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ANALYSIS OF COST AND TIME CONTROL ON THE LIBRARY CONSTRUCTION PROJECT OF THE POLICE TRAINING USING THE EARNED VALUE

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ABSTRACT

In a construction project, the factors that become indicators of the success of a project are that it must be cost, time and quality that can be achieved by planning, scheduling, and controlling its implementation properly. The method used to analyze data regarding cost control and project implementation time so that it can be effective and efficient is to use the concept of the value of the results (Earned Value Concept). From the data that has been obtained, the next step is to calculate the work weight for each item. Then an analysis of cost and time control is carried out using several approaches, namely: BCWS, BCWP and ACWP. The results of project data processing use the analysis calculation of the result value method. From the calculation of the Schadule Variance (SV) the work accelerates 1 week from the predetermined schedule. the total schedule/schedule 17 weeks of work and the results of the calculation on the 17th week is 2,710,716.28. Showing a positive number, this indicates that the implementation of the work is faster than the planned schedule. From the results of the calculation of Cost Variance (CV) the work has accelerated by 1 week from the predetermined schedule. week 17 is 2,011,321,591.90. Showing a positive number, this indicates that the cost to complete the project is less than the planned cost. The calculation result of the Schedule Performance Index (SPI) that the work has accelerated 1 week from the predetermined schedule. In week 1 to week 17 of 1.00, it shows that the project was carried out on time. The results of the calculation of the Cost Performance Index (CPI) of work accelerated by 1 week from the predetermined schedule. In the 1st week to the 17th week of 1.00 indicates that the work in the field costs in accordance with the planned budget

Keywords: *Cost and Time Control Analysis, With the Concept of Value Results*

1. PRELIMINARY

Background

The success of a construction project is often indicated by its timely completion, which can be achieved through proper planning, scheduling, and execution control. A construction process encompasses all activities within the project life cycle, making it essential to monitor and control its implementation. Effective control ensures that the work is completed on time.

Time and cost control in a project are crucial to ensure that the project can be completed within the planned timeframe and budget (Aziza, 2020). In field implementation, it is not uncommon to encounter projects that experience delays in completion or even suspension of execution. Therefore, effective control is necessary to address any deviations, ensuring that the project is completed on schedule and meets the planned quality standards.

The success of a project is inseparable from a series of activities encompassing the stages of planning, implementation, and supervision to achieve the predetermined objectives. To ensure the success of a construction project, effective management techniques or methods are required to enhance efficiency, productivity, and work quality. In line with this, supervision and control actions must be carried out across all sectors, particularly time control, to ensure the project is completed on schedule or even earlier than the planned timeframe.

During project implementation, planning and control are the most critical functions for achieving project success. Planning serves as the foundation for ensuring the efficiency and effectiveness of the resources to be utilized throughout the project execution. Without proper planning, it is almost certain that the project will not proceed as expected. Projects are constrained by costs, time, and resources, making it essential to develop a plan that allocates these limitations to each task within the project. Based on the prepared plan, the project implementation is expected to align with the plan and achieve its objectives.

During project execution, control is required, particularly regarding time, to ensure adherence to the plan. In the construction project of the Sepolwan Library, deviations or delays that may occur have not yet been identified.

2. LITERATURE REVIEW

Library

A library is a room or building used to store books and other publications, which are usually arranged in a specific order for use by readers, not for sale. (Prof. Sulistyo Basuki, 2020).

Project Management

Project management is the process of planning, scheduling, managing resources, analyzing needs, designing, and testing to achieve the objectives and goals of a project. Without project management, it would be difficult to complete a project within the given time. Therefore, project management is necessary to eliminate limitations and obstacles in project development and to achieve the project's objectives. (Vidianto, Agung Sirajuddin; Haji, Wachyu).

Time Management

Time management is the planning, organizing, directing, and monitoring of time productivity. Time management aims at productivity, which means the ratio of output to input. It may seem and feel like wasting time by following management functions in managing time. However, planning time usage in advance is not a waste; rather, it provides guidelines, direction, and even control over time. (Mochtar, Benny, 2019).

Project Control

Control can be defined as a systematic effort to establish standards that align with planning objectives, compare actual performance with these standards, design information, analyze the possibility of taking corrective actions, and ensure that resources are used efficiently and effectively to achieve the project's goals.

