,638	13.275.254.312	33,443,326
24	13,431,054,545	13,431,054,545	0

Source: 2024 Analysis Data

Based on mark from BCWS, BCWP, ACWP, CV, SV tables are obtained chart draft mark results as following below:

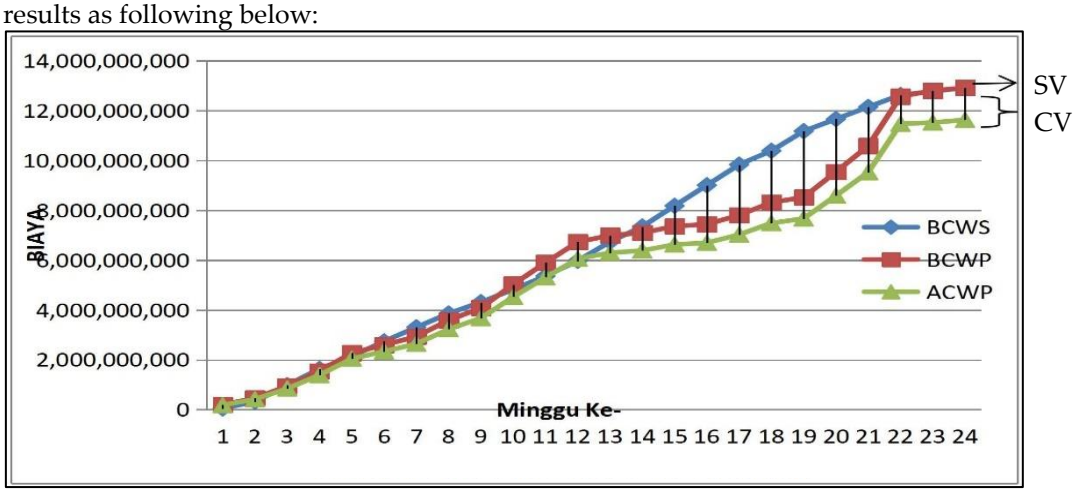

Figure 2. Schedule Variant (SV) graph

3.3.6. Cost performance index (CPI)

Table 7. CPI Calculation

Sunday To	BCWP (Rp)	ACWP (Rp)	CPI
(1)	(2)	(3)	(4)= (2) : (3)
1	206,838,240	186.154.416	1.11
2	478.145.542	430,330,988	1.11

Sunday To	BCWP (Rp)	ACWP (Rp)	CPI
(1)	(2)	(3)	(4)= (2) : (3)
3	977.780.771	880,002,694	1.11
4	1,600,981,702	1,440,883,532	1.11
5	2,362,522,494	2.126.270.245	1.11
6	2,694,269,542	2,424,842,587	1.11
7	3,050,192,487	2,745,173,238	1.11
8	3,727,117,636	3,354,405,872	1.11
9	4,241,527,025	3,817,374,323	1.11
10	5,220,650,902	4,698,585,811	1.11
11	6.129.127.431	5,516,214,688	1.11
12	6,992,744,238	6,293,469,814	1.11
13	7,268,886,720	6,541,998,048	1.11
14	7,370,962,734	6,633,866,461	1.11
15	7,653,014,880	6,887,713,391	1.11
16	7,731,989,480	6,958,790,532	1.11
17	8,111,551,082	7.297.253.107	1.11
18	8,645,301,190	7,777,628,203	1.11
19	8,858,452,025	7,969,463,956	1.11
20	9,919,639,645	8,924,532,813	1.11
21	11,002,719,883	9,899,305,028	1.11
22	13.064.118.135	11,754,563,454	1.10
23	13,308,697,638	11,974,564,128	1.11
24	13,431,054,545	12,087,949,090	1.11

Source: 2024 Analysis Data

From Week 1 to Week 24, the CPI value is greater than 1, which means the cost incurred is lower or more economical than the planned costs. The chart showing the Cost Performance Index (CPI) value is as follows:

