Time and cost performance analysis: earned value management method on HPK Project Using Mobox

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Article Info

***Article history*:**

Received:
April 29, 2024
Revised:
September 10, 2024
Accepted:
September 10, 2024
Available online:
September 30, 2024

***Keywords*:**

Earned value management
IKN
Mobox

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Abstract

Conventional construction methods have proven inadequate for meeting the accelerated development needs of IKN, highlighting the necessity for innovative approaches to expedite construction. Additionally, challenges related to material supply further exacerbate the situation. The Mobox method emerges as a promising alternative, offering potential to streamline project completion. This study compares time performance between conventional concrete methods, which typically require 7 months, and the Mobox method, which achieves the same in 4 months. The aim is to evaluate whether time and cost performance align with the project owner's expectations, using the Earned Value Management (EVM) method for a 4-storey building project utilizing Mobox modular construction. At week 16, the project's time performance met expectations, as evidenced by a Schedule Variance (SV) of zero and a Schedule Performance Index (SPI) of 1. Cost performance also exceeded expectations, with a positive Cost Variance (CV) of Rp 11,784,790,045.29 and a Cost Performance Index (CPI) of 1.023, indicating cost efficiency. The Mobox method, coupled with the EVM approach, proves to be an effective and efficient alternative for construction projects, demonstrating the capability to complete projects on time and within budget while maintaining quality.

Introduction

Background

Access to Penajam Paser Utara, East Kalimantan, is challenging due to its 2-hour road journey from Balikpapan. The road conditions, though paved, are narrow with a single lane in each direction, which significantly hampers logistical operations and extends transportation times. Additionally, the region faces a shortage of essential construction materials, including cement, sand, aggregate, and reinforcement, with supplies primarily sourced from Palu and Surabaya. The high demand for these materials, driven by accelerated construction schedules, exacerbates the supply constraints.

Given these logistical and material challenges, the project owner has set an ambitious goal to complete construction within 4 months to facilitate the timely occupancy of Ibu Kota Nusantara (IKN) workers. Traditional construction methods, which typically require about 7 months, are deemed inadequate for meeting this accelerated timeline. Consequently, there is a pressing need to explore innovative construction methods that can expedite the development process.

Among the available alternatives, the Mobox modular construction system emerges as a promising solution. This method, known for its rapid assembly and minimal reliance on heavy equipment (Fau et al., 2023), aligns well with the need for accelerated development (Rahmansah & Hartati, 2022). The Mobox system is designed to address the constraints associated with conventional methods, potentially reducing the construction period to 4 months.

Project success is generally measured by timely completion, cost efficiency, and quality (Rumbarar et al., 2019). To evaluate the effectiveness of the Mobox method in achieving these success criteria, this study employs the Earned Value Management (EVM) technique to assess time and cost performance. Previous research has demonstrated the utility of Mobox in various contexts, including post-disaster housing (Saputra et al., 2024), residential projects (Rahmansah & Hartati, 2023), and specialized construction projects (Aldi et al., 2023; Permana et al., 2023). Concurrently, EVM has been applied in construction project management to monitor and control performance metrics (Wahyuni & Hendrawan, 2018; Castollani et al., 2020; Zakariyya et al., 2020; Isnaini et al., 2022; Atarima et al., 2023; Ariana & Lestari, 2023; Moerdiwanto & Zuhdy, 2023; Arthono et al., 2024).

This research aims to validate the Mobox modular construction method’s ability to meet the 4-month completion target, ensuring both time and cost performance align with project goals. By assessing the time and cost performance using the EVM method, this study seeks to provide actionable insights for effective project management and offer a viable alternative for future construction projects, particularly in challenging logistical environments.

Construction Implementation

According to Nurhayati (2010), a project is a structured endeavor aimed at achieving specific goals, objectives, and expectations within a defined timeframe, using allocated funds and available resources. Projects are characterized by:

1. The aim to produce a distinct final product or deliverable.
2. Establishing clear criteria for cost, schedule, and quality to delineate the project's scope.
3. Having a definitive start and end date, distinguishing them from ongoing operations.
4. Involving non-routine and non-repetitive activities, varying in nature and complexity.

