

Sustainable Project Control of Jakarta Infracom Building Using Earned Value Analysis

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Abstract

Original Research Article

In the implementation of construction projects there is often a mismatch between the plan to the actual realization or conditions in the field, causing delays in implementation time which has an impact on the cost overruns of the planned budget. This study aims to evaluate and control the time and impact on costs in the Central Jakarta Infracom Office Building Project. The method used is the concept of value results (earn value analysis), the concept of calculating the amount of the budget in accordance with work completed so that it can be used to analyze performance time and cost of implementing the project. The method used in this study is quantitative descriptive, with data data used to include a budget plan with a value of Rp. 33,632,697,373, time schedule and weekly progress report, Results of control analysis in September 2018 period up to week 22, namely the indicator indicator value of BCWS Rp. 14,520,406,836, BCWP Rp. 14.169.455.403 and ACWP of Rp. 13,584,582,796. Project performance from a cost aspect with a CV value of Rp 584,872,607 with a CPI value of $1,043 > 1$ means that the cost is more economical than the budget, while the aspect of the schedule SV value is Rp (350,951,433) with SPI $0.98 < 1$ means experiencing delays. Predicting the cost required up to the end of Rp. 32,299,238,536 and predicting the time needed for 58 weeks, experiencing a delay of 6 weeks from the plan.

Keywords: Cost and time control, earned value analysis, performance project, evaluation, cost variance, project control, earn value management.

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INTRODUCTION PRELIMINARY

In the implementation of construction projects, there is often a mismatch between the plans and the actual conditions in the field, which causes delays in implementation time which results in cost overruns. The technical point of view is a measure of project success, related to the extent to which the three objectives, namely the cost, time and quality of a project can be met.

The concept of project management is basically based on several things, namely: (a) using the understanding of management based on its function, (b) short-term managed activities, with specific outlined goals, (c) using a system approach (*system approach to management*), and (d) has a horizontal hierarchy besides the vertical hierarchy. From some of the above opinions it can be concluded that project management is the process of planning, organizing, implementing, and controlling a project with the aim that the project can be

completed in a timely manner, optimal costs, and in accordance with the expected quality so that it is able to meet or exceed the needs and expectations of consumers and stakeholders.

A project is a series of activities to achieve a goal that has been planned and determined, within a certain period of time using a number of resources including costs, energy and materials. Project implementation is basically an activity to achieve goals and objectives through the implementation of various methods and strategies in implementation. Achievement of project targets and objectives one of which depends on the control process in project management.

In implementing a project, it is very rare to find a project that runs on time as planned. In general, they often experience delays from the planned time, but there are also projects that have accelerated from the initial planned schedule. To find out the project implementation in a period we can forecast (forecasting) the time of project completion and the

impact on costs with the Concept of Value (*Earned Value Analysis*).

The earned value method is one way to measure the performance indicators that occur. To avoid losses and delays in the project we can estimate the condition of the project to the end of the cost and time of project completion with Earned Value.

Juliana [1] states that using the Earned Value Management method, can predict delays that might occur, so that management can more quickly anticipate the problem of quickly taking follow-up steps in the project control process.

Gupta [2] states that controlling time and costs using the concept of the value of the results of the Earned Value Analysis is able to provide an accurate estimate of project performance which is an important contribution to project management.

Case studies concerning this research issue are regarding ineffective project control so that project activities become inefficient.

Delay in completion of the Infracom Office Building Construction Project can have the potential impact of increasing the time and cost of implementation so that the potential for the withdrawal of PT. Infracom that will be used by the Task Giver.

Infracom Office Project with a cost or contract value of Rp 33,632,697,373 with an implementation period starting from May 7, 2018 and completed on April 26, 2019. To determine the performance of project control in this study seen from the project reports, one of which is a weekly or monthly progress report .

In the review of project development based on the performance of the S Curve schedule from the 1st to 5th month of the period 07 May 2018 to 30 September 2018 with a cumulative plan value of 40,911% and a cumulative realization value of 40,110% with a deviation of - 0.801%.

From this value, it can be seen that the cumulative value of the plan is greater than the cumulative realization, so that the project experiences delays in project completion. This can result in increased implementation time, and an increase in the cost of implementing some of the delays in the completion of this project due to changes in the design drawings from the assignor, material approval process, and the amount of resources both in terms of workers and equipment

THEORITICAL REVIEW

Project Management

According to the Project Management Institute 2008 project management the application of science, skills, techniques and tools for the activities of a work activity on a project with a view to meeting or exceeding the targets and expectations of a project effectively and efficiently . Project management is planning, organizing, leading and controlling company resources to achieve short-term goals that have been determined [3].

Understanding Projects according to Larson [4], Projects are complex activities, the process is limited by time, cost, resources, and technical specifications planned to meet the needs of customers. According to Heizer and Render [5], the Project is a series of tasks focused on a goal or outcome.

While understanding the Project according to PMBOK (Project Management Body of Knowledge) 3rd Edition, the Project is a temporary activity from the beginning to the end that must be done to create a product, or a unique result.