Cost Management

Cost management is the process of finding and executing a project or task in the right way. In short, cost management plays a role in covering the entire project cycle, from the planning stage to measuring actual cost performance and project completion (Rusdiono, 2020). A budget is more like a financial forecast for the company for the upcoming period, whereas cost management focuses on managing the company's finances for the strategies to be implemented in the future. There are four main stages required in the project cost management process: resource planning, cost estimation, cost budgeting, and cost control. The actual design must provide information that is both financial (revenue and costs) and non-financial (quality and productivity) for the organization's management to identify various improvement opportunities, strategic planning, and operational decision-making regarding the procurement and use of resources needed by the organization (Rio, Qofi, 2020).

Cost Control

Cost control is a systematic effort to establish standards that align with planning objectives (Bertinus, Simanihuruk, 2022). The control function is carried out in all types of organizations, both commercial and non-commercial. The control function compares the organization's performance with established standards, identifies deviations, and makes efforts to take corrective actions. Cost control is the final step in the project cost management process, which aims to ensure that costs and expenditures align with the planned budget. The goal of cost control is to prevent project costs from exceeding the budgeted amount. Therefore, cost control is crucial to ensure the project runs smoothly and continuously.

Time Control

Timeliness is at the core of project management. Scheduling often becomes a key factor in project management. The primary goal of scheduling is to allocate resources so that the overall project objectives are achieved within a reasonable and predetermined timeframe. In general, scheduling involves assigning time periods for specific tasks in the work schedule. The availability of resources, time constraints, levels of importance, required performance levels, priority requirements, work priorities, technical constraints, and others complicate the scheduling process. Assigning tasks to specific points in time does not always guarantee that those tasks will perform satisfactorily according to the schedule. As a result, careful control must be developed and maintained throughout the scheduling process.

3. RESEARCH METHODOLOGY

Research Design, Location, and Time of Research

The time for this research was conducted only up to the 17th week of the total project completion time.

Population

Population is a generalization area that consists of objects/subjects with specific qualities and characteristics set by the researcher to be studied and from which conclusions are drawn (Sugiyono, 2015:80). In this study, data is collected from both primary and secondary sources. The primary data is obtained from the project, including the project's master schedule, daily project reports, and the budget plan

(RAB). Secondary data is obtained through direct interviews on-site with various parties, including the contractor.

Sampel

According to Sugiyono (2015:215), a sample is a part of the population. In this study, the sample consists of a portion of the entire population of consumers at the University of Abdurachman Saleh Situbondo. The sampling method used in this research is purposive sampling, where the researcher intentionally selects members of the population who are considered to provide the necessary information or are appropriate according to specific criteria desired by the researcher (Sugiyono, 2015:217). The criteria used by the researcher are individuals or groups directly involved and contacted. Data is collected from primary data (Master project schedule, daily project reports, and budget plans (RAB)) and secondary data obtained through direct interviews with the contractor.

Identification of Variables

A variable is something that is studied and has varying values. Research variables are attributes, characteristics, or aspects of people or objects that have certain variations determined by the researcher to be studied and from which conclusions are drawn (Sugiyono, 2015:138). In this study, the variables are as follows:

a. Independent Variable (X)

   Dalam penelitian ini variabel bebasnya adalah: Pengendalian biaya dan waktu

b. Dependent Variable (Y)

   In this study, the dependent variable is the construction project of the Sepolwan Library at the Lemdiklat Polri, using the earned value method.

Types and Sources of Data

1. Primary Data

   Primary data is data that comes directly from respondents. In this study, the primary data is obtained from the project schedule, daily project reports, and the Budget Plan (RAB).

2. Secondary Data

   Secondary data is data obtained indirectly, either in the form of information or literature related to the research, which complements or supports the primary data. In this study, secondary data is obtained through direct interviews with the contractor.