To achieve a project's objectives, it is crucial to adhere to certain constraints: cost (budget), schedule, and quality. These three constraints, often referred to as the "triple constraints," are essential in defining the project's success (Husen, 2009):

1. Budget
   Projects must be completed within the allocated budget (Pratama, 2022). For projects with substantial financial commitments and extended timelines, the budget should be detailed, not only encompassing the total project cost but also segmented by components or specific periods, such as quarterly adjustments.
2. Schedule
   The project must be completed within the designated timeframe and adhere to the set end date (Pratama, 2022). For projects that result in a new product, the delivery must be made within the specified time constraints.
3. Quality
   The outcomes of the project must meet the required specifications and standards (Pratama, 2022). Achieving quality means fulfilling the intended purpose and ensuring that the results are fit for their intended use.

The interaction between the three constraints, often referred to as the triple constraint, is illustrated in Figure 1 (Husen, 2009).

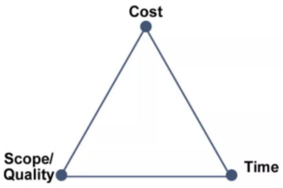

Figure 1. Relationship between project constraint types

The figure illustrates the inherent tension between the three constraints. Enhancing product performance, as agreed upon in the contract, typically necessitates improving quality, which in turn often leads to higher costs that exceed the budget. Conversely, reducing costs usually requires compromises in both quality and the project schedule (Husen, 2009).

Earned Value Management

Gray et al. (2008) describe Earned Value as a system that compares planned costs with actual costs to determine which activities can be completed within the budgeted amounts. Similarly, Soeharto (1995) emphasizes that the value for money concept can be applied to analyze project performance and forecast the likelihood of achieving project goals. To facilitate this analysis, three key indicators are used: ACWP (Actual Cost of Work Performed), BCWP (Budgeted Cost of Work Performed), and BCWS (Budgeted Cost of Work Scheduled).

1. Actual Cost of Work Performed (ACWP)
   ACWP (Actual Cost of Work Performed) represents the total expenditure recorded for the work completed, including overhead costs, up to the reporting date. It reflects the actual amount spent on work packages or accounting codes over a given period (Soeharto, 1995).
2. Budgeted Cost of Work Performed (BCWP)
   BCWP (Budgeted Cost of Work Performed) is an indicator that represents the value of completed work assessed against the budget. By comparing BCWP with ACWP (Actual Cost of Work Performed), one can determine whether the cost incurred aligns with or deviates from the budgeted cost for the work completed (Soeharto, 1995).
3. Budgeted Cost of Work Scheduled (BCWS)
   BCWS (Budgeted Cost of Work Scheduled) represents the planned budget for work packages, structured according to the project's implementation schedule. It integrates costs, timelines, and work scope, assigning specific budgets and deadlines to each work element, providing a benchmark for measuring project progress (Soeharto, 1995).
4. Cost Variance (CV) and Schedule Variance (SV)
   Cost Variance (CV) quantifies the difference between BCWP and ACWP, where a positive CV signifies that costs are below budget, and a negative CV reflects cost overruns. Schedule Variance (SV) evaluates the difference between BCWS and BCWP, with a positive SV indicating that more work has been completed than planned, while a negative SV shows that less work has been finished than scheduled. The formulas for calculating Cost Variance and Schedule Variance are shown in Equations (1) and (2).

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

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

The criteria for these indicators are outlined by Soeharto (1995) in Table 1.

Table 1. Performance indicator criteria

Cost Variation (CV)	Schedule Variation (SV)	Description
Positive	Positive	Work realized ahead of schedule at a cost less than budget
Positive	Zero	Work realized on schedule at a cost less than budget
Zero	Positive	Work realized within budget and completed ahead of schedule
Zero	Zero	Work is realized according to schedule and budget
Negative	Negative	Work completed late and costing more than budgeted
Negative	Zero	Work was realized on schedule and cost over budget
Zero	Negative	Work is delayed and costs are within budget

Modular system concept

The modular system is a construction method that involves using materials or prefabricated components that are either produced off-site or assembled on-site. These components must then be erected and positioned correctly at the project site (Ervianto, 2008). The comparison between conventional construction and the modular system is illustrated in Figure 2 and 3.