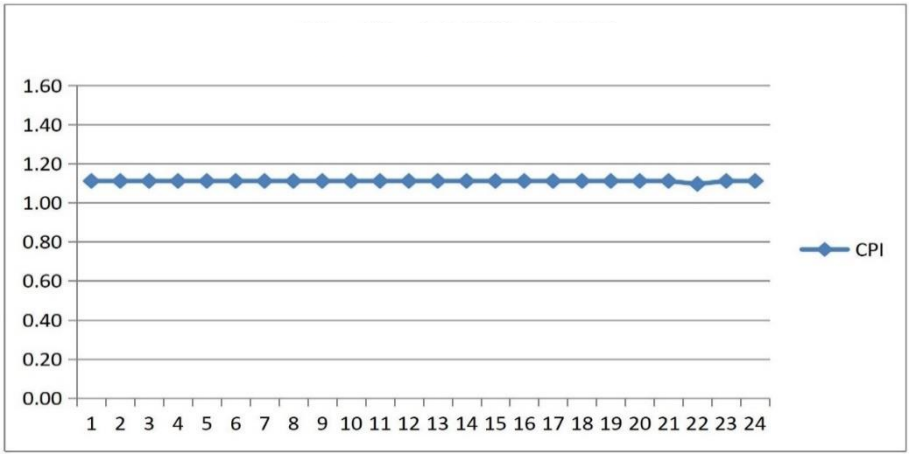

Figure 3. Cost performance index (CPI) graph

3.3.7 Schedule performance index (SPI)

Tabel 8. SPI Calculation

Sunday to -	BCWP (Rp)	BCWS (Rp)	SPI
(1)	(2)	(3)	(4)= (2) : (3)
1	206,838,240	47,008,691	4.40
2	478.145.542	333.090.153	1.44
3	977.780.771	1,023,446,356	0.96
4	1,600,981,702	1,697,685,294	0.94
5	2,362,522,494	2,222,839,527	1.06
6	2,694,269,542	2,846,040,458	0.95
7	3,050,192,487	3,437,006,858	0.89
8	3,727,117,636	4,009,169,782	0.93
9	4,241,527,025	4,481,942,902	0.95
10	5,220,650,902	5,009,783,345	1.04
11	6.129.127.431	5,571,201,425	1.10
12	6,992,744,238	6,207,833,411	1.13
13	7,268,886,720	7,001,608,734	1.04
14	7,370,962,734	7,638,240,720	0.97
15	7,653,014,880	8,501,857,527	0.90
16	7,731,989,480	9,361,445,018	0.83
17	8,111,551,082	10,221,032,509	0.79
18	8,645,301,190	10,798,567,854	0.80
19	8,858,452,025	11,617,862,181	0.76
20	9,919,639,645	12,122,869,832	0.82
21	11,002,719,883	12,627,877,483	0.87
22	13.064.118.135	13.126.169.607	1.00
23	13,308,697,638	13.275.254.312	1.00
24	13,431,054,545	13,431,054,545	1.00

Source: 2024 Analysis Data

Based on Table 8, the Schedule Performance Index (SPI) value is as follows:

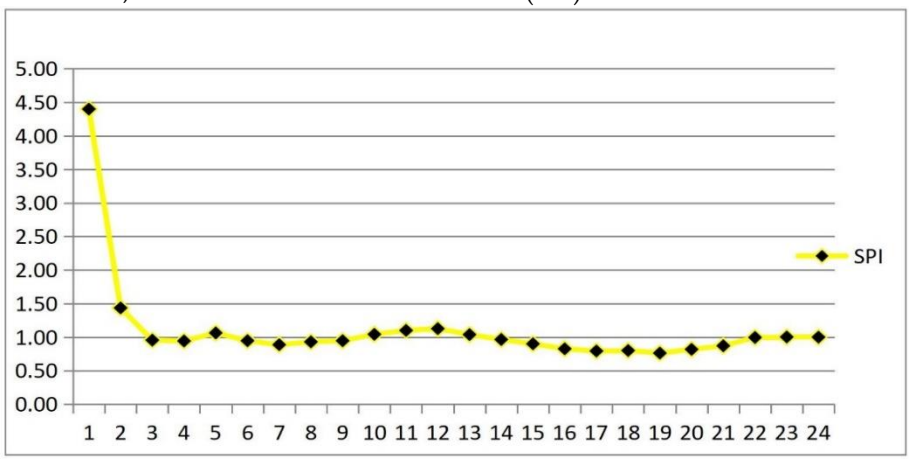

Figure 4. Schedule Performance Index (SPI) graph

3.3.8 Estimate To Complete (ETC)

Tabel 9. SPI Calculation

Sunday to -	WEDNESDAY	BCWP	CPI	ETC
1	13,431,054,545	206,838,240	1.11	11,901,794,674
2	13,431,054,545	478.145.542	1.11	11,657,618,102
3	13,431,054,545	977.780.771	1.11	11,207,946,396
4	13,431,054,545	1,600,981,702	1.11	10,647,065,558
5	13,431,054,545	2,362,522,494	1.11	9,961,678,845
6	13,431,054,545	2,694,269,542	1.11	9,663,106,503
7	13,431,054,545	3,050,192,487	1.11	9,342,775,852
8	13,431,054,545	3,727,117,636	1.11	8,733,543,218
9	13,431,054,545	4,241,527,025	1.11	8,270,574,767
10	13,431,054,545	5,220,650,902	1.11	7,389,363,279
11	13,431,054,545	6.129.127.431	1.11	6,571,734,402
12	13,431,054,545	6,992,744,238	1.11	5,794,479,276
13	13,431,054,545	7,268,886,720	1.11	5,545,951,042
14	13,431,054,545	7,370,962,734	1.11	5,454,082,629
15	13,431,054,545	7,653,014,880	1.11	5,200,235,699
16	13,431,054,545	7,731,989,480	1.11	5.129.158.558
17	13,431,054,545	8,111,551,082	1.11	4,785,492,045
18	13,431,054,545	8,645,301,190	1.11	4,305,438,232
19	13,431,054,545	8,858,452,025	1.11	4,113,719,966
20	13,431,054,545	9,919,639,645	1.11	3.159.160.879
21	13,431,054,545	11,002,719,883	1.11	3.159.160.879
22	13,431,054,545	13.064.118.135	1.11	2,184,807,555
23	13,431,054,545	13,308,697,638	1.11	330.154.494
24	13,431,054,545	13,431,054,545	1.11	110.091.210

Source: 2024 Analysis Data

Table 9 shows the Estimate To Complete (ETC) value for weeks 1 to 24. The project work is progressing according to the weight of the work plan based on the time schedule, which is 100%. While the actual performance in the field is also 100%, by the 24th week, the project has improved to 100% of the planned work. The analysis results show that the estimated cost for the remaining work (ETC) is Rp. 0.00.

3.3.9 Estimate at Completion (EAC)

Tabel 10. SPI Calculation

Sunday to -	ACWP	ETC	EAC
1	186.154.416	11,901,794,674	12,087,949,090
2	430,330,988	11,657,618,102	12,087,949,090
3	880,002,694	11,207,946,396	12,087,949,090
4	1,440,883,532	10,647,065,558	12,087,949,090
5	2.126.270.245	9,961,678,845	12,087,949,090
6	2,424,842,587	9,663,106,503	12,087,949,090
7	2,745,173,238	9,342,775,852	12,087,949,090
8	3,354,405,872	8,733,543,218	12,087,949,090
9	3,817,374,323	8,270,574,767	12,087,949,090
10	4,698,585,811	7,389,363,279	12,087,949,090
11	5,516,214,688	6,571,734,402	12,087,949,090
12	6,293,469,814	5,794,479,276	12,087,949,090
13	6,541,998,048	5,545,951,042	12,087,949,090

Sunday to -	ACWP	ETC	EAC
14	6,633,866,461	5,454,082,629	12,087,949,090
15	6,887,713,391	5,200,235,699	12,087,949,090
16	6,958,790,532	5.129.158.558	12,087,949,090
17	7.297.253.107	4,785,492,045	12,082,745,151
18	7,777,628,203	4,305,438,232	12,083,066,436
19	7,969,463,956	4,113,719,966	12.083.183.922
20	8,924,532,813	3.159.160.879	12,083,693,692
21	9,899,305,028	2,184,807,555	12,084,112,583
22	11,754,563,454	330.154.494	12,084,717,948
23	11,974,564,128	110.091.210	12,084,655,338
24	12,087,949,090	0	12,087,949,090

Source: 2024 Analysis Data

Table 10 shows the Estimate at Completion (EAC) calculation. The estimated total cost at the end of the project is Rp. 12,087,949,090, which is less than the overall project budget (RAB) of Rp. 13,431,054,545. Therefore, it can be said that the project has experienced a profit, with costs incurred being less than the budget (cost underrun).