Data Collection Methods

1. Observation
2. Interview
3. Literature Studyudy Pustaka
4. Documentation

Research Diagram

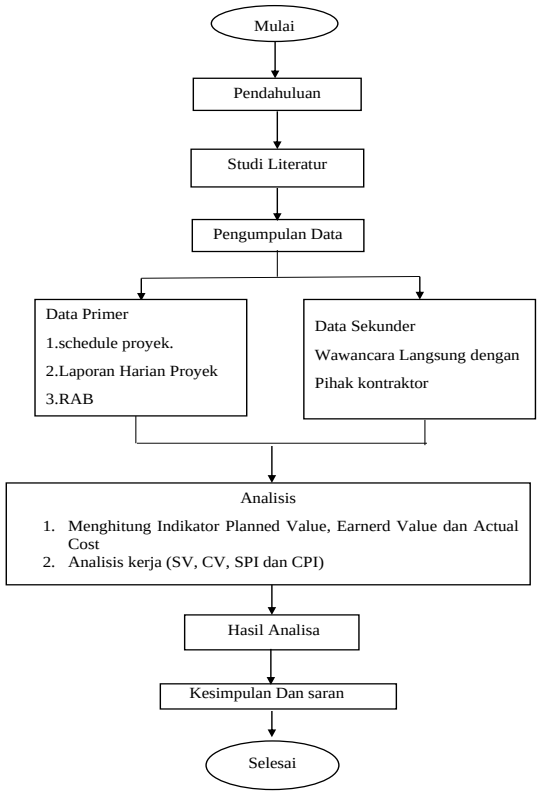


Figure 1. Research Flowchart

Data Analysis Methods

1. Analysis Budgeted Cost of Work Schedule (BCWS)

   BCWS = (% Weight of the Plan) × (BAC)

   Keterangan :
   BCWS : Budget Cost of Work Schedule
   BAC : Budgeting at Completion

2. Analysis Budget Cost of Work Perfomance (BCWP)

   Analysis of the amount of costs incurred according to the work completed (BCWP).

   BCWP = (%Actual Weight x (BAC)

   Keterangan :
   BCWP : Budget Cost of Work Performed
   BAC : Budgeting At Completion

3. Calculation of Actual Cost of Performance (ACWP)

   ACWP is obtained from the actual budget amount used for activities that have been implemented.

4. Calculation of Schedule Variance (SV)
   The author performed SVM calculations to determine the deviation between the BCWP and BCWS values. which were implemented more than planned.

   SV = BCWP – BCWS

   Where :
   SV: Schedule Variance
   BCWS : Budget Cost of Work Schadule
   BCWP : Budget Cost of Work Performed

   SV = 0 : on-time project.
   SV > 0 : quick project.
   SV < 0 : delayed project.

5. Calculation of Cost Variance (CV)
   The author performs a CV calculation to determine whether the project being worked on is still within budget or has exceeded the budget.

   CV = BCWP – ACWP

   Where :
   CV : Cost Variance
   BCWP : Budget Cost Of Work Performed
   ACWP : Actual Cost Of Work performed

   CV = 0 : The cost is in line with the planned budget.
   CV > 0 : The cost is lower/economical.
   CV < 0 : The cost is higher/wasteful.

6. Calculation of Schedule Performance Index (SPI)
   The author performs the SPI calculation to compare the weight of work on-site with the planned schedule. If the SPI value = 0, the project is on time; if the SPI value < 1, the project progress is behind the planned schedule. Conversely, if the SPI value > 1, the project progress is ahead of the scheduled time.

   SPI = BCWP/BCWS

   Where :
   SPI : Schedule Performance Index
   BCWP : Budget Cost of Work Performed
   BCWS : Budget Cost of Work Schedule

   SPI = 1 : The cost is in line with the planned budget.

SPI > 1 : The cost is lower/economical
SPI < 1 : The cost is higher/wasteful.

7. Calculation of Cost Performance Index (CPI)

   The author performs the CPI calculation by comparing the value of the physical work completed (BCWP) with the actual cost incurred during the same period (ACWP).

   CPI = BCWP/ACWP

   Where:
   CPI : Cost Performance Index
   BCWP : Budget Cost Of Work Performed
   ACWP : Actual Cost Of Work performed

   CPI = 1 : The cost is in line with the planned budget.
   CPI > 1 : The cost is lower/economical
   CPI < 1 : The cost is higher/wasteful.