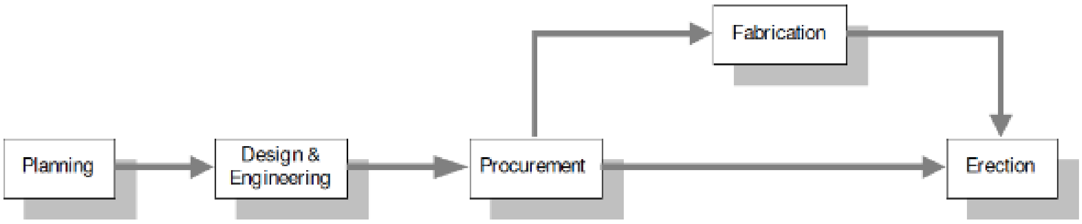

Figure 2. Dependency between parties in the application of conventional systems (Ervianto, 2008)

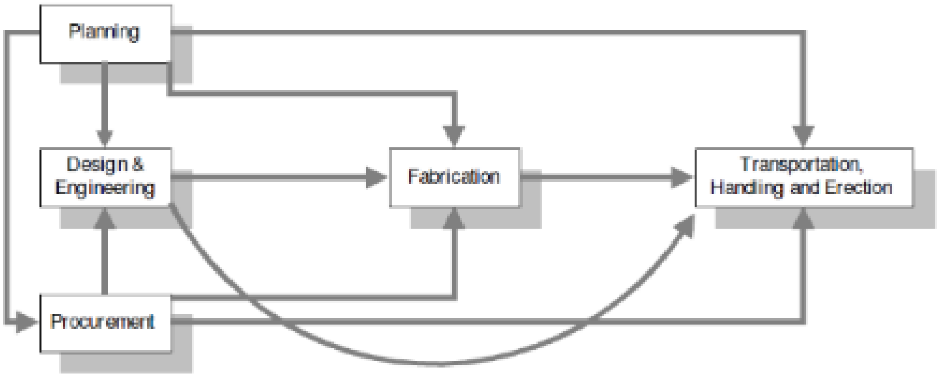

Figure 3. Dependency between parties in the application of modular systems (Ervianto, 2008)

Tatum et al. (1987) define the levels of construction implementation methods as follows: (a) Prefabrication refers to the manufacturing process in which various materials are assembled using specialized tools to form building components; (b) Preassembly involves the assembly of prefabricated components at a location other than their final position; (c) Module is the outcome of assembling prefabricated components, often requiring substantial transportation logistics to move the module to its designated location.

The implementation of construction projects using the modular system involves the following sequence of activities: (1) planning; (2) design and engineering; (3) procurement; (4) fabrication; and (5) transportation, handling, and erection. Among these activities, planning is particularly crucial due to its complexity and the extensive considerations required compared to conventional methods (Ervianto, 2008).

Building on the levels of prefabrication adoption, Gibb categorizes off-site construction into four distinct types: (1) Component Manufacture and Sub-Assembly, (2) Non-Volumetric Pre-Assembly, (3) Volumetric Pre-Assembly, and (4) Modular Building. As the degree of completeness increases, the extent of factory-produced components also grows, culminating in the creation of both non-volumetric and volumetric (three-dimensional) modules (Gibb, 1999).

Modular systems offer both advantages and disadvantages compared to conventional construction methods. Hesler highlights several benefits of modular systems, including improved constructability, positive impacts on scheduling, reduced need for field and project office workers, enhanced quality and productivity, and thorough testing (Hesler, 1990). Modular building involves utilizing a variety of structural systems and materials rather than relying on a single type of structure. Off-site prefabrication contributes to shorter overall construction schedules, better quality, and minimized resource wastage (Lacey et al., 2018).

Mobox method

The Mobox method closely resembles the "Puzzle" system. The process begins with arranging the floor beams and 3-way joints, followed by securing the four sides of each joint. Next, hollow beams measuring 40 x 80 and 80 x 80 are installed and fastened to the main floor beams, as illustrated in Figure 4.

In the second stage, columns are positioned on all four sides, and the joints are tightened. Subsequently, a 3-way joint is installed at the top, followed by the sequential installation of beams, which are then secured by tightening the joints. This process is illustrated in Figure 5.

