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# Application of the Earned Value Method to Analyzing of the Road Improvement Project in Makmur Jaya Village, Air Rami District, Mukomuko Regency, Bengkulu Province

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**Abstract** Cost control and time are the most important part of project management. In addition to assessment in terms of quality, the achievement of a project can also be assessed in terms of cost and time. The presence of significant cost and time deviations indicates poor project management. One method that can be used in cost and time control is the earned value method. This method is used to analyze performance and make estimates of goal achievement. In its application, three main indicators are used, namely the actual cost of work performance (ACWP) or the actual cost of the work that has been implemented, the budgeted cost work performance (BCWP) or budget with the work done, and the budgeted cost work schedule (BCWS ) or the Budget amount for the planned work. This study aims to analyze the status and projection of Performance Road Improvement Project using earned value method, estimating cost at the end of the project, and estimating project completion time. In general, the method of analysis of the study begins with the selection of problems followed by a preliminary study with the intent to seek necessary information, followed by data collection through observation and field observation. The results show that the Schedule variance (SV) shows a positive value of Rp 181.382.570, so it can be seen that the job performance on the project is relatively good, because the work packets that are executed are faster than the planned schedule; The Schedule Performance Index (SPI) shows a value of 1,29, or greater than 1, so it can be concluded that the performance on the project development of environmental Road Improvement Project at week 12 is quite efficient, because the work is in accordance with the expected (on time), as well as being able to exceed the planned work targets; Cost variance (CV) at 12 weeks shows a positive value of Rp 26.771.875, so it can be concluded that the cost of work that has been issued is smaller than the cost of the plan. This indicates that this project if evaluated from the cost parameters tend to profit up to the 12th week; Cost Performance Index (CPI) at 12th week shows the number 1.03, so it can be concluded that the cost performance in the project development of the Road Improvement Project environment is relatively efficient, because the cost is smaller than the value obtained or in other words does not happen waste. Expenses to be incurred until the project expires is estimated at Rp 1.260.155.391. The profit project amounts to Rp 43.142.803 or 3,31% of the overall project value, while the estimated cost estimate to be spent for the remaining week (week 13 to end of project) is predicted to be Rp 478.177.391. The project completion time is predicted to be completed sooner than the plan, which is 15,5 weeks.

**Keywords** Control, Cost, Time, Project, Earned value

## 1. Introduction

Control costs and time is the most important part of Project Management. In addition to the assessment in terms of quality, achievement of a project can also be assessed in terms of cost and time. The existence of cost deviations and significant time indicates bad project management. According to Mockler (1972), control is a systematic attempt to determine standards that fit the target planning, designing a system information,

comparing implementation with standards, then take action corrections are needed for all resources are used effectively and efficient in order to achieve the target. One method that can be used in controlling costs and time is earned value method. This method is used to analyze performance and make estimated target achievement. In its application, used 3 main indicators, the actual cost of work performance (ACWP) or the actual cost of the work budgeted cost of work performance (BCWP) or budget worth with the work done, and the budgeted cost work schedule (BCWS). Total budget for the work planned. This study aims to analyze project performance status and projections Improvement of Jalan Desa Makmur Jaya Air Rami Sub-District Mukomuko District Bengkulu province using the method earned value, estimating the estimated cost at the end of the project, and estimate estimated project completion time. In general, the method of research analysis starting with the selection of the problem followed by a preliminary study with intent to seek information required, followed by the collection data through observation and observation the road improvement project Makmur Jaya Village Air Rami District Mukomuko Regency Bengkulu Province. The data used for analyze the master schedule, S curve, weekly progress (for 8 weeks), direct and indirect costs, and other data deemed necessary. Data is further processed by the approach three basic elements that become a reference in analyze the performance of the project based on the earned value method is the budgeted cost of work performance (BCWP), the actual cost of work performance (ACWP), Budgeted cost of work schedule (BCWS). The three basic elements will project project performance in cost and time aspects.

## 2. Research Problem

Based on the above background, then subject matter in this study can formulated as follows:

1. What is the status and projected performance Makmur Village Road Improvement Project Jaya Air Rami District Mukomuko Bengkulu Province based on the earned value method?
2. How to estimate the cost of end of Village Road Improvement Project Makmur Jaya Air Rami District Mukomuko District Bengkulu?
3. How to estimate time completion of Road Improvement Project Makmur Jaya Village Air Rami District Mukomuko District Bengkulu?

## 3. Literature Review

### 3.1. Construction Project Management

Project management is all planning, implementation, control, and coordination of a project from the beginning (idea) until the end of the project to ensure project implementation in a timely, precise cost and quality right (Ervianto, 2005). Project management is a technique used to plan, perform, and control activities a project to meet time constraints and project costs (Muslich, 2009). This technique oriented towards achieving goals, where such purposes may be the construction of buildings, opening a new office, or control research and development activities. According to Oberlender (1993), management projects are an art and a science in coordinate human, equipment, materials, money, and schedule for finishing a specific project, on time and in approved cost limits. Project management also be the scheduling and supervision of project activities to achieve objectives, costs and time, for the scope of work which has been determined using Resources Efficiently and effectively.

