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Project Performance Analysis Based on Earned Value Method on Infrastructure & Infrastructure Improvement of Yohanis Kapiyau Timika Airstrip

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KEYWORDS
earned value method, project performance analysis, cost variance, schedule variance, cost performance index, schedule performance index

ABSTRACT
This study analyzes the performance of construction projects using the Earned Value Method (EVM) on the Infrastructure and Facilities Improvement Project at Yohanis Kapiyau Airbase in Timika. Utilizing key performance indicators such as Cost Variance (CV), Cost Performance Index (CPI), Schedule Variance (SV), and Schedule Performance Index (SPI), the research evaluates cost and time deviations to provide a comprehensive understanding of project performance. EVM offers precise insights into the project's current status, including estimates for total costs and completion timelines, which are critical for effective decision-making and ensuring adherence to project plans. The findings demonstrate that EVM is a reliable tool for accurately monitoring and managing construction projects, enabling stakeholders to identify inefficiencies and implement corrective measures in a timely manner. By providing an in-depth evaluation of cost efficiency and schedule performance, the study contributes to the broader application of EVM in enhancing construction project management. This research is expected to benefit academics by advancing theoretical knowledge, assist contractors in optimizing project execution, and inform public stakeholders on best practices for infrastructure development, ultimately contributing to more effective and efficient management of construction projects in Indonesia.

Introduction

The Unitary State of the Republic of Indonesia is divided into provinces and the provinces are divided into regencies and cities, each of which has a regional government, which is regulated by law. However, every region in Indonesia does not quite have an equitable economy or education. Especially in the Papua region, there are still gaps compared to other regions in Indonesia. One of the central government's efforts to realize a more advanced and equitable Indonesia is through infrastructure development

(Lumentah et al., 2020). Papua, located at the eastern tip of Indonesia, has many interesting places to see. Its human resources, culture, and natural beauty are valuable assets. It is no surprise that Papua is nicknamed Little Paradise for its infinite beauty. Papua is known for its mountains, lush forests, grasslands, swamps, and incredible underwater scenery and is already globally recognized. Cities such as Sorong, Merauke, Manokwari, and Jayapura are tourist centers to enjoy the beauty of Papua (Fazis & Tugiah, 2022).

Infrastructure development plays a very important role in spurring economic growth, both at the national and regional levels, as well as reducing unemployment, alleviating poverty, and improving people's welfare. Therefore, the government is committed to continuously improving infrastructure development because the availability of adequate infrastructure is very important to support economic activities and business growth (Hidiyati et al., 2023)

Construction is an important part of infrastructure development. Many projects in Indonesia need to be improved, so the construction service industry is growing. It is expected that construction projects can be completed quickly, with the right quality, and at an efficient cost. However, in reality, project delays are a common problem in every construction project in Indonesia. Often there are different problems between one project and another in the work process so that the project experiences cost and time overruns (Natalia et al., 2021).

One of the infrastructures being worked on is the Infrastructure and Sarpras Improvement Construction Work of Yohanis Kapiyau (YKU) Airbase. The existence of the Air Force III Air Operations Command (Koopsud) in Biak, Papua Province, is an important strategic step because it plays an active role in maintaining the sovereignty of Papua's airspace located in the Pacific archipelago. Koopsud III TNI AU is responsible for fostering the ability and operational preparedness of TNI AU units to carry out air operations aimed at upholding state sovereignty in the airspace of the Republic of Indonesia (Jatnika, A., & Johari, 2022).

The Air Force plans to develop Yohanis Kapiyau Airstrip in Timika, Central Papua, as a forward operating base (FOB) that can safely be used to conduct advanced operations and act as a tactical center for TNI operations. Yohanis Kapiyau Airstrip has a runway length of 2,340 meters and shares land with Mozes Kilangin Airport. Due to the location of mining company PT Freeport Indonesia in Timika, the region is dominated by the mining, business and service sectors (Kurniawati et al., 2022).

The Yohanis Kapiyau Airbase is where various TNI military operations began. One of them was Operation Mapnduma, a military operation aimed at freeing twenty-six researchers involved in the 95th Lorentz Expedition. In Mapnduma Village, Tiom District, Jayawijaya, Papua, they were taken hostage by the Free Papua Organization (OPM) led by Kelly Kwalik (Malaiholo et al., 2022).