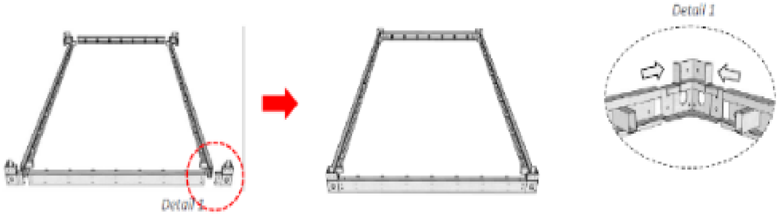

Figure 4. Stage 1 of Mobox installation

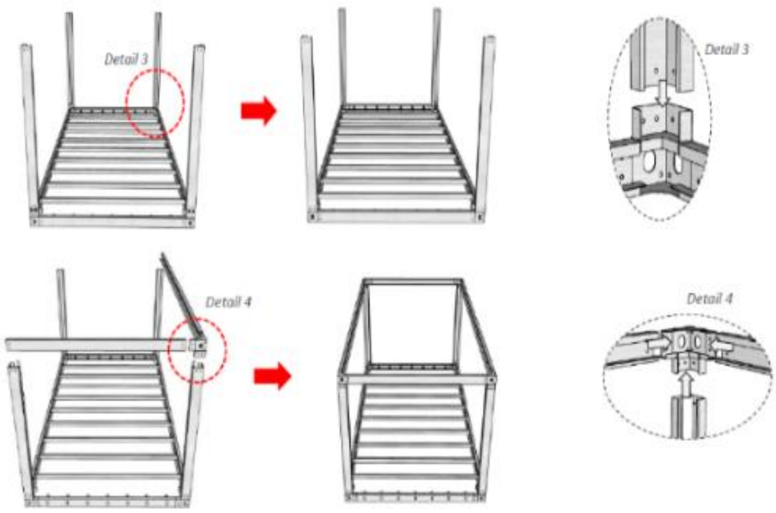

Figure 5. Stage 2 Mobox installation

In the third stage, the alignment and dimensions of the main structure are verified using a water level and measuring tape, as shown in Figure 6. Once confirmed, bolts at each joint are tightened. A 50 x 50 hollow section is then attached crosswise, followed by a 20 x 40 hollow section installed lengthwise to serve as the ceiling beam.

E-ISSN: 2746-0185

Figure 6. Stage 3 Mobox installation

Research Methodology

Data

This research requires primary data, including the schedule of work implementation and the Budget Estimate Plan (BEP) for the Mobox modular system. Additionally, secondary data is needed, which comprises project drawings and the Bill of Quantities (BOQ) or job descriptions.

Analysis

Based on the primary and secondary data, the Earned Value Management (EVM) method can be applied to analyze the time and cost performance of Mobox construction. Key indicators for this analysis include:

- Actual Cost of Work Performed (ACWP): The total expenditure recorded for completed work.
- Budgeted Cost of Work Performed (BCWP): The value of completed work compared to the budget.
- Budgeted Cost of Work Scheduled (BCWS): The planned budget for work scheduled up to the reporting date.

From these indicators, Cost Variance (CV) and Schedule Variance (SV) can be calculated. CV measures the difference between BCWP and ACWP, while SV measures the difference between BCWS and BCWP. Additionally, Cost Performance Index (CPI) and Schedule Performance Index (SPI) provide insights into cost efficiency and schedule adherence, respectively.

Furthermore, the analysis will include estimating the remaining cost and time required for project completion through Estimate to Complete (ETC) and Estimate at Completion (EAC).

Results and Discussion

The cumulative results of BCWS, BCWP, and ACWP data were aggregated and compared, as shown in Table 2.