### 3.2. Time Management

The Project Management Institute (2004), time management on a project (project time management) include all the process required in an effort to ensure project completion time. There are five main processes in management project time, that is (1) Defining activity, is a process identify all specific activities must be done in order to achieve overall goals and objectives of the project (project deliverables). In this process produced grouping all activities be the scope of the project from the level highest to the smallest level or this is called the work breakdown structure (WBS). (2) Sequence of activities, is a process activity sequencing involves identification and documentation of interactive logical relationships. Each activity must be sorted accurate to support development schedule, so as to obtain a schedule realistic. In this process can be used computer tools to simplify implementation or done manually. Manual techniques are still effective for small-scale or early-stage projects stage of a large-scale project that is when no detailed details required. (3) Estimated duration of activity,

is the process of Information Retrieval related to the scope of the project and the necessary resources are then proceed with the calculation estimate the duration of all activities required in the project used as input in the development schedule. Accuracy rate of duration estimation very much depends on the number of information available. (3) Schedule development. Development schedule means determining when a activities in the project will begin and when to finish. Schedule creation the project is an iterative process of input processes involving estimation duration and costs up to the determination of the schedule projects. (4) Schedule control. Schedule control it is a process to ensure whether the performance is done already in accordance with the allocation of time already planned. Things to note in controlling the schedule is the influence of these factors cause changes in schedule and ensure changes occur approved, determine the change from schedule, take action when project implementation is different from preliminary planning of the project.

**3.3. Cost Management**.

The Project Management Institute (2004), project cost management (project cost management) involves all processes required in project management for ensure the completion of the project in accordance with approved budget. The main thing highly regarded in management project cost is the cost of resources necessary to complete the project. According to Ervianto (2005), control is the process of determining what has been achieved, performance evaluation and improvement steps when needed. This process is carried out if there have been previous planning activities because the essence of control is to compare what should happen with what has already happened. The second variant of the activity reflects the self-portrait of the project. The control instrument commonly used in construction projects is a bar chart in the form of an S curve. Making the S curve is done at an early stage before the project begins by applying the assumptions so that a rational plan of activities is produced. This instrument will be used as a guideline for what should happen in a construction project. There are several methods of measuring the performance of construction projects, such as Balanced Score Card (BSC), Performance Pyramid System (PPS), Tableau de Bord (TdB), and Earned Value Method. Of the four methods, the earned value method is considered the most efficient in measuring project performance based on cost and time indicators, this is because the calculations used in the earned value method are quite simple, and the data needed in the analysis (S curve, work performance progress, direct and indirect costs) are quite easy to obtain in the field.

**3.4. Earned Value Method**

According to Rismawan (2013), from the cost accounting system, performance reports and project cost predictions can be generated, while from the schedule System, project completion status reports are generated. Project management information from both systems complement each other, but can produce different information about the status of the project. Thus, it takes a system that is able to integrate information between time and cost (Crean and Adamczyk, 1982). For this purpose, the earned value method can be used as a performance measurement tool that integrates cost and time aspects. The use of the earned value method in the United States began in the late 20th century in the manufacturing industry. In the 1960s the United States Department of Defense began to develop this method (Abba, 2000). There are 35 criteria called cost / schedule system criteria (C / SCSC). However, C / SCSC is more considered as a financial control tool that requires strong analytical skills in using it. In 1995 to 1998 earned value management (EVM) was transferred for industrial purposes into a project management standard (ANSI/EIA 748-a). Since then EVM has not only been used by the Department of Defense, but also used by other industries such as NASA and the United States Department of Energy. EVM reviews were also included in the PMBOK Guide First Edition in 1987 and subsequent editions. According to Flemming and Koppelman (1994), there are three basic elements that become a reference in analyzing the performance of the project based on the earned value method, namely (1) Budgeted cost for work scheduled (BCWS) is a budget that is allocated based on a work plan that has been prepared against time. BCWS is calculated from the accumulated budget of planned costs for work in a certain period of time. BCWS at the end of the project (100% completion) is called budgeted at completion (BAC). BCWS is also a benchmark for the time performance of project implementation. BCWS reflects the absorption of plan costs cumulatively for each work packages based on the order according to the planned schedule. (2) The Actual cost

for work performed (ACWP) is a representation of the total expenditure incurred to complete the work in a given period. ACWP can be cumulative up to the period of performance calculation or the amount of the cost of expenses in a certain period of time. (3)The Budgeted cost for work performed (BCWP) is the value received from the completion of work over a period of time. BCWP is called earned value. BCWP is designed based on the accumulation of the work that has been completed. The relationship between budgeted cost for work scheduled (BCWS), actual cost for work performed (ACWP), budgeted cost for work performed (BCWP) can be seen in Figure 1 below.