4. RESEARCH RESULTS AND DISCUSSION

Project Organizational Structure

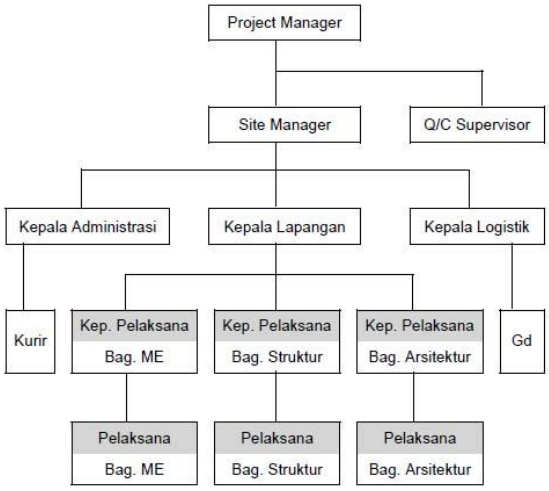


Figure 2. Project Organizational Structure.

Analysis of Budgeted Cost of Work Scheduled (BCWS)

Analysis of Budgeted Cost of Work Schedule (BCWS) is a combination of time and cost, typically used as a target or baseline in planning. This analysis is performed on the budget that has been prepared in the planning phase, which will later be implemented during execution. BCWS can be calculated by multiplying the cumulative percentage of planned progress each week by the total project budget (BAC). The BCWS calculation based on field data for 18 weeks is as follows:

1. 22 November – 28 November

   BCWS = % Bobot Rencana x Anggaran

   = 7,251 % Rp. 4.318.695.000,00

   = Rp 313.148.574,45

2. 29 November – 5 Desember

   BCWS = % Bobot Rencana x Anggaran

   = 19,401% x Rp. 4.318.695.000,00

   = Rp 837.870.016,95

3. 5 Desember – 12 Desember

   BCWS = % Bobot Rencana x Anggaran

   = 24,973% x Rp 4.318.695.000,00

   = Rp 1.078.507.702,35

The result of the Budgeted Cost of Work Schedule (BCWS) analysis shows that the installation work of the sewer pipeline network was completed 1 week ahead of the scheduled timeline. The total project schedule was 18 weeks, but by week 17, the work was already completed.

From the results, it can be seen that by week 1, activities were already underway, so the weight (value) was already assigned. The increase in BCWS value each week indicates that the planned expenditure for each week has increased. The calculation is carried out from week 1 to week 17.

Analysis of Budget Cost of Work Performance (BCWP)

Analysis of Budgeted Cost of Work Performed (BCWP) is the total budgeted cost up to a certain period, based on the actual work completed. It represents the cost incurred according to the work that has been finished. The BCWP value per month is obtained based on the schedule data reflecting the progress of the work. The BCWP calculation based on field data for 26 weeks is as follows:

1. 22 November – 28 November

   BCWP = %Bobot Aktual x Anggaran

   = 7,25% x Rp 4.318.695.000,00

   = Rp 313.148.574,45

2. 29 November – 5 Desember

   BCWP = % Bobot Aktual x Anggaran

   = 19,66% x Rp 4.318.695.000,00

   = Rp 849.098.623,95

3. 6 Desember – 12 Desember

   BCWP = % Bobot Aktual x Anggaran

   = 25,23% x Rp 4.318.695.000,00

   = Rp 1.089.649.935,45

The results of the Budget Cost Of Work Performance (BCWP) Analysis calculation, in the work of installing wastewater network pipelines, were 1 week faster than the predetermined schedule. With a total schedule of 18 weeks of work, but in week 17 the work had been completed. From table 4.2 it can be seen that in week 1 there was an activity, so the weight was already there, the increase in the BCWP value every week means that the planned cost expenditure each week has increased. Calculation from week 1 to week 17.

Actual Cost of Performance (ACWP) Calculation Shows the actual budget for activities that have been implemented within a certain period of time. The ACWP value is obtained from the project's financial accounting data, where the data is taken from all weekly expenses.