Table 2. Recapitulation of analysis results of BCWS, BCWP, and ACWP

Week 1	Cumulative BCWS (Rp)	Cumulative BCWP (Rp)	Cumulative ACWP (Rp)
1	5,834,520,205.14	7,553,278,055.28	7,384,157,483.93
2	15,661,538,432.19	35,155,696,786.63	34,368,548,281.93
3	30,643,747,272.80	50,893,530,881.41	49,754,006,696.32
4	56,948,818,682.18	98,121,076,894.67	95,924,111,224.33
5	96,864,066,638.23	141,805,699,713.60	138,630,619,863.38
6	171,753,737,165.04	222,561,928,897.38	217,578,688,468.44
7	294,069,592,916.57	316,050,471,412.39	308,973,989,398.90

Table 2 (continued). Recapitulation of analysis results of BCWS, BCWP, and ACWP

Week 1	Cumulative BCWS (Rp)	Cumulative BCWP (Rp)	Cumulative ACWP (Rp)
8	391,761,319,403.37	432,381,137,639.76	422,699,970,800.16
9	424,298,833,434.59	458,571,396,485.78	448,303,820,472.91
10	442,688,312,186.83	481,327,269,732.22	470,550,181,656.26
11	452,401,966,750.07	483,986,605,739.18	473,149,974,187.98
12	467,119,794,723.99	498,513,698,105.71	487,351,799,810.30
13	485,845,504,431.63	506,282,054,302.36	494,946,219,759.82
14	518,106,164,566.73	522,387,214,806.22	510,690,780,014.87
15	521,107,061,964.43	523,378,663,442.93	511,660,029,765.39
16	526,333,345,045.05	526,333,345,045.05	514,548,554,999.76

From Table 2, the following conclusions can be drawn:

1. At Event Time 25% (week 4):
    - The cumulative Budgeted Cost of Work Scheduled (BCWS) was Rp 56,948,818,682.18.
    - The cumulative Budgeted Cost of Work Performed (BCWP) was Rp 98,121,076,894.67.
    - The cumulative Actual Cost of Work Performed (ACWP) was Rp 95,924,111,224.33.
2. At Event Time 50% (week 8):
    - The cumulative BCWS amounted to Rp 391,761,319,403.37.
    - The cumulative BCWP was Rp 432,381,137,639.76.
    - The cumulative ACWP was Rp 422,699,970,800.16.
3. At Event Time 75% (week 12):
    - The cumulative BCWS was Rp 467,119,794,723.99.
    - The cumulative BCWP was Rp 498,513,698,105.71.
    - The cumulative ACWP was Rp 487,351,799,810.30.
4. At Event Time 100% (week 16):
    - The cumulative BCWS and BCWP were both Rp 526,333,345,045.05.
    - The cumulative ACWP was Rp 514,548,554,999.76.

After obtaining the cumulative results for the three indicators, a combined graph can be created using the "S" curve, as illustrated in Figure 7.

Figure 7 illustrates the cumulative results from week 1 to week 16, showing that BCWS consistently falls below BCWP, indicating that the construction process is delayed and project performance has diminished. Although ACWP and BCWP show negative values from week 1 until the final calculation, by week 16, ACWP is less than BCWP. This suggests that while the project continues to experience delays, there are cost savings being realized. These findings are consistent with research conducted by Wahyuni & Hendrawan (2018), which observed similar cost and schedule performance trends in the 6-month analysis of the PT Asian Sealand Engineering project.

Cost Variant (CV) and Schedule Variant (SV) analysis

In the analysis of Cost Variance (CV) and Schedule Variance (SV), the results are interpreted as follows: A negative result indicates that costs have exceeded the planned budget and there are delays in the work. Conversely, a result of zero signifies that the work is proceeding as planned and is on schedule. A positive result indicates that the work is being completed under budget and progress is ahead of schedule. The detailed results of the CV and SV calculations are summarized in Table 3.