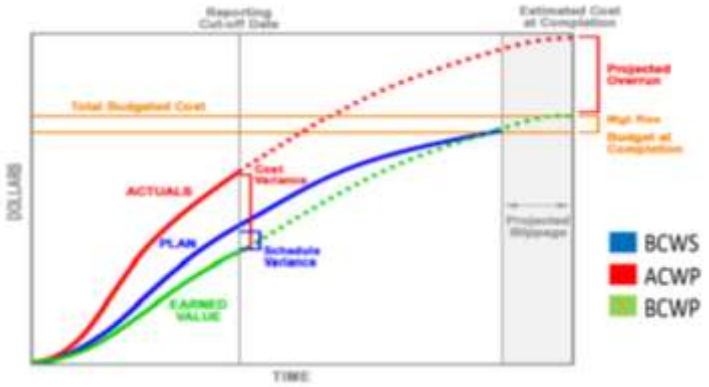


*Figure 1: Graph of Earned Value*

**4. Research Methodology and Analysis**

The research process was conducted with exploratory observation study approach, using earned value analysis. In summary, the research process begins with the selection of the problem followed by a preliminary study with the intention of finding the information needed by the researcher so that the problem becomes clear position. The next stage is to formulate the problem so that the research can be carried out as well as possible, and it is clear where to start. After formulating the problem, the study continued by choosing the type of approach that will be used as a method of solving the problem. The study continued with field observations, collecting and analyzing data. The analysis used in this study is earned value analysis with research output in the form of budgeted cost of work performance (BCWP), actual cost of work performance (ACWP), Budgeted cost of work schedule (BCWS), as well as tables and graphs of earned value. After data analysis, then proceed with drawing conclusions and preparing reports. Technique or method of data collection is a way done by researchers to obtain the necessary data in a study. In general, the data in this study is divided into two data sources, namely primary data sources and secondary data. Primary data collection in this study will be conducted by field observation or direct review by making visual observations of the object of research, as well as following the work process that takes place in the field. Secondary data collection is done by researchers not directly to the object of research, but through documents related to the object of research. Secondary Data can be in the form of master schedule or work plan schedule, mapping progress, budget plan, and other data deemed necessary.

**5. Results and discussion**

Based on the analysis that has been done, the performance of the Makmur Jaya village road construction project, Air Rami District, Mukomuko Regency, Bengkulu province. it can be said to be very good, if viewed from the parameters of time and cost. The company / contractor can make considerable savings, as well as a faster turnaround time than planned. Here is further explained about the results of research:

1. The project value is the overall value of the work under the contract. In earned value analysis, the project value used is the value before Added Value Added Tax (VAT), this is because the data analyzed is only real data in the field, excluding tax factors.
2. BCWS is the cumulative percentage value of the weight of the work based on the plan (time schedule) multiplied by the project value before VAT. The value of 48.14% is the cumulative value of the weight of the work based on the time schedule from Week 5 to Week 12.

3. BCWP is the cumulative percentage value of the weight of work based on work performance (progress) multiplied by the project value before VAT. Value 62.05% is the value cumulative work weight based on work performance (progress) from Week 5 to Week 12.
4. The ACWP is the cumulative of the direct and indirect costs of the project up to Week 12. In other words, ACWP is a real cost that has been incurred until the 12th week. The value of 60.00% is the result of dividing the ACWP value by the project value before VAT multiplied by 100%.
5. Schedule variance (SV) shows a positive value of Rp 181.382.570, so it can be seen that the performance of work on the project is relatively good, because the work packages are carried out faster than the planned schedule.
6. Schedule performance index (SPI) shows a value of 1.29 or greater than 1, so it can be concluded that the performance of the project is quite efficient in terms of time parameters, because it is able to achieve and even exceed the planned work targets.
7. Cost variance (CV) at Week 12 showed a positive value of Rp 26.771.875, so it can be seen that the cost of work that has been issued is smaller than the cost of the plan.
8. Cost Performance Index (CPI) at Week 12 showed a figure of 1.03, so it can be seen that the performance of the project based on cost parameters is relatively efficient, because the costs incurred are smaller than the value obtained, or in other words there is no waste.
9. The cost to be incurred for the remaining Week (Week 13 to the end of the project) is predicted at Rp 478.177.391. The remaining employment is 36.69% of the total employment.
10. The cost to be incurred until the end of the project is predicted at Rp 1.260.155.391.
11. The project is predicted to profit of Rp 43.142.803 or 3.31%.
12. The project is predicted to be completed faster than planned, which is 15.5 weeks.

## 6. Conclusion

Based on the analysis that has been used using earned value, it can be said that the road improvement project in the village of Makmur Jaya, Air Rami District, Mukomuko Regency has been very efficient. Evidenced by the work completed on time, as well as a sizable profit. This research is expected to be a consideration for various parties in construction projects in controlling project costs and time by considering the earned value method. It is necessary to carry out further research by considering other factors, as well as research data need to be added and collected in the latest year and project with different methods and data processing to obtain a more accurate comparison of research results. It is hoped that this research can be used as a reference and evaluation material for further research with a broader research scope.

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