1. 22 November – 28 November

   ACWP = % Bobot Kamulatif (ACWP) x Anggaran

   = 7,25 % x Rp 4.318.695.000,00

   = Rp 313.148.574,45

2. 29 November – 5 Desember

   ACWP = % bobot kamulatif (ACWP) x Anggaran

   = 12.4% x Rp 4.318.695.000,00

   = Rp 535.950.049,50

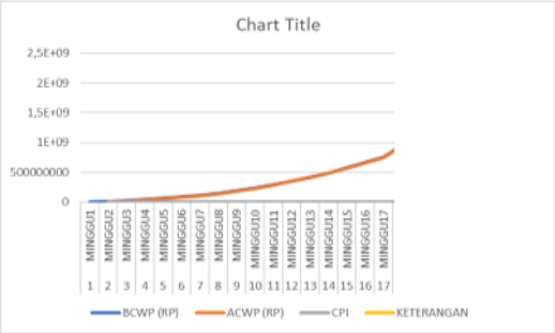
3. 6 Desember – 12 Desember

   ACWP = % bobot kamulatif (ACWP) x Anggaran

   = 45.29% x Rp 240.551.311,50

   = Rp 1.089.649.935,45

Table of Results of the Analysis of Actual Cost Work Performance (ACWP) Analysis, in the work of installing waste pipelines 1 week faster than the predetermined schedule. With a total schedule of 18 weeks of work period, but in week 17 the work has been completed. From table 4.3 it can be seen that in week 1 there were already activities then there were already expenditures, the increase in the ACWP value every week means that the planned expenditure of costs each week has increased. Calculation from week to week 17.



Calculation of Schedule Variance (SV)

Schedule Variance is used to determine whether the project being carried out is still

in accordance with the planned schedule or not.

1. 22 November – 28 November

   SV = BCWP – BCWS

   = Rp 313.148.574,45 – Rp 313.148.574,54 = 0

2. 29 November – 5 Desember

   SV = BCWP – BCWS

   = Rp 849.098.623,95 - Rp 837.870.016,95

   = Rp. 11.228.607

3. 6 Desember – 12 Desember

   SV = BCWP – BCWS

   = Rp 1.089.649.935,45 - Rp 1.078.507.702,35

   = Rp. 11.142.233,1

Where :

a. SV (+) Work is faster than the initial plan / implemented faster than the initial plan
b. SV (-) Less work was done than the initial project plan.

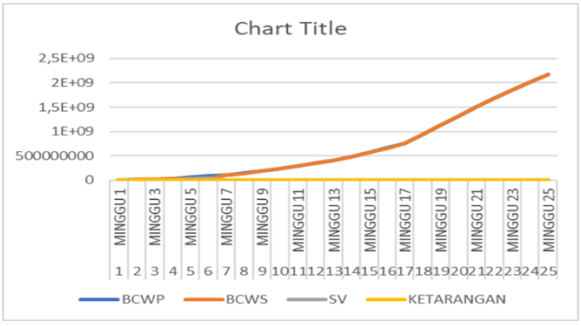


Figure 3. Weekly Schedule Variance (SV) Analysis Chart.

The results of the calculation of the Schedule Variance Analysis (SV), in the work of installing the wastewater network pipeline, were 1 week faster than the predetermined schedule. With a total schedule of 18 weeks of work, but in the 17th week the work was completed.

Cost Variance (CV) Calculation Analysis

1. 22 November – 28 November

   CV = BCWP – ACWP

   = Rp 313.148.574,45 – Rp 313.148.574,45

   = 0

2. 29 November –5 Desember

   CV = BCWP – ACWP

   = Rp 849.098.623,95 – Rp 535.950.049,50

   = Rp. 313.148.574,45

3. 6 Desember – 12 Desember

   CV = BCWP – ACWP

   = Rp 1.089.649.935,45 – Rp. 1.089.649.935,45

   = Rp. 0

Where :

a. If the CV value = 0 The project cost is as planned / Does not exceed the budget.
b. If the CV value < 0 The project cost is greater than planned / Exceeds the budget.
c. If the CV value > 0 The project cost is smaller than planned.

Based on the results of the Cost Variance (CV) analysis, the installation of the sewer pipeline network was completed 1 week ahead of the scheduled timeline. The total project schedule was 26 weeks, but by week 25, the work had already been completed. From Table 4.5, it can be seen that the CV value in week 1 is zero, indicating that the project cost is in line with the plan. From week 2 to week 25, the CV values are positive, which indicates that the costs are lower than the budgeted amount.