The hostage liberation operation made Timika the FOB which took 129 days. Since February 7, 2023, Yohanis Kapiyau Airstrip has again been used to pursue KKB hiding in mountainous Papua after Susi Air pilot Philip Mark Mehrtens was taken hostage by Papuan KKB at Paro Airstrip, Nduga, mountainous Papua. Timika is in the middle of at least three major regions of Papua: Biak, Jayapura, and Merauke. These three cities can be used to move combat power to Timika as an FOB (Rizqie et al., 2022).

The limited facilities of Lanud Yohanis Kapiyau have a direct impact on the ability, readiness and speed of Lanud Yohanis Kapiyau in supporting operations due to the density of TNI flight operations. Lanud Yohanis Kapiyau not only assists TNI operations,

but also conducts independent operations related to monitoring and securing flight activities. The airbase has successfully supervised at least 2,131 flights, including unscheduled flights in Ilaga and Bilorai (Almi et al., 2024).

A Forward Operating Base, or FOB, is a secure frontline base used to support strategic and tactical objectives (Soemardi & Ervianto, 2015). FOBs can consist of air bases, hospitals, maintenance centers, and other logistics facilities. Compared to stationing all troops at the main operating base, the presence of an FOB will shorten the reaction time of troops to the local area.

Yohanis Kapiyau Air Force Base (Lanud YKU, Type C) plays an important role as a strategic element in the operations of Koopsud III TNI AU in Timika, Mimika Regency, Central Papua Province. As an enclave military base, Lanud YKU still uses the aviation infrastructure of Mozes Kilangin Airport owned by PT Freeport Indonesia. Its strategic location makes it the main gateway for TNI operational activities in the region.

Lanud YKU is the main interconnection center for logistics lines, movement of Task Force personnel, implementation of major SAR operations, and air operations in the Central Papua region (Susanti et al., 2019). With facilities such as apron, taxiway, baseops building, hali shelter, dispatch building, and fire shelter, the air base is a vital operational center. However, to ensure operational efficiency and reliability, special attention to the construction and development of its facilities is required.

The construction work to improve the infrastructure and sarpras of Yohanis Kapiyau Airbase is carried out by the implementing contractor PT Surya Manunggal Wisesa with an initial contract value of Rp118,611,726,000.00 (TRAK/417/III/2024/PUSKON PDN) with an implementation period of 240 calendar days, starting from April 22, 2024 to December 17, 2024. To maintain quality, the Ministry of Defense of the Republic of Indonesia appointed a supervisory consultant PT Binamitra Bangunsarana Pratama (TRAK/418/III/2024/PUSKON PDN).

Obstacles often occur in the implementation of construction work. At the start of the contract, work cannot begin immediately because working drawings or Detail Engineering Design (DED), cost budget plans, and S-curves have not been finalized. This obstacle causes the contractor to use personal funds without certainty of payment. Weather conditions were also a major obstacle. In the second month of construction, work was interrupted by rain throughout the day, and construction materials had to wait for shipments. In addition, site measurement and clearance were hampered by the lack of a final RAB from the MoD center in Jakarta.

In the third month, the project started to catch up with the delay, but the deviation remained high at week 25 with minus -12.1139%. Other obstacles included terror threats from the Armed Criminal Group (KKB) who want Papuan independence. The Earned Value Method (EVM) concept is an effective project performance control method. It enables the assessment of project duration, required cost, and estimated project completion based on planned progress, realized progress, and actual cost (Tariq et al., 2020). In the construction industry, this method is relevant for duration prediction and project management decision-making.

This research aims to optimize the performance of construction projects at Yohanis Kapiyau Airbase so that the work can be completed on time, meet quality standards, and in accordance with the predetermined budget. The results of the research are expected to fulfill the agreement in the executor's work contract, prevent losses, and ensure that the infrastructure built can support the economy of the surrounding community and advance Papua like other regions in Indonesia. This research raises several key questions, namely

how the project cost performance based on *Cost Variance* (CV) and *Cost Performance Index* (CPI) indicators, how the project time performance based on *Schedule Variance* (SV) and *Schedule Performance Index* (SPI) indicators, and how much is the estimated total cost and duration required to complete the project. To answer these questions, this study aims to analyze project cost performance through CV and CPI indicators, analyze project time performance using SV and SPI indicators, and estimate the cost and time of project completion based on actual performance data. With the achievement of these objectives, the results of this study are expected to be a reference in improving the management of construction projects in the future.