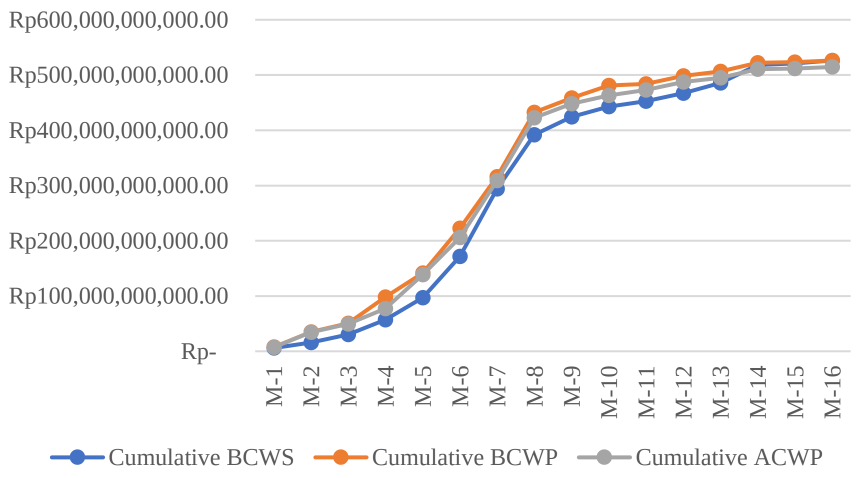

Figure 7. BCWS - BCWP - ACWP Chart

Table 3. Recapitulation of cost variant and schedule variant analysis

Week 1	Cost Variant (Rp)	Schedule Variant (Rp)
1	169,120,571.35	1,718,757,850.14
2	787,148,504.70	19,494,158,354.44
3	1,139,524,185.09	20,249,783,608.61
4	2,196,965,670.34	41,172,258,212.49
5	3,175,079,850.22	44,941,633,075.37
6	4,983,240,428.94	50,808,191,732.34
7	7,076,482,013.48	21,980,878,495.82
8	9,681,166,839.60	40,619,818,236.39
9	10,267,576,012.87	34,272,563,051.19
10	10,777,088,075.96	38,638,957,545.39
11	10,836,631,551.21	31,584,638,989.11
12	11,161,898,295.41	31,393,903,381.72
13	11,335,834,542.53	20,436,549,870.73
14	11,696,434,791.35	4,281,050,239.49
15	11,718,633,677.54	2,271,601,478.50
16	11,784,790,045.29	0.00

Based on Table 3, the Cost Variance (CV) from week 1 to week 16 shows a consistently increasing positive value. In contrast, Schedule Variance (SV) fluctuates throughout the period but remains positive overall. By week 16, the cumulative CV is Rp 11,784,790,045.29, while the cumulative SV is 0. This indicates that, over time, the project's time efficiency improves and then stabilizes. The SV value initially increases and later decreases to zero, suggesting that the project aligns with the planned schedule. This finding is consistent with research by Arthono et al. (2024), which demonstrated that the West Jakarta Police Command Headquarters construction project adhered to its schedule without significant issues.

Cost efficiency in the project implementation stabilizes and improves from week 1 to week 16, leading to sustained positive Cost Variance (CV) values throughout this period. This suggests that the project has the potential for cost savings. This finding aligns with Isnaeni et al. (2022), which showed that applying the Earned Value Management (EVM) concept in construction projects can result in lower actual costs compared to the originally planned budget.

Cost Performance Index (CPI) and Schedule Performance Index (SPI) analysis

In the analysis of Cost Performance Index (CPI) and Schedule Performance Index (SPI), the interpretation of the results is as follows: if the calculation result is less than 1, it indicates that expenditures exceed the planned budget and that performance is not meeting the target schedule. Conversely, if the result is greater than 1, it signifies that expenditures are below the planned budget and work performance is ahead of schedule. A result equal to 1 indicates that both cost and schedule performance are in line with the plan. A summary of the CPI and SPI calculations is presented in Table 4 below.

Table 4. Recapitulation of Cost Performance Index and Schedule Performance Index analysis

Week 1	CPI	SPI
1	1,023	1,295
2	1,023	2,245
3	1,023	1,661
4	1,271	1,723
5	1,023	1,464
6	1,081	1,296
7	1,023	1,075
8	1,023	1,104
9	1,023	1,081
10	1,039	1,087
11	1,023	1,070
12	1,023	1,067
13	1,023	1,042
14	1,023	1,008
15	1,023	1,004
16	1,023	1,000

Table 4 presents the following findings from the CPI and SPI analysis:

1. At Event Time 25% (week 4), the cumulative CPI is 1.271, indicating that costs are significantly below the planned budget, while the cumulative SPI is 1.723, showing that work performance is ahead of schedule.
2. At Event Time 50% (week 8), the cumulative CPI is 1.023, suggesting that costs are slightly below the planned budget, and the cumulative SPI is 1.104, indicating that work performance is moderately ahead of schedule.
3. At Event Time 75% (week 12), the cumulative CPI remains at 1.023, reflecting consistent cost performance just below the planned budget, while the cumulative SPI is 1.067, demonstrating that work performance is slightly ahead of schedule.
4. At Event Time 100% (week 16), the cumulative CPI remains at 1.023, confirming that costs are consistently below the planned budget, and the cumulative SPI is 1.000, indicating that work performance aligns with the planned schedule.