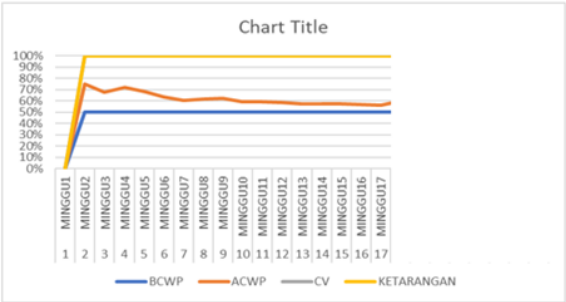


Figure 4. Weekly Cost Variance (CV) Analysis Chart

Calculation of Schedule Performance Index (SPI)

Schadul Performance Index (SPI) digunakan untuk membandingkan antara nilai pekerjaan yang telah di selesaikan secara fisik (BCWP) dengan rencana pengeluaran biaya yang dikeluarkam nerdasarkan rencana pekerjaan (BCWS).

Where :

a. If the SPI value = 1, The project is on schedule.
b. If the SPI value < 1, The project is behind schedule.
c. If the SPI value > 1, The project is on schedule.

Results of the Schedule Performance Index (SPI) Analysis In the installation of the sewer pipeline network, the project was completed 1 week ahead of the scheduled plan. The total schedule was 18 weeks, but by week 17, the work was already finished. From Table 4.6, it can be seen that the SPI values are as follows: In Week 1 and Week 2, the SPI value = 1, meaning the work was completed on time. From Week 3 to Week 9, the SPI value > 1, indicating that the work was progressing ahead of schedule. In Week 10, the SPI value = 1, meaning the work was on schedule. From **Week 11 to Week 17, the SPI value > 1, indicating that the work was completed faster than planned.

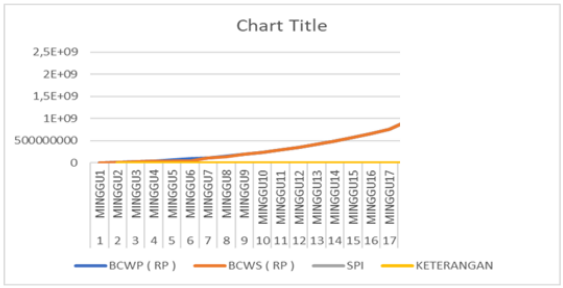


Figure 5. Weekly Schedule Performance Index (SPI) Analysis Chart

Calculation of Cost Performance Index (CPI)

The Cost Performance Index (CPI) is used to determine the financial situation of a project. If the value of CPI = 1, it means the costs are in line with the budget. If CPI < 1, it indicates the project is over budget (costs are higher than planned). If CPI > 1, it means the project is under budget (costs are lower than planned).

1. 22 November / 28 November

   CPI = BCWP / ACWP

   = Rp 313.148.574,45 / Rp 313.148.574,45

   = 1,00

2. 29 November / 5 Desember

   CPI = BCWP / ACWP

   = Rp 849.098.623,95 / Rp 849.098.623,95

   = 1,00

3. 6 Desember / 12 Desember

   CPI = BCWP / ACWP

   = Rp 1.089.649.935,45 / Rp 1.089.649.935,45

   = 1,48

Where :

a. If the value of CPI = 1, then the costs are in line with the budget.
b. If the value of CPI < 1, then the project budget is overspent.
c. If the value of CPI > 1, then the project budget is under budget.

The results of the calculation of the Schedule Performance Index (CPI) value analysis, in the work of installing wastewater pipelines, were 1 week faster than the predetermined schedule. With a total schedule of 18 weeks of work, but in week 17 the work had been completed. From table 4.7, the CPI value can be seen, in week 1 to week 17 the CPI value = 1, so the costs are according to budget.

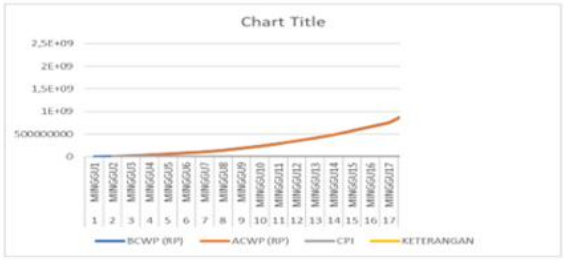


Figure 6. Weekly Schedule Performance Index (SPI) Analysis Chart

The results of the overall recapitulation of the calculation of the analysis of BCWS, BCWP, ACWP values, SV deviation values, CV and productivity or performance values of SPI, CPI.