3.4 Discussion of Results

The discussion of the results from the Earned Value Method analysis in the Construction Project of the IAIN Lhokseumawe Laboratory Center Building is as follows:

a. As can be seen in graph 4.1, the implementation of the project from week 1 to week 24 shows varying progress. In weeks 1 to 2, the project progressed faster than expected. However, in weeks 3 to 4, delays occurred. Then, in week 5, the work speed increased again, followed by more delays from weeks 6 to 9. Weeks 10 to 13 experienced faster progress again, while weeks 14 to 22 were delayed. In week 23, the project sped up once more, and by week 24, the project was completed as planned (as shown by the SV value). The project's cost from week 1 to week 24 remained below the planned budget (as shown by the CV value).
b. The Schedule Variance (SV) value in week 24 is Rp (0), and the Cost Variance (CV) value is Rp 1,343,105,455. This indicates that the project was completed on schedule (SV = 0) and that the costs incurred were lower than the budget (positive CV).
c. The Schedule Performance Index (SPI) value from week 1 to week 24 is 1, indicating that the project was efficient in terms of time (on schedule), while the Cost Performance Index (CPI) of 1.11 indicates that the costs incurred were highly efficient.

4. Conclusion

Based on the performance analysis of time and cost for the IAIN Lhokseumawe Laboratory Center Building Construction Project using the Earned Value Method, the following conclusions can be drawn:

- Time Performance: The project progressed faster than planned during weeks 1 to 2, as indicated by the positive Schedule Variance (SV) and Schedule Performance Index (SPI) = 4.4. From weeks 3 to 4, there were delays (negative SV), with the SPI dropping to 0.94. In weeks 6 to 9, the project slowed down further (SPI = 0.95). However, in weeks 10 to 13, the project regained speed, with SPI at 1.04. From weeks 14 to 22, the project experienced delays again (SPI = 0.99), but by week 24, the project was completed according to schedule.
- Cost Performance: Throughout weeks 1 to 24, the costs were consistently below the planned budget, as indicated by the positive Cost Variance (CV) and Cost Performance Index (CPI) = 1.11. This shows that the project performed well in terms of cost management.

- Overall Project Status: The estimated total cost at the end of the project is Rp 12,087,949,090, which is lower than the overall project budget (RAB) of Rp 13,431,054,545. Therefore, it can be concluded that the project experienced a profit due to cost underrun.

References

[1] G. Prasetia, S. Sofyan, D. Sarana, N. Usrina, M. Maizuar, and F. Fadhliani, "Improving Improving Efficiency and Accuracy of Quantity Take-Off Through BIM Integration: A Case Study of the D Lecture Hall Building at Malikussaleh University," *Proc. Malikussaleh Int. Conf. Multidiscip. Stud. MICoMS*, vol. 4, pp. 00013–00013, Dec. 2024, doi: 10.29103/micoms.v4i.893.

[2] M. I. Maromi and R. Indryani, "Metode Earned Value Untuk Analisa Kinerja Biaya Dan Waktu Pelaksanaan Pada Proyek Pembangunan Condotel De Vasa Surabaya," *J. Tek. ITS*, vol. 4, no. 1, pp. D54–D59, Mar. 2015, doi: 10.12962/j23373539.v4i1.8970.

[3] Sunario Sunario, Syahrudin Syahrudin, and Riyanny Pratiwi, "Penerapan Model Pengendalian Waktu dan Biaya," *J. Mhs. Tek. Sipil Univ. Tanjungpura*, vol. 3, no. 3, Dec. 2016.

[4] H. M. Sari, I. Hendriyani, and A. E. Widyaningrum, "Earned Value Analysis pada Proyek Pembangunan Gedung Arsip Kantor BPN: Earned Value Analysis of BPN Office Archives Building Projects," *J. Ilm. Tek. Sipil TRANSUKMA*, vol. 3, no. 2, pp. 154–167, Jun. 2021, doi: 10.36277/transukma.v3i2.84.

[5] A. Husen, "Manajemen Proyek Perencanaan, Penjadwalan & Pengendalian Proyek," *Yogyak. Andi*, 2009, Accessed: Jan. 07, 2025. [Online]. Available: https://scholar.google.com/scholar?cluster=18892848258637675 37&hl=en&oi=scholarr