Literature Review

Definition of Earned Value and its Application in Project Performance

Earned Value Management (EVM) is a project control method used to measure cost and schedule performance in an integrated manner. This concept involves calculating indicators such as Planned Value (PV), Earned Value (EV), and Actual Cost (AC) to identify deviations and evaluate the efficiency of project performance (Mahapatni et al., 2019). In the context of the case study of Infrastructure & Infrastructure Improvement of Yohanis Kapiyau Airbase, this method becomes an important tool to analyze the achievement of cost and time targets that are influenced by the conflict-prone project location and dependence on materials outside Papua.

Influence of Cost and Time Performance Variables in Projects

Cost performance is often measured by the Cost Performance Index (CPI) which shows the efficiency of budget utilization. A CPI value > 1 indicates the actual cost is less than the plan, so the project is considered efficient (Setyagraha et al., 2024). Meanwhile, time performance is measured through the Schedule Performance Index (SPI). SPI > 1 indicates schedule acceleration, but SPI < 1 indicates delay, as seen in previous projects, including the Kayuagung-Palembang-Betung Toll Road case study, where SPI < 1 indicates a 5.8% delay from plan.

Relevance of Earned Value Theory to Previous Research

The Earned Value Method has been widely applied in past studies to measure the performance of construction projects, ranging from road preservation to building construction. For example, research by Borges & Asa (2023) showed that the use of EVM can ensure the project goes according to plan without additional costs. Other research such as that conducted by Setiawan & Ihsan (2023) emphasizes the need to accelerate work on the critical path to minimize delays. These findings are relevant to the case study of Lanud Yohanis Kapiyau, given its unique geographical and logistical conditions.

Implications of Project Control Based on EVM Method

The Earned Value method not only provides an overview of the project status, but also helps predict the final cost requirement (Estimate at Completion, EAC) and completion time (Estimate to Complete, ETC). Research by Mahapatni et al. (2019) highlights the importance of these predictions for managerial decision-making. In the Lanud Yohanis Kapiyau project, EVM-based control can help identify critical areas such as material procurement and weather factors that can affect schedule and cost. This research takes the approach of previous studies to evaluate the Yohanis Kapiyau Airbase Infrastructure & Infrastructure Improvement project. Using EVM indicators such as CV, SV, CPI, and SPI, this study aims to provide a comprehensive overview of the project's performance status amidst the unique challenges faced, such as logistics and security in Papua.

Construction project management involves managing time, cost, and quality simultaneously to achieve project success according to predetermined goals. One approach that is often used to monitor project performance in an integrated manner is the Earned Value Management (EVM) method. EVM integrates three main indicators, namely Actual Cost (ACWP), Budgeted Value of Work Performed (BCWP), and Budgeted Cost Under Schedule (BCWS). From these indicators, cost efficiency (CPI), schedule efficiency (SPI), and cost (CV) and schedule (SV) deviations can be calculated. With EVM, project implementers can detect potential delays or cost overruns and take corrective steps early.

Previous research shows that the application of EVM yields deep insights into project efficiency and performance. However, a common problem encountered is schedule and cost mismatches due to external factors such as material availability, geographical conditions, and operational constraints. Therefore, it is necessary to conduct an in-depth analysis to assess the ongoing project performance and predict the end result.

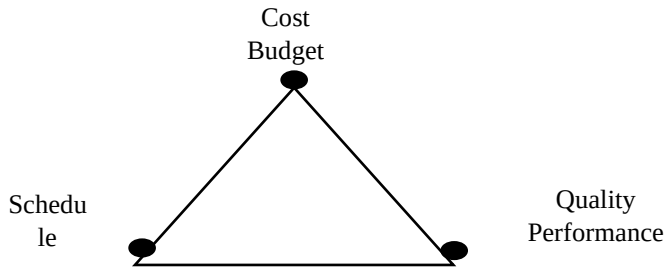

Figure 1: Cost, Time and Quality Relationship of the triple contrain triangle
Source: Setyagraha, 2024