For the calculation of the analysis of BCWS, BCWP, ACWP, there was progress with a total schedule of 18 weeks of work, but in the 17th week the work had been completed with the cost expenditure according to plan.

The SV deviation value is faster than the planned schedule, while the CV deviation value of the cost to complete the project is smaller than the planned cost.

The productivity or performance value of the Schedule Performance Index (SPI) that the project was implemented on time. And the productivity or performance value of the Cost Performance Index (CPI).

5. CONCLUSION AND RECOMMENDATIONS

Conclusion

a. Calculate the Schedule Variance (SV) of the work accelerated by 1 week from the specified schedule. With a total schedule of 18 weeks of work, but in week 17 the work has been completed. The calculation result in week 17 is 86,373.90. Showing a positive number, this indicates that the implementation of the work is faster than the planned schedule. The calculation result of the Schedule Performance Index (SPI) of the work accelerated by 1 week from the specified schedule. The calculation result in week 1 to week 17 of 1.00 indicates that the project was carried out on time. 2. From the calculation result of the Cost Variance (CV) of the work accelerated by 1 week from the schedule. With a total schedule of 18 weeks of work, but in week 17 the work has been completed. The calculation result in week 17 is 4,202,953,974.00. Showing a positive number, this indicates that the cost to complete the project is less than the planned cost. The calculation result of Cost Performance Index (CPI) of the work experienced an acceleration of 1 week from the predetermined schedule. The calculation result in week 1 to week 17 of 1.00 indicates that the cost is in accordance with the planned budget.

Recommendations

a. Accuracy of data such as the Cost Budget Plan (RAB), Time Schedule, daily reports and weekly reports of project implementation are required in order to correctly predict the working conditions of the project.
b. Project management must carry out strict and comprehensive supervision of cost and schedule control of the use of initial costs so that project implementation is within the planned time.

REFERENCES

[1] B.Sihite, Aron Aleksander. (2021). Analisis Pengendalian Biaya Dan Waktu Dengan Metode Nilai Hasil (Earned Value Method). Langkat Binjai: Universitas Sumatra Utara.

[2] Cakra Habibilah and Lava Himawan. (2019). Analysis of the Earned Value Concept on Cost and Time Control in the Hasibuan Gas Pipeline Bridge Relocation Project, Bekasi. Yogyakarta: Gadjah Mada University.

[3] Deden, M. (2016). Cost Management. Bandung: Siliwangi University.

[4] Mochtar, Benny. (2019, June). Analysis of Time Management Implementation in Environmental Road Construction Projects. Journal of Civil Engineering Science, 2.

[5] Muniroh, Ma'rifatul; Kempa, Meidy; , C.G Buyang. (2021, June). Cost and Time Control with Earned Value Concept. Symmetric Journal, 10 (Year 2021).

[6] Nasution, Muhammad Salam Harika. (2019). Analysis of the Application of Time Management in the Installation of Box Girder. Medan: University of North Sumatra.

[7] Putri, Nadya Karina. (2019). Information Systems Project Management Paper.

[8] Rifqi Auzan N, Daniar Rizky S, and Suharyanto. (2017). Project Cost and Time Control Using Earned Value Concept Method. Civil Engineering Work Journal, 6 (Year 2017), 460-470. Retrieved from http://ejournal-s1.undip.ac.id/index.php/jkts

[9] Rio, Qofi. (2020, August). Understanding Cost Management, Concepts and Benefits.

[10] Rusdiono. (2020, July). Understanding Cost Management, Concepts and Implementation Steps.

[11] Sanjaya, I Putu Ari. (2019). Cost and Time Control Using the Yield Value Method. Denpasar: Udayana University.

[12] Sanjaya, I Putu Ari. (2019). Pengendalian Biaya dan waktu dengan Metode Nilai Hasil Pada Proyek Pembangunan Reservoir. Denpasar: Universitas Udayana.

[13] Vidianto, Agung Sirajuddin; Haji, Wachyu Hari. (2020, April). Kanban-Based Project Management Information System. Journal of Information Technology and Computer Science, 7, 283-292.

[14] Dewita, Hikma. (2023, April) Cost and Time Analysis of Gateway Park Jati Cempaka Apartment Project Using the Yield Value Method.