After analyzing the CPI and SPI results, a combined graph illustrating both indicators has been created. This graph is shown in Figure 8.

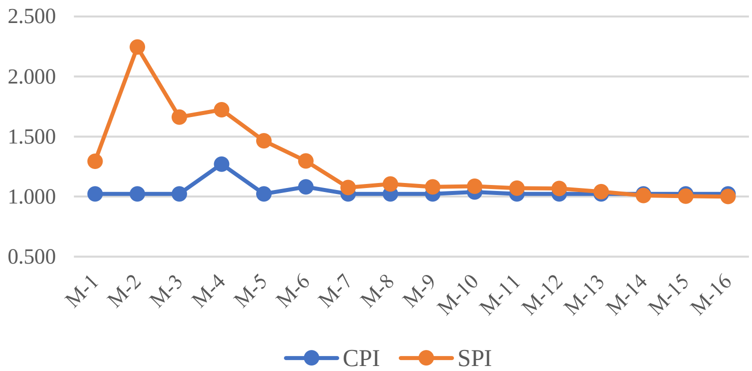

Figure 8. CPI and SPI results

Figure 8 presents the combined graph of the Schedule Performance Index (SPI) and Cost Performance Index (CPI) from week 1 to week 16. Both indices show values consistently greater than 1 throughout this period. The SPI graph indicates that while the project's time performance initially improved, it gradually decreased over time. Despite this decline, the final SPI value at week 16 remains above 1. This suggests that the project maintained a relatively stable performance level throughout the duration, with satisfactory time and cost efficiency.

Estimate to Complete (ETC) and Estimate at Completion (EAC)

The recapitulation of the calculation results for Estimate to Complete (ETC) and Estimate at Completion (EAC) is provided in Table 5.

Table 5. Recapitulation of ETC and EAC

Week 1	ETC (Rp)	EAC (Rp)
1	507,164,397,515.83	514,548,554,999.76
2	480,180,006,717.83	514,548,554,999.76
3	464,794,548,303.44	514,548,554,999.76
4	336,832,835,691.04	414,015,118,941.00
5	375,917,935,136.38	514,548,554,999.76
6	280,919,821,289.08	486,739,243,288.98
7	205,574,565,600.86	514,548,554,999.76
8	91,848,584,199.60	514,548,554,999.76
9	66,244,734,526.86	514,548,554,999.76
10	43,301,161,656.97	506,394,861,156.75
11	41,398,580,811.78	514,548,554,999.76
12	27,196,755,189.46	514,548,554,999.76
13	19,602,335,239.94	514,548,554,999.76
14	3,857,774,984.89	514,548,554,999.76
15	2,888,525,234.37	514,548,554,999.76
16	0.00	514,548,554,999.76

Table 5 presents the Estimate to Complete (ETC) calculations from week 1 to week 16. The data shows that, over time, the estimated additional costs required to complete the remaining work decrease steadily until week 15. By week 16, the ETC reaches zero, indicating that the actual costs align with the planned budget.

Based on Table 5, the Estimate at Completion (EAC) calculations from week 1 to week 16 are presented. These calculations allow for determining the difference between the Budget at Completion (BAC) and the EAC, providing insights into any variances from the planned budget.

ΔH EAC = BAC - EAC

ΔH EAC = Rp 526.333.345.045,05 - Rp 514,548,554,999.76

ΔH EAC = Rp 11,784,790,045.29

ΔH EAC is positive (+), which indicates that the project has projected savings with a value of Rp 11,784,790,045.29.

Discussion of project cost and time

The analysis of cost and schedule for the Construction Workers Residential Project, utilizing the Mobox and Earned Value Methods, is detailed from week 4 (25% completion) to week 15 (100% completion). This comprehensive analysis is presented in Table 6, Table 7, Table 8 and Table 9.