A project has non-routine activities carried out by the organization, with a certain time span that can have an impact on the survival of the company's business in the long run.

A project has the following characteristics:

- *Waktu (Timeline)*: The project has a timeline or time of the worker 's certainly the starting point and end point measured.
- *Resources* : A project has limited resources, materials, tools and workers.
- *Tools* : Using special tools and techniques used to manage projects, for example Bar Charts, Earn Value Analysis.
- *Team (Team)*: Project Management requires a diverse team from various departments and functions.

The cycle of a project can be described in general with 4 stages, namely the preparation phase (the project problem definition), planning (making a timetable for implementation and budgeting costs), execution (project implementation with optimal work methods), completion (introduction of project results and reporting).

Some criteria in measuring the success and success of a project in its implementation if it meets the following criteria:

- Determine the definition of clear and measurable objectives, how big the project will be implemented and what resource requirements are needed in project implementation
- The results of the project can be received by the customer or assignor and related stakeholders, the

right deadline, and according to the planned budget or not exceeding the budget.

- A strong commitment to a project, in terms of management and organization in a project on aspects of time, quality and work safety.
- 4). Projects must be completed with expenses that do not exceed the budget or can be said to meet budget targets.
- Projects carried out in accordance with the time schedule or handover in accordance with the time agreed upon together.
- Products of the project are of good quality and meet the required standards or meet the technical specifications according to the contract documents.
- The completed project does not pose a risk, bring benefits to the surrounding environment and does not cause new problems.

Meanwhile, according to Suharto Iman *et al.*, [6] indicators of project success can be measured from the following four aspects: time of work implementation, quality of work results, implementation costs, and work safety.

There are 3 (three) outlines in the process of a project, namely:

Planning

To achieve a goal, a project requires clear and measurable planning by setting the basis of project objectives and preparing technical and administrative programs to be implemented. meet the specifications requirements specified in the limits of cost, time, quality, work safety costs.

Scheduling

A project activity planning that provides information about the planned schedule and realization of the progress of project activities including costs, materials, labor, and equipment, with a certain duration and percentage of progress time to complete work on a project.

The process of updating and monitoring between plans and realization is carried out periodically to get realistic scheduling in achieving the goals and objectives of the work on the project. Several methods are used to monitor and schedule projects, including Time Schedule, S Curve, Microsoft Project, Primavera.

Project Control

Control affects the final outcome of a project, control objectives to minimize all irregularities that may occur during the project, optimization of cost performance, time, quality and also work safety. Activities carried out in the control process are the process of supervision, inspection, evaluation and correction in the implementation process ongoing project.

Project Control

The strategy in controlling a project needs to be carried out so that it continues to run according to the limits specified in terms of time, cost, quality that has been determined in the initial plan. Control concentrates on controlling work towards the goal, effective use of resources, evaluation, review, improvement or correction, in achieving the goals and targets of a goal.

Control is essentially aimed at implementing the project in accordance with the budget and master schedule determined [7]. Project control is a systematic strategy for determining standards that are appropriate to planning goals, making information systems, comparing plans with realization, analyzing potential deviations, and taking corrective actions needed so that the resources used are effective and optimal in achieving targets [8].

The steps in carrying out the project control process are by clearly defining project objectives, setting standards and criteria as a reference in achieving goals such as technical specifications, budgeted costs, schedule or resource requirements, planning the project management information system, monitoring and reporting the results of implementation project, reviewing and analyzing the performance of work results with standard criteria or planned targets, carrying out the action of review, evaluation and correction of the causes of deviations between performance results with specified standards.

Project resources, especially in the construction service industry, consist of budget, materials, labor, funding, work methods and equipment. These resources are planned and managed to achieve the project's targets and objectives so that the time, cost and quality of the project's performance are in line with the constraints. The challenge in project implementation is how to plan an effective time schedule and cost efficient planning.

Cost and time are two things that are very influential in the process of carrying out project work in addition to quality, because the costs to be incurred during implementation are related to the duration of time needed to carry out the work.

In construction projects the costs are divided into two namely direct costs (*Direct Cost*) and indirect costs (*Indirect Cost*) [8].

Direct costs are all costs directly related to the implementation of work in the field and later will become a permanent component at the end of project completion. Costs classified as direct costs are the cost of preparing the land (Site preparation) material costs, labor costs and costs of procuring equipment and equipment work. While indirect costs are project costs

that are not directly related to construction in the field, these costs are also required in the project [10]. Components of indirect costs include overhead costs, unexpected costs, profits, taxes, project team salaries and benefits, temporary facilities in the field, licensing or coordination costs, and insurance costs.

If the execution time of a project is accelerated, this will have an impact on increasing direct costs, but indirect costs will decrease.

According to [9] controlling has two very important functions, namely:

- The monitoring function, with good monitoring of all project activities will force the implementing elements to work competently and honestly.
- Managerial functions, the use of controls and a good information system will make it easier for managers to immediately find parts of the work that experience irregularities or have poor performance.