- **H1**: There is a positive relationship between higher Earned Value (EV) than Actual Cost (AC) and efficient project cost performance (CPI > 1).
- **H2**: There is a significant relationship between Schedule Performance Index (SPI) values greater than 1 and project schedule acceleration.
- **H3**: Project control using the Earned Value method can minimize cost and schedule deviations on the Yohanis Kapiyau Airbase Infrastructure and Infrastructure Improvement project.
- **H4**: The use of EVM predictive indicators (ETC and EAC) is able to provide accurate cost and completion time estimates for projects with geographical and logistical challenges.
- **H5**: Delay factors in the project are influenced by the mismatch of Planned Value (PV) with Earned Value (EV), which can be identified through negative Schedule Variance (SV).

Research Framework

The research began by determining the relevant research title and formulating the background of the problem to provide an understanding of the importance of the topic being discussed. Next, a literature review was conducted to review previous research as well as relevant research, which was then used to formulate research questions. From here, hypotheses are formulated based on supporting theories and literature. After that, research variables were determined that would be used as the basis for answering research questions and testing hypotheses. All variables and data that have been determined are

directed to be processed and analyzed at the next stage. In the analysis stage, data is collected from various sources, such as the Cost Budget Plan (RAB), project schedule, weekly reports, and the actual cost of the project. This data is used to analyze project performance using the Earned Value Management (EVM) method. The performance analysis consists of three main parts: cost and schedule analysis involving Planned Value (PV), Earned Value (EV), and Actual Cost (AC); variance analysis including Cost Variance (CV) and Schedule Variance (SV); and performance index analysis in the form of Cost Performance Index (CPI) and Schedule Performance Index (SPI). The results of this analysis are used to estimate the final cost and time of the project, such as Estimate to Schedule (ETS), Estimate at Schedule (EAS), Estimate to Complete (ETC), and Estimate at Completion (EAC). The final stage of the research includes the presentation of the analysis results which include the CV, SV, CPI, SPI, ETS, EAS, ETC, and EAC values. Based on these results, conclusions were drawn to answer the research objectives, and suggestions were given as recommendations for future project management improvements. The overall process of this research provides a thorough insight into project performance and the steps required to achieve time and cost efficiency.

The urgency of this research lies in the critical need to improve the performance of infrastructure development projects in regions like Papua, where logistical challenges and geographical constraints often lead to delays and cost overruns. Given the strategic importance of Yohanis Kapiyau Airbase for national security and regional connectivity, ensuring the timely and cost-efficient completion of its development is essential for advancing local economic growth and strengthening national infrastructure.

The research gap stems from the limited application of Earned Value Method (EVM) in Indonesian construction projects, particularly in conflict-prone and geographically challenging areas like Papua. While EVM has been widely used globally to monitor cost and schedule performance, its implementation in such unique contexts remains underexplored. Additionally, there is a lack of studies integrating EVM with local project management practices to address region-specific obstacles, such as security risks and material procurement delays.

The novelty of this study lies in its application of EVM to evaluate project performance in a high-stakes, logistically complex setting. By employing key indicators such as Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), and Schedule Performance Index (SPI), the research demonstrates how EVM can provide actionable insights for improving project management. This approach bridges the gap between theoretical frameworks and practical solutions tailored to the unique conditions of infrastructure projects in remote regions.

The study aims to analyze the performance of the Yohanis Kapiyau Airbase infrastructure project using EVM, with the goal of identifying strategies to optimize time and cost efficiency. The findings are expected to benefit project managers, policymakers, and contractors by offering a robust framework for monitoring and decision-making. This research contributes to the advancement of infrastructure development practices in Indonesia, ensuring projects in challenging environments are completed efficiently and effectively.

Research Methods

This research uses a project performance analysis approach with the Earned Value Management (EVM) method. The data used in this research are secondary and primary. Secondary data includes the Cost Budget Plan (RAB), project implementation schedule

(time schedule), weekly project reports, and actual cost data. Primary data was obtained through field surveys, interviews with implementing contractors, as well as collecting information on the price of goods, workers' wages, and tool rental costs. Data collection procedures were carried out by referring to relevant sources such as weekly and daily reports published by the implementing contractor. Data analysis techniques involved the calculation of Planned Value (PV), Earned Value (EV), and Actual Cost (AC) to determine cost (Cost Variance - CV and Cost Performance Index - CPI) and schedule (Schedule Variance - SV and Schedule Performance Index - SPI) performance indicators. Estimation of the final cost and time of the project is done by calculating Estimate To Complete (ETC) and Estimate At Completion (EAC). The research steps start from setting the background, collecting data, analyzing data, to drawing conclusions related to project performance.