Table 6. Recapitulation of project cost and time analysis in week 4

Analysis	Results
Estimate to Completion (ETC)	Rp 336,832,835,691.03
Estimate at Completion (EAC)	Rp 414,015,118,941.00
Remaining Budget	Rp 20,938,793,644.71
Percentage of Savings	3,98%
Estimate Temporary Schedule (ETS)	7,0
Estimate All Schedule (EAS)	11,0

Table 7. Recapitulation of project cost and time analysis in week 8

Analysis	Results
Estimate to Completion (ETC)	Rp 91,848,584,199.60
Estimate at Completion (EAC)	Rp 514,548,554,999.76
Remaining Budget	Rp 11,335,834,542.53
Percentage of Savings	2,15%
Estimate Temporary Schedule (ETS)	7,2
Estimate All Schedule (EAS)	15,2

Table 8. Recapitulation of project cost and time analysis in week 12

Analysis	Results
Estimate to Completion (ETC)	Rp 27,196,755,189.46
Estimate at Completion (EAC)	Rp 514,548,554,999.76
Remaining Budget	Rp 11,784,790,045.28
Percentage of Savings	2,24%
Estimate Temporary Schedule (ETS)	3,7
Estimate All Schedule (EAS)	15,7

Table 9. Recapitulation of project cost and time analysis in week 15

Analysis	Results
Estimate to Completion (ETC)	Rp 2,888,525,234.37
Estimate at Completion (EAC)	Rp 514,548,554,999.76
Remaining Budget	Rp 11,784,790,045.28
Percentage of Savings	2,24%
Estimate Temporary Schedule (ETS)	1,0
Estimate All Schedule (EAS)	16,0

From Table 6, Table 7, Table 8, and Table 9, it is evident that the estimated cost to complete the remaining work as of week 15 is Rp 2,888,525,234.37. The total estimated cost to complete the entire project is Rp 514,548,554,999.76. With a remaining project budget of Rp 11,784,790,045.28—representing just 2.24% of the total budget—the analysis indicates that the actual costs incurred up to week 15 have been relatively low compared to the volume of work completed. This suggests that the Mobox construction method allows for project completion in a shorter timeframe than conventional methods, without compromising quality or increasing costs.

Based on the analysis up to week 15, the estimated time to complete the remaining work is 1 week, making the total project duration 16 weeks. This indicates that the project is on schedule. The application of Earned Value Management (EVM) in Mobox proves beneficial in making timely adjustments to avoid delays and cost overruns, thereby enhancing project efficiency and mitigating the risk of failure. EVM not only improves project performance but also highlights its significant value in achieving project success. This aligns with findings by Atarima et al. (2023), who demonstrated that the use of EVM in the Malang City Monfort Seminary Dormitory project ensured timely completion and cost savings, allowing for faster project completion than originally planned.

Conclusions

Based on the preceding analysis and discussion, the following conclusions can be drawn:

1. Mobox Method Efficiency: The Mobox method presents a viable alternative for completing construction projects more quickly. It addresses several common issues, including concrete scarcity, access and logistics challenges, quality control, expedited timelines, and cost-effective labor deployment.
2. Earned Value Management (EVM) Benefits: Implementing the Earned Value Management (EVM) method in Mobox construction projects facilitates timely adjustments, preventing delays and cost overruns. This leads to enhanced project efficiency and reduced risk of failure, ultimately improving overall project performance and outcomes.
3. Project Schedule Adherence: By week 16, the project's time performance is consistent with the plan, as evidenced by a Schedule Variance (SV) of zero and a Schedule Performance Index (SPI) of 1. This confirms that the project is on schedule, with an estimated final completion time of 16 weeks aligning perfectly with the planned timeline.
4. Cost Performance Analysis: As of week 16, the project's cost performance is favorable, with expenditures below the planned budget. This is reflected in a positive Cost Variance (CV) of Rp 11,784,790,045.29 and a Cost Performance Index (CPI) of 1.023, indicating cost savings. Should the project maintain its current performance level through to completion, the estimated total cost at completion (EAC) will be Rp 514,548,554,999.76, resulting in a cost saving of Rp 11,784,790,045.28, or a profit margin of 2.24% below the planned budget.

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