The control strategy in implementing construction projects is to better guarantee performance in the use of 5M resources, among others (*Men, Money, Machines, Materials & Methods*) with the limits specified in the implementation instructions [11]. To control costs and schedules there are two kinds of techniques and methods, namely the identification of variants and the concept of yield value (*Earned Value Concept*) [12].

Project Cost Management

Project cost management (project cost management) is all process activities required in project management to ensure that project completion is in line with or does not exceed the budget (budget) that has been planned to achieve project goals.

The main thing that is considered in project cost management is the cost of the resources needed to complete the project as follows [13]:

- Resource Planning is a process for planning human resources, equipment, materials including the amount or volume needed to carry out the project up to the specified deadline.
- Estimated Cost (*Cost Estimating*) is a process to calculate the estimated cost of the resources required to complete the project.
- Cost Budgeting (*Cost budgeting*) is the process of making the allocation of costs for each activity in the work item from the total cost incurred during the process of counting estimates.
- Cost Control (*Cost control*) is the process of activities carried out to control the actual costs of project implementation whether in accordance with the budgeted or planned costs. Cost control includes the process needed

to ensure that the project is completed with the agreed funds. Cost control is not only the monitoring / monitoring of costs and recording the amount of data, but also the analysis of data so that corrective actions can be done before it's too late. Cost control is carried out by all personnel, both in the project management organizational structure of the project owner (owner) and the main contractor. Even so, the project management owner must be responsible for controlling project costs, including management of funding, approvals, and bill payments from the main contractor and controlling funds / budget [14].

Cost control is the final step in the project cost management process, which is to ensure that project costs are spent according to plan, in the form of a predetermined budget. Thus, aspects and objects of cost control will be identical with cost planning, so that various types of activities in the head office and field must always be monitored and controlled so that their implementation is in accordance with a predetermined budget [15].

Cost management in construction project management covers all aspects related to the cost and time of project activities, ranging from calculating the work budget, finding and selecting resources and financing plans. In order for cost management to be efficient, techniques for calculating project cost budgets can be used, identifying variants, yield value concepts, and calculating cost and time performance [13].

Project Time Management

Project time management (project time management) is the process of planning, arranging, and controlling the schedule of project activities, in which planning and scheduling has provided specific guidelines for completing project activities more quickly and efficiently [16].

There are five main processes in project time management. Explanation according to Soemardi [17], namely:

1. Defining work activities

That is the process of identifying all work item activities that must be carried out in order to achieve the project goals and objectives. This process results in the grouping and detailed detail of all work item activities which are the scope of the project from the highest level to the smallest level, known as the Work Breakdown Structure.

2. Work sequence

Namely The process of sorting work activities involves identifying and documenting interactive logical relationships. Each activity must be sorted

according to the stages of work to support the development of schedules and interrelationships or dependencies between jobs.

3. Estimated Duration of Work

Estimated duration of work is the process of taking information related to the scope of the project and required resources which is then followed by calculating the estimated duration of all work needed in the project.

4. Schedule Development

Development of the schedule is to determine when a project work will begin and when it must be completed.

5. Schedule Control

Schedule control is a process to ensure whether the performance carried out is in accordance with the planned time allocation or not.

The basis used in the time management system is operational planning and scheduling that is aligned with the project duration that has been set. The aspects of time management are determining the project scheduling, measuring and making reports of project progress, comparing scheduling with actual project progress in the field, determining the effect caused by comparing the planned schedule with progress on the field at the end of project completion, planning follow-up to overcome these effects, and renew project scheduling [16].

According to Suharto [18] Scheduling is the detailed arrangement needed to carry out a work plan. Starting with a drawing document, work method planning, resource requirements planning and then developed at the time of the contract, to be used as a basis for control from the beginning to the completion of the work.

Planning and scheduling is an integral part of the costing process. The work schedule can inform the percentage of work, the time for the plan to be completed, and the order of the work itself.

Time control is controlling the time of project implementation to be on schedule [7]. Project schedule is a tool that can show the time or duration of each work, so that it can be used to control the overall project implementation time. Scheduling provides information about project progress in terms of resource performance in the form of costs, labor, equipment and materials as well as the project duration plan and progress time for project completion [19].

Scheduling is the allocation of time available to carry out each work in order to complete a project to achieve optimal results by considering the existing limitations. In the project control process, scheduling

follows the updating of the progress of work implementation in the field and can affect various problems. Monitoring and updating the schedule is always done to get the most realistic duration of work so that the allocation of resources and their duration are in accordance with project targets [20].

Schedule control includes the processes needed to ensure project completion on time. Managing project development in a timely manner, in accordance with agreed costs and good performance is very difficult [14].

Scheduling is made to describe planning on a time scale. Scheduling determines when activities are started, postponed, and completed, so that the financing and use of resources will be adjusted according to the needs to be determined [21].

Curve - S (*S Curve*)

S curve (*S-Curve*) is a curve that describes the progress of work performance (weight%) or the relationship between the time of project implementation and the value of work accumulation. Comparison The weight of work performance on the "S" curve of the plan with the implementation curve can be known whether the progress of work implementation is appropriate, late, or faster than planned.