Population and Sample

The population in this study is a development project that uses the Earned Value Management approach, specifically the Yohanis Kapiyau Airbase Infrastructure Improvement Project in Timika in the 2023/2024 fiscal year. The research sample was purposively selected, namely the building construction project carried out by PT Surya Manunggal Wisesa as the implementing contractor and PT Binamitra Bangun Sarana as the supervisory consultant. The selection of this sample is based on the suitability of the available data, relevance to the analysis method applied, and the scope of the project that meets the research criteria. The data collected includes aspects of cost, time, and work progress to support project performance analysis.

Results and Discussions

Results

The Yohanis Kapiyau Airbase Infrastructure and Sarpras Improvement Project is managed with the Earned Value Management (EVM) approach, which is a method of analyzing project performance based on time and cost indicators. Up to week 25, the data shows that the Planned Value (PV) of the project is IDR 62,621,502,489.57. This value represents the budget allocated for the work that should have been completed in that week. However, the Earned Value (EV), which represents the cost of the work completed, stood at IDR 49,655,551,634.79. This resulted in a Schedule Variance (SV) of -Rp 12,965,950,854.78, indicating a delay in project implementation.

Table 1. Planned Value

Sunday	Plan Weight (%)		Budget (Rp)	*Planned Value* (Rp)	
To	Weight	Cumulative		Plan	Cumulative
1	0,0436	0,0436	106.857.410.810	46.578.131,87	46.578.131,87
2	0,044	0,087	106.857.410.810	46.578.131,87	93.156.263,74
3	0,188	0,275	106.857.410.810	201.111.778,77	294.268.042,51
4	0,304	0,579	106.857.410.810	324.738.696,29	619.006.738,80
5	0,333	0,912	106.857.410.810	355.645.425,67	974.652.164,47
6	0,390	1,302	106.857.410.810	417.095.415,87	1.391.747.580,34
7	0,218	1,520	106.857.410.810	232.949.155,57	1.624.696.735,91
8	0,262	1,783	106.857.410.810	280.180.131,15	1.904.876.867,05
9	0,546	2,328	106.857.410.810	583.227.748,21	2.488.104.615,26
10	0,396	2,725	106.857.410.810	423.369.061,63	2.911.473.676,89

Source Processed by Researchers 2024

In terms of cost, the Actual Cost (AC) value was recorded at IDR 40,195,101,488.78. The difference between EV and AC resulted in a positive Cost Variance (CV) of Rp 9,460,450,146.01. This means that the actual costs incurred are lower than the budget allocated for the completed work. The PV, EV, and AC comparison chart shows that up to week 25, although the project cost is lower than the budget, the project time performance is still lagging behind the plan.

Table 2. Earned Value

Sunday	Progress		Budget (Rp)	*Earned Value*	
to	Realiasai	Komulatif		Realization (Rp)	Cumulative (Rp)
1	0,147	0,14752	106.857.410.810	157.641.248,16	157.641.248,16
2	0,101	0,248	106.857.410.810	107.630.671,32	265.271.919,48
3	0,362	0,462	106.857.410.810	386.569.038,78	494.199.710,10
4	0,278	0,640	106.857.410.810	296.946.526,62	683.515.565,40
5	0,548	0,826	106.857.410.810	585.321.685,74	882.268.212,36
6	0,257	1,083	106.857.410.810	274.570.117,08	1.156.838.329,44
7	0,172	1,254	106.857.410.810	183.367.316,95	1.340.205.646,39
8	0,254	1,508	106.857.410.810	271.417.823,46	1.611.623.469,85
9	1,367	2,875	106.857.410.810	1.460.740.805,78	3.072.364.275,63
10	4,330	7,205	106.857.410.810	4.626.498.458,46	7.698.862.734,10
11	2,081	9,285	106.857.410.810	2.223.275.289,33	9.922.138.023,43
12	1,528	10,814	106.857.410.810	1.633.101.809,42	11.555.239.832,85
13	0,836	11,649	106.857.410.810	893.007.382,15	12.448.247.214,99
14	1,273	12,923	106.857.410.810	1.360.401.697,03	13.808.648.912,03
15	1,464	14,387	106.857.410.810	1.564.606.209,09	15.373.255.121,12
16	3,831	18,218	106.857.410.810	4.093.644.812,95	19.466.899.934,07
17	4,221	22,438	106.857.410.810	4.509.993.394,77	23.976.893.328,84
18	0,989	23,427	106.857.410.810	1.056.592.080,24	25.033.485.409,08
19	3,198	26,625	106.857.410.810	3.416.836.789,24	28.450.322.198,33