Job weight is the percentage value of the work item which is used to determine the progress of the job

Actual results of work at any one time can be compared with the plan, if the actual results are above the S curve, then a feat but if under the curve S need an overall evaluation or the need for rescheduling (*Rescheduling*) [22]. In accordance with the description above, the purpose of time control is the process of time management activities using a graphical S curve method that is measured by a description of work activities, time of implementation, and the value of the percentage of work.

Project Cost Estimation

According to Sunarto [23] costs are costs that are used or used to obtain an income. Meanwhile, according to Madiasmo [24] costs in a broad sense are the use of economic resources as measured by units of money to achieve certain targets and goals.

Cost estimation is the calculation of costs required to complete a job in accordance with specified specifications or requirements or contracts by calculating the required resource requirements including *preliminary* costs, labor, materials, equipment, services, taxes, insurance and also reserve costs escalation or inflation factor.

Cost estimation according to Hartono, 2007 is a prediction of the costs that will be needed from a

project based on the data and scope of the project given to be carried out at a predetermined location and time.

Meanwhile, according to Istimawan Dipohusodo [25] estimation on construction projects is an effort to apply engineering concepts based on tender documents, field conditions and contractor resources. In calculating the estimated project costs required technical skills regarding the calculation of work production capacity, understanding work methods, mastering the calculation of unit price analysis, understanding drawings, specifications, being able to calculate the volume of work.

According to [13] the purpose of making estimated project costs is as follows:

- Determine how long the project needs to be carried out and how much it will cost
- Prepare a budget and set a project baseline
- Can be used to monitor the progress of work progress.
- Can be used as a cost database that can be used as a reference for the calculation of subsequent cost estimates.

Budget Plan

Budget Plan Cost is the price or cost of the building which is calculated in detail, carefully, and meets the requirements. The budget will be different in the same type of building because of differences in material prices in each region. According to Soemardi *et al.*, [13], cost budgeting involves allocating overall estimated costs for individual activities or working to establish a basic cost package to measure project performance.

Results Value Method (*Earned Value Method*)

Cost and time control is one part of construction project management. In addition to evaluating the quality or quality of work, the performance of a construction project can also be assessed in terms of the results of cost and time management. Potential discrepancies between plans and realization in terms of costs and time spent on a construction work must be planned, controlled and monitored periodically or continuously. Mismatches in the management of costs and time on a significant project can indicate the existence of less optimal project management [26].

The concept of yield value (*Earned Value Analysis*) is one of the tools used in project management by combining costs and time. The advantage of the *earned value analysis* method is that the Result Value Concept can be used to determine the performance of activities being carried out in terms of cost and time aspects and can improve effectiveness in monitoring and controlling project work activities.

The concept of outcome value is the concept of calculating the amount of the budget in accordance with the work that has been carried out or completed so that it can be used to analyze the performance of project implementation and make estimates of achievement of targets.

Fleming and Koppelman [27] explain the concept of earned value compared to traditional cost management is as follows.

Project control using the traditional method only presents two indicators, namely the performance between the time and cost plan with time and the realization of time and cost. If you still use the traditional control concept, the project's performance and projected status cannot be known optimally so that preventive measures tend to be delayed. The concept of earned value analysis can provide a third performance besides the plan and realization, which is the value or progress of physically completed work (earned value or percent complete).

With these dimensions, it will be better understood how much performance is generated from a number of costs that have been incurred on a job.

The Earned Value Analysis method provides information about cost performance, schedule and progress in the achievement of work, as well as measuring the amount of work costs that have been completed at a time and also assesses based on the amount of the planned budget for the job with the following formula :

$$\text{Value Value} = \% \times \text{Completion Budget.}$$

Information:

- % Completion of progress achieved at the time of reporting.
- Budget is the cost of the work.

Indicators Used

- 1. BCWS (Budgeted Cost for Work Schedule) is a budget that has been planned based on a work plan that has been prepared against time.
- 2. BCWP is the value received from the completion of work during a certain period of time. When the ACWP number is compared with the BCWP value, a comparison between the costs incurred for the work done and the costs that should have been incurred will be seen.
- 3. ACWP is the actual cost incurred for completion of work in the relevant time period to complete the work within a certain time period.

Project Performance and Productivity Analysis

1. Cost Variance and Integrated Schedule

CV (*cost variance*) = $EV - AC$ or $CV = BCWP - ACWP$

- $CV < 0$: Costs greater than the *Cost Overrun* budget
- $CV = 0$: Costs according to budget plan
- $CV > 0$: Costs less than the *Cost Underrun* budget

SV (*schedule variance*) = $EV - PV$ or $SV = BCWP - BCWS$

- $SV < 0$: W ime behind schedule
- $SV = 0$: *On Time* (on time)
- $SV > 0$: L M ore ahead of schedule

2. Productivity and Performance Index

Cost Performance Index (CPI) or *cost performance index* = EV / AC or $CPI = BCWP / ACWP$

Schedule Performance Index (SPI) or *schedule performance index* = EV / PV or $SPI = BCWP / BCWS$

Information:

CPI (*Cost Performance Index*) : I Index This performance fee.

SPI (*Schedule Performance Index*) : I Index This schedule performance.

BCWP (*budgeted Cost of Work Performed*) : N use values results.

ACWP (*Actual Cost of Work Performed*) : P engeluaran costs.

BCWS (*budgeted Cost of Work Schedule*) : A nggaran costs.

With Performance Index Criteria:

- Performance index < 1 , means expenditure is greater than the budget or the implementation time is longer than the planned schedule.
- Performance index > 1 , the performance of the project implementation is better than planning, the cost of expenditure is smaller than the budget or schedule faster than planned.
- The greater the performance index difference from number 1, the greater the deviation from basic planning or budget.

3. Projected Cost Expenditures and Project Completion Period

$ETC = (BAC - BCWP) / CPI$

$EAC = ACWP + ETC$

While the estimated time of completion of all work:

$ETS = \text{remaining time} / SPI$

$EAS = \text{end time} + ETS$

Information:

BAC (*Budget a Completion*) : Overall Project Cost Budget

SPI (*Schedule Performance Index*) : Schedule Performance Index

CPI (*Cost Performance Index*) : *Cost Performance Index*

ETC (*Estimate Temporary Cost*) : Estimated Cost for Remaining Work

EAC (*Estimate a t Completion*) : Estimated Total Project Cost

ETS (*Estimate Temporary Schedule*) : Estimated time for remaining work

EAS (*Estimate All Schedule*) : Estimated Total Project Time

RESEARCH METHODS

The method used in this research is quantitative descriptive analysis method, which is a method for solving an existing problem by collecting data, compiled, processed and analyzed so that the final results can be used as conclusions from the research conducted. This research focuses on controlling costs and time that aims to pay attention to project performance.

The case study used in this research is the Central Jakarta Infrakom Office Building Construction Project.

In analyzing the value of these results required data relating to the project. The following data are used in this study:

- *Time schedule* for project implementation
- Cost Budget Plan (RAB)
- Weekly project reports.

RESULTS AND DISCUSSION

Project General Data

Here are the technical administrative data p royek:
 Job Name : Infracom Technology Office Building Construction
 Contract Value : Rp. 33,632,697,373
 Project Location : Jalan Tanah Abang II No. 46 Jakarta Pusat,
 Time of Implementation : May 7, 2018 - April 26, 2019
 Building Size : 3154 m2

Data Analysis Results

The results of the calculation of the recapitulation of the indicators of the concept of the results.

Table-1: Cost Budget Recapitulation

No	Job description	Total Price
I	Preparatory Work	2,868,700,000
II	Structural Work	4,982,200,375
III	Architectural Work	12,594,097,458
	Mechanical, Electrical, Plumbing Work	13,187,699,540
	Total	33,632,697,373

Table-2: Recapitulation of PV, EV and AC indicators

Month	Planned Value BCWS	Earned Value BCWP	Actual Cost ACWP
May	981.825.976	1.052.703.428	945.078.796
June	2.878.073.127	2.936.134.481	2.761.244.454
July	4.981.968.259	4.819.565.534	4.507.117.775
August	9.348.507.712	9.158.183.495	8.707.841.677
September	14.520.406.836	14.169.455.403	13.584.582.796

Table-3: Recapitulation of Index indicators and Variants of Cost and Time

Bulan	CV	SV	ETC	EAC	SPI	CPI
May	107.624.631	70.877.452	30.950.994.248	31.896.073.044	0.90	1.05
June	174.890.026	58.061.354	29.793.722.807	32.554.967.262	0.85	1.03
July	312.447.759	(162.402.725)	27.309.838.004	31.816.955.779	0.97	1.05
August	450.341.818	(190.324.217)	23.658.696.749	32.366.538.426	1.16	1.03
September	584.872.607	(350.951.433)	18.714.655.740	32.299.238.536	0.98	1.04

Evaluation of Results Calculation Result Concept Value

Reporting work performance up to September 2018, as follows:

a. Based on weekly reports monitoring , project achievement me n to achieve 40.11 % should be at Bulan September 2018 project achievement reached 40.91 % , this means that the project has been delayed by -0.80 % .

b. Budget analysis for activities carried out in September 2018

$$\begin{aligned} BCWS &= 14 . 520 . 406 . 836 \\ BCWP &= 14 . 169 . 455 . 403 \\ ACWP &= 13 . 584 . 582 . 796 \end{aligned}$$

Time Deviation (SV)

The search formula for SV is:

$$SV = BCWP - BCWS$$

So for work in September 2018

Known:

$$\begin{aligned} BCWP &= Rp . 14 . 169 . 455 . 403 \\ BCWS &= Rp . 14 . 520 . 406 . 836 \end{aligned}$$

$$\begin{aligned} SV &= Rp . 14 . 169 . 455 . 403 - Rp 14 . 520 . 406 . 836 \\ &= Rp (350 , 951 , 433) \end{aligned}$$

= SV negative means being behind schedule

Deviation from Costs (CV)

The value of cost variance (CV) for each period can be obtained using the formula, as follows: $CV = BCWP - ACWP$. So for work in September 2018.