Source: Processed by Researchers, 2024

In the SPI (Schedule Performance Index) and CPI (Cost Performance Index) graphs, it can be seen that the SPI value at week 25 is below 1, i.e. 0.7929, which indicates project delay. In contrast, the CPI was above 1, i.e. 1.2354, indicating that the project was more cost efficient. In other words, although the work has not been completed as scheduled, the cost expenditure is still under control. This value also indicates that the project cost management is running well despite the time delay.

Table 3. Comparison of PV, EV, and AC

Week to	*Planned Value* (Rp)	*Earned Value* (Rp)	*Actual Cost* (Rp)
1	46.578.131,87	157.641.248,16	-
2	93.156.263,74	265.271.919,48	3.546.297.162,08
3	294.268.042,51	494.199.710,10	3.546.297.162,08
4	619.006.738,80	683.515.565,40	3.546.297.162,08
5	974.652.164,47	882.268.212,36	3.546.297.162,08
6	1.391.747.580,34	1.156.838.329,44	3.546.297.162,08

Source: Processed by Researcher, 2024

The calculation results also show that the project is projected to require an additional time of approximately 17 days to complete the entire work. This estimate is calculated based on the SPI at week 25 with the assumption that the speed of work remains consistent. In addition, the final project cost is estimated at IDR 99,187,494,986.54, lower than the initial contract value of IDR 106,857,410,810.81. This provides a positive indication that the project can be completed with significant cost efficiency. The results of the analysis showed that the main constraint of the project was the delay in implementation time. However, the cost efficiency achieved shows that the budget management is on track. With acceleration strategies, such as additional working hours and prioritization of work that does not depend on material delivery, the project is expected to reduce the delay.

Analysis

Project performance analysis based on the Earned Value Management (EVM) method provides a clear picture of cost efficiency and implementation time. In this project, Planned Value (PV), Earned Value (EV), and Actual Cost (AC) are compared to quantitatively evaluate project performance. Based on the data up to week 25, a higher PV value than EV indicates that the project is not running according to the planned schedule. This is reflected in the negative SV value of -Rp 12,965,950,854.78. This negative SV value indicates that less work was completed compared to the original plan.

Table 4. Time Performance Index (SPI) and Cost Performance Index (CPI)

Week	*Planned Value*	*Earned Value*	*Actual Cost*	SPI	CPI
1	46.578.131,87	157.641.248,16	-	3,3844	#DIV/0!
2	93.156.263,74	265.271.919,48	3.546.297.162,08	2,8476	0,0748

Source of Researcher's Process, 2024

In addition, the cost performance analysis shows better results. The positive CV value of Rp 9,460,450,146.01 indicates that the actual cost is less than the budget of the completed work. This means that the project is running with good cost efficiency. Analysis of the CPI value of 1.2354 reinforces these results, indicating that every Rp 1 spent provides greater value than the work produced.

However, the project's main problem was time performance. With an SPI value of 0.7929, the project is running behind schedule. The cause of the delay could be material delivery constraints, sub-optimal coordination, or limited resources in the field. This also has an impact on the estimated completion of the project, which requires an additional 17 days from the original schedule. This obstacle can be overcome by carrying out acceleration strategies, such as increasing working hours or prioritizing work for which materials are already available.

The conclusion of this analysis is that although the project experienced time delays, the cost efficiencies achieved provided positive value to the project management. With proper re-planning and mitigation strategies, the time performance of the project can be improved.