Known:

$$\begin{aligned} BCWP &= Rp . 14 . 169 . 455 . 403 \\ ACWP &= IDR 13,584,582,796 \end{aligned}$$

$$\begin{aligned} CV &= Rp . 14 . 169 . 455 . 403 - Rp. 13,584,582,796 \\ &= Rp . 584 872 . 607 \end{aligned}$$

Schedule Performance Index (SPI)

To get the SPI value for each period the formula is used:

$$SPI = \frac{BCWP}{BCWS}$$

So to work p a da Month September 2018:

$$SPI = \frac{Rp 14.169.455.403}{Rp 14.520.406.836} = 0.98$$

This value indicates $SPI < 1$ means that project implementation is experiencing delays from planning.

Cost Performance Index (CPI)

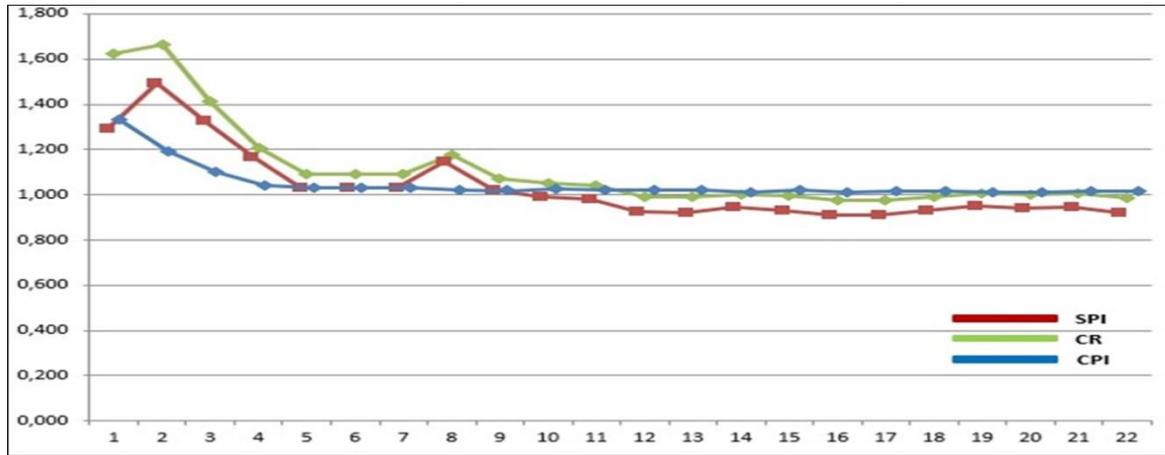
To get the CPI value for each period the formula is used:

$$CPI = \frac{BCWP}{ACWP}$$

So to work p a da Month September 2018:

$$CPI = \frac{Rp\ 14.169.455.403}{Rp\ 13.584.582.796} = 1,043$$

This value indicates $CPI > 1$, so that means spending is more efficient than the budget.



Graph 1.1: CPI, SPI dan CR

Estimated Cost and Time of Project Completion

The following can be seen the estimated cost and estimated time until the project is completed according to plan,

Calculation of estimated costs and time until September 2018:

a. Estimated Final Project Cost

Estimated Temporary Cost (ETC)

$$ETC = \frac{BAC - BCWP}{CPI}$$

$$ETC = \frac{33.632.697.373 - 14.169.455.403}{1,043}$$

$$ETC = 18.714.655.740$$

Estimated At Completion (EAC)

$$\begin{aligned} EAC &= ETC + ACWP \\ &= 18.714.655.740 + 13.584.582.796 \\ &= 32.299.238.536 \end{aligned}$$

From the above calculation it is known that the costs needed until the completion of the project is smaller than the planned budget and there is a remaining budget of Rp.

$$\text{Remaining budget (VAC)} = BAC - EAC$$

$$\begin{aligned} &= Rp\ 33.632.697.373 - Rp\ 32.299.238.536 \\ &= Rp\ 1.333.458.837 \end{aligned}$$

The results of the calculation of the remaining work budget shows a positive value, this means that the project realization budget is smaller than the planned cost budget .

b. Estimated Time for Project Completion

$$\begin{aligned} \text{Total Time} &= 52 \text{ Weeks} \\ \text{Time traversed} &= 22 \text{ Sunday} \\ \text{Remaining completion time} &= 30 \text{ Weeks} \end{aligned}$$

Estimate Temporay Schedule (ETS)

$$\begin{aligned} ETS &= \text{Sisa Waktu} / SPI \\ &= 30 / 0.816 = 36.78 \text{ Weeks} \end{aligned}$$

Estimate All Schedule (EAS)

$$\begin{aligned} EAS &= \text{End Time} + ETS \\ &= 52 \text{ Minggu} + 36.78 \text{ Weeks} \\ &= 88.78 \text{ Weeks} \end{aligned}$$

$$\begin{aligned} \Delta EAS &= EAS - \text{End time} \\ &= 88.7 \text{ Weeks} - 52 \text{ Weeks} \\ &= 36.7 \text{ Weeks} \\ &= (6.7 \text{ week extra time required}) \end{aligned}$$

Table-4: Recapitulation of Index indicators and Variants of Cost and Time

Minggu Ke	CV (EV-AC)	SV (EV-PV)	ETC (BAC-EV)/CPI	EAC (AC+ETC)	VAC (BAC-EAC)	EAS
Minggu ke 1	16.816.349	17.922.129	26.561.983.295	26.625.885.420	7.006.811.953	(11,32)
Minggu ke 2	40.359.237	56.023.877	25.645.828.619	25.787.085.948	7.845.611.425	(18,88)
Minggu ke 3	73.991.934	114.787.385	29.426.834.093	29.833.789.731	3.798.907.642	(9,62)
Minggu ke 4	90.808.283	109.648.767	30.565.155.139	31.190.723.310	2.441.974.063	1,05
Minggu ke 5	107.624.632	70.877.452	30.950.994.248	31.896.073.044	1.736.624.329	5,42
Minggu ke 6	124.440.980	32.106.136	30.631.483.623	31.896.073.044	1.736.624.329	5,30
Minggu ke 7	141.257.329	(6.665.179)	30.311.972.998	31.896.073.044	1.736.624.329	5,19
Minggu ke 8	158.073.678	161.276.020	30.445.468.254	32.651.773.202	980.924.171	(11,56)
Minggu ke 9	174.890.026	58.061.354	29.793.722.807	32.554.967.262	1.077.730.111	7,76
Minggu ke 10	208.522.724	14.598.700	27.324.212.327	30.388.151.057	3.244.546.316	5,43
Minggu ke 11	238.455.824	4.768.744	27.563.790.260	30.967.755.561	2.664.941.812	1,09
Minggu ke 12	272.088.522	(135.419.718)	27.121.126.889	30.895.051.861	2.737.645.512	13,89
Minggu ke 13	312.447.759	(162.402.725)	27.309.838.004	31.816.955.779	1.815.741.594	1,36
Minggu ke 14	329.264.107	(82.425.442)	27.357.821.829	32.823.471.479	809.225.894	(3,12)
Minggu ke 15	376.349.884	(136.978.947)	25.485.136.075	31.744.517.383	1.888.179.990	2,40
Minggu ke 16	393.166.232	(258.797.848)	25.653.339.921	32.669.456.920	963.240.453	5,67
Minggu ke 17	420.072.390	(313.351.354)	24.570.353.613	32.400.381.888	1.232.315.485	2,27
Minggu ke 18	450.341.818	(190.324.217)	23.658.696.749	32.366.538.426	1.266.158.947	(4,61)
Minggu ke 19	467.158.167	(50.282.318)	22.964.549.906	32.832.719.643	799.977.730	(3,93)
Minggu ke 20	483.974.515	(102.787.611)	21.804.221.847	32.832.719.643	799.977.730	1,43
Minggu ke 21	534.423.561	(54.394.812)	19.995.857.774	32.319.214.418	1.313.482.955	(1,12)
Minggu ke 22	584.872.607	(350.951.433)	18.714.655.740	32.299.238.536	1.333.458.837	6,78

COVER CONCLUSION

Based on the results of data collection and data analysis of the Central Jakarta Infrakom Teknologi Office Building Construction Project, the following conclusions can be drawn:

1. The results obtained at the end of the calculation of the Value Result Concept,

BCWS (*Planned Value*) of : Rp . 14 . 520 . 406 . 836

BCWP (*Earned Value*) of : Rp . 14 . 169 . 455 . 403 , and

ACWP (*Actual Cost*) of : Rp . 13 . 584 . 582 . 796

2. P is no end of the review period of September 2018 , namely

Time Performance SPI = $0.98 < 1$, meaning that the implementation of the project is slower than planned.

While the cost performance value of CPI = 1.04 or $CPI > 1$, meaning that expenditure is smaller than the planned budget.

3. Estimated project completion time according to plan is 26 April 2019 (354 calendar days or 52 weeks) . The estimated amount of the total cost of project completion is Rp 32,299,238,536 , the indicator shows that the project estimate of the efficiency of the VAC value of Rp. 1,333,458,837

SUGGESTION

Based on the evaluation results, suggestions and recommendations are as follows:

- In managing a project, controlling time and costs using the method of the concept of the value of the results (*Earn Value Analysis*) should be done from the beginning of project planning, so that the performance or performance of time and cost will be more monitored and controlled from the beginning to the end of the project to achieve targets and project target.
- In the implementation of project control using the concept of yield value, it is necessary to ensure that there are no changes in design, Variation Order, or changes in technical specifications that can result in increased implementation time and cost overruns