Model Test

The analysis model used in this project is Earned Value Management (EVM), which integrates cost and time aspects to evaluate project performance. This model provides three main indicators: Planned Value (PV), Earned Value (EV), and Actual Cost (AC). The data obtained shows that the model is effective in identifying time delay and cost efficiency issues on projects.

Model tests were conducted by comparing PV, EV, and AC for each week of project implementation. The test results show that up to week 25, the EV value is below the PV, which indicates delay. However, the lower value of AC compared to EV indicates cost efficiency. The comparison graph of PV, EV, and AC provides a clear visualization of the project performance position at each week.

In addition, SPI and CPI indicators are used to evaluate time and cost performance more specifically. SPI values below 1 indicate that the project is not running on schedule, while CPI values above 1 indicate cost efficiency. The model was also used to project the time and cost of project completion. The projection results show that the project will take an additional 17 days, with an estimated final cost of IDR 99,187,494,986.54, which is lower than the initial contract value.

Model tests show that EVM is an effective tool for evaluating project performance. The model not only provides an overview of the current performance but also projects the final outcome of the project, thus enabling better decision-making.

Testing Results

The project performance test results showed that up to week 25, the SPI value was 0.7929, indicating that the project was running behind schedule. Meanwhile, the CPI value of 1.2354 indicates cost efficiency, with actual expenditure being lower than the budget for the completed work. From this data, it can be concluded that the project is facing time delay issues, but cost management is going well.

Table 5. Schedule Variance (SV) and Cost Variance (SV)

Sunday	*Schedule Variance (SV*	Description	*Cost Variance (SV)*	Description
1	111.063.116,29	Positive	157.641.248,16	Positive
2	172.115.655,74	Positive	-3.281.025.242,61	Negative
3	199.931.667,60	Positive	-3.052.097.451,98	Negative
4	64.508.826,60	Positive	-2.862.781.596,68	Negative

Source: Processed by Researchers, 2024

Tests were also conducted on the estimated time and cost of project completion. Based on the SPI value, the project completion time is estimated to require an additional 17 days from the original schedule, bringing the total time required to 257 days. Meanwhile, the estimated final project cost of Rp 99,187,494,986.54 was lower than the contract value, indicating significant cost efficiency. The results of this test provide a clear picture of the project conditions. Despite time constraints, cost efficiency has a positive impact on project performance.

Hypothesis Test

Hypothesis testing is carried out to evaluate whether the project performance is in accordance with the original plan. Based on the test results, the hypothesis that the project can be completed on schedule is rejected. This can be seen from the SPI value which is consistently below 1, indicating a delay in implementation time. However, the hypothesis that the project can be managed with cost efficiency is accepted, as the CPI value is always above 1. These results show that the main constraint of the project is time performance, while cost management is going well. With appropriate mitigation strategies, such as work acceleration and resource optimization, time delays can be reduced.

Discussion

The discussion of the results shows that the main constraint of this project is time delay. This was caused by several factors, such as delayed material delivery, limited resources in the field, and less than optimal coordination. Nonetheless, the cost efficiency of the project gave a positive value to budget management. The CPI value, which was always above 1, showed that the actual expenditure was less than the budget for the completed work.

To overcome time constraints, several strategies can be applied, such as increasing working hours, prioritizing work for which materials are already available, and improving coordination between related parties. With these strategies, the project is expected to reduce delays and approach the target completion time.

This discussion shows that although the project faced time constraints, cost efficiency provided positive value to project performance. With proper re-planning and mitigation strategies, the project has the opportunity to achieve optimal results.

Conclusion

Based on the analysis that has been done, it can be concluded that the cost performance of the Yohanis Kapiyau Timika Airbase Infrastructure and Facilities Improvement project shows good results with a CPI value of more than 1. However, the time performance at week 25 monitoring shows unsatisfactory results, characterized by an SPI value of less than 1 and a negative Schedule Variance, which indicates a delay from the planned schedule. The estimated cost until project completion is Rp. 14,756,485,176.51, with a total estimated overall cost of Rp. 99,187,494,986.54. Meanwhile, the estimated project completion time is 82 calendar days from now, with a total duration of 257 days, or 17 days longer than the planned schedule.

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