REFERENCES

1. Juliana. Analysis of Cost and Time Control in Construction Projects with Earned Value Management Method. *Exacta Factor*. 2016; 9(3): 257-265.
2. Gupta R. Earned Value Management System. *International Journal of Emerging Engineering Research and Technology*, 2014, 2(4), 160-165.
3. Kerzner HR. *Project Management, A Systems Approach to Planning, Scheduling and Controlling*, Eleventh Edition. New Jersey: John Wiley & Son Inc. 2013.
4. Larson EB, Wang L, Bowen JD, McCormick WC, Teri L, Crane P, Kukull W. Exercise is associated with reduced risk for incident dementia among

- persons 65 years of age and older. *Annals of internal medicine*. 2006 Jan 17;144(2):73-81.
5. Heizer J, Render B. *Operations Management (Manajemen Operasi)*. Jakarta: Salemba Empat. 2006.
 6. Soeharto I. *Manajemen Proyek Dari Konseptual Operasional*. Penerbit Erlangga, Jakarta. 1999.
 7. Pinontoan VM, Tombakan SG. Hubungan umur dan paritas ibu dengan kejadian bayi berat lahir rendah. *JIDAN (Jurnal Ilmiah Bidan)*. 2015;3(1):20-5.
 8. Liddle RW, Mallarangeng R. Indonesia in 1996: Pressures from above and below. *Asian Survey*. 1997 Feb 1;37(2):167-74.
 9. Ervianto WI. *Construction Project Management*. CV Andi Offset. Yogyakarta, 2004.
 10. Natan I, Nugraha P, Sucipto R. *Manajemen Proyek Konstruksi*. Penerbit: Kartika Yudha. 1986.
 11. Soekoto I. *Pengendalian Pelaksanaan Konstruksi (Construction Management)*. 1995.
 12. Kartikasari D. Cost and Time Control with Earned Value Method (Case Study of Production Hall-02 Pandaan Structure and Architecture Project). *Extrapolation Journal of Civil Engineering Untag Surabaya*. 2014, 7(2), 107-114.
 13. Soemardi AR. Bandung as a creative city: Visions on creative culture and the making of place. In *Paper for International Seminar on Urban Culture–Arte-Polis: Creative Culture and the Making of Place–Bandung 2006 Jul* (pp. 21-22).
 14. Dimiyati AH, Kadar N. *Project Management*. Faithful Reader. Bandung, 2016.
 15. Rantung AHP, Bonny FS, Robert JMM. Analysis of Cost and Schedule Control in the Implementation Stage of Construction with Analysis of the Result of the Value (Earned Value Analysis) Case Study on the Coastal Building Construction Project in North Sulawesi Province. *Journal of Media Engineering Scientific*. 2014 November, 4(3), 2087-9334.
 16. Lahndt L. TQM tools for the construction industry. *Engineering Management Journal*. 1999 Jun 1;11(2):23-7.
 17. Soemardi B, Wirahadikusumah R, Abduh M. *Construction Project Planning and Control Practices in Indonesia*. In *Proceedings of the 1st Construction Industry Research Achievement International Conference (CIRAIC 2007)*, Universiti Teknologi Mara-CIDB Malaysia, March 2007 (pp. 13-14).
 18. Baker GC, Gaffar S, Cowan DA, Suharto AR. Bacterial community analysis of Indonesian hot springs. *FEMS Microbiology Letters*. 2001 Jun 1;200(1):103-9.
 19. Aulady M, Cesaltino O. Comparison of Construction Project Time Duration Between Critical Path Method (CPM) Method and Critical Chain Project Management Method (Case Study: Rungkut Tower Building Project Development). *Science and Technology Journal*. May 2016, 20(1), 1411-7010.
 20. Simanjuntak RAM, Imam F. Recommendations on the Results of the Analysis of the Time of the Construction of Government Buildings in Serang City, Banten Province. *Journal of Media Engineering Scientific*. 2014 December, 4(4), 219-228.
 21. Daulasi A, Jantje BM, Walangitan DRO. Building Project Cost Comparison of Four Floors STKIP Kie Raha Ternate d ith Earned Value Method". *Static Civil Journal*. 2016 February, 4(2), 75-82.
 22. Efendi A, Sumarsiddin LO. Time and Cost Control on Projects with Earned Value Method (Case Study of Kasipute Pier Development in Kabombana). *ITS Engineering Journal*. 2015, 4(1).
 23. Zulkifli S. *Panduan Praktis Transaksi Perbankan Syariah*. Zikrul Hakim; 2003.
 24. Mardiasmo D, MBA A. *Akuntansi Keuangan Dasar*. Cetakan Pertama, Penerbit Fakultas Ekonomi UGM, Yogyakarta. 2000.
 25. Dipohusodo I. *Project Management & Construction I*. Kanesusius. Yogyakarta. 1996.
 26. Ahuja HN, Dozzi SP, AbouRizk SM. *Project management: techniques in planning and controlling construction projects*. John Wiley & Sons; 1994 May 19.
 27. Fleming QW, Koppelman JM. The essence of evolution of earned value. *Cost Engineering*. 1994 Nov 1;36(11):21.