

Research on Earned Value Management of Project Cost Control at Home and Abroad

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Abstract

The earned value method of project management is widely used in foreign project management practice. The article introduces the basic principles of earned value management, and describes how to effectively implement earned value management in construction cost control. With more and more companies adopting project-based management methods and drawing lessons from the experience of western projects on earned value management, it will give certain enlightenment to engineering technicians and managers who implement project cost management.

Keywords

Construction cost control, earned value management, project management, earned value curve, research inspiration.

1. Introduction

The concept of Earned Value originated in the industrial era at the turn of the 19th and 20th centuries. In the 1960s, EVM was first used in the US Navy's Polaris Program and further developed by the Air Force; in 1967, the U.S. Department of Defense established the cost/schedule control system. The Systems Criteria (C/SCSC) uses the earned value method as an effective tool for the integrated management of costs, schedules and technical performance, and is used in industrial and government projects. Subsequently, many countries, such as Australia, Canada, Sweden, and the United Kingdom, formulated the respective government and industrial engineering management standards in accordance with the guidelines of the US Department of Defense.

2. Fundamentals of Earned Value Management

The earned value method is actually a method to analyze the difference between the project implementation and the desired goal. Therefore, it is often called the deviation analysis method. In the traditional project management, the cost and progress are managed by different methods. For project schedule management, Gantt charts, milestones, network plans, plan reviews, critical paths, parallel operations, and event boxes are commonly used. For project cost management, the method of cost accounting analysis is applied. Compare the predicted and actual costs of the project progress. However, traditional project management methods can't point out the causes of deviations in the process of project development. Therefore, project managers cannot provide information of decision-making. The use of earned value management allows for comprehensive monitoring of the project's costs and schedules, and on this basis, project cost control, so as to achieve the "three major" control objectives of the project's progress, cost and quality.

2.1 Three basic parameters of earned value management

Earned value management is a method of measuring project performance by comparing planned work, actual earned work, and actual costs to determine whether costs and schedules are planned. The three

basic parameters are the planned work budget cost BCWS, the completed work budget cost BCWP, and the actual work cost ACWP. BCWS refers to the budgetary expenses required to complete the work required during the implementation of a project at a certain stage of the project. It is a benchmark or benchmark for measuring project progress and costs. Generally speaking, it will remain unchanged during the project implementation unless the contract is changed. The BCWP is the earned value, which refers to the actual calculated workload at a certain stage of project implementation and the cost calculated according to the budget quota. ACWP is the amount of work actually completed at a certain stage of the project implementation process and reflects the actual consumption of the project. When using the earned value method in project management, it is necessary to establish a work breakdown structure (WBS) of the project, compile a practical work schedule, and regularly perform data detection on each parameter in the project execution, and adjust the project based on the test results. And forecast.

2.2 Four evaluation indicators of earned value management

In the analysis of project progress and cost variance, the earned value method introduced four evaluation indicators: cost deviation CV, progress deviation SV, cost performance index CPI, and progress performance index SPI. CV is the difference between BCWP and ACWP during inspection; SV is the difference between BCWP and BCWS during inspection; CPI is the ratio of earned value to actual cost; SPI is the ratio of earned value to planned value. For a project, a negative cost deviation indicates that the cost is too high, and a positive cost deviation indicates that the cost does not exceed the budget. Similarly, if the schedule deviation is negative, it means that the project schedule is behind the schedule, and a positive schedule deviation means that the project progresses ahead of schedule. For cost performance indicator CPI and progress performance indicator SPI, if CPI or $SPI = 1.0$, indicating that the project is progressing as expected, it performs very well; if CPI or $SPI > 1.0$, the expected performance of the project will be good; if CPI or $SPI < 1.0$, indicating that the project is not expected to perform well. In the evaluation of progress and costs, cost deviations and schedule deviations must be compared at the same time because cost deviations cannot reflect progress deviations, and progress deviations cannot reflect cost deviations.

2.3 Earned Value Curve Correlation Analysis

The earned value curve is usually used when conducting earned value analysis. The earned value curve represents the project progress time on the abscissa, the cost on the ordinate, and the earned value curve plotted (see Figure 1). The BCWS curve is usually referred to as the execution effect measurement baseline.

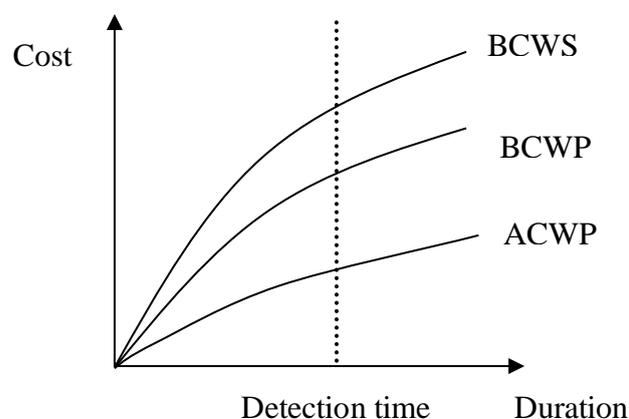


Figure 1 Earned value withdrawal

In project management, the three curves of BCWP, ACWP, and BCWS are generally represented on the same graph, which can clearly reflect the progress of the project and the consumption of resources. It will tell us whether the progress of the work unit being tested is advanced or delayed. , And can quantitatively assess whether the postponed or advanced workload has been postponed or advanced.

At the same time, analyzing the implementation effect of this work can reflect the efficiency and economic efficiency of the work, and can predict its final result quantitatively. In the practical operation of the project, the most ideal state is that the three curves are close together and rise steadily, indicating that the project is in the same direction as people expect, and it is moving in a good direction. If the deviation and dispersion of the three curves are large, it indicates that there are major problems in the implementation of the project, or serious problems have occurred, and the project should be reassessed and arranged.

3. Research status of earned value management in foreign projects

In the mid-1990s, the earned value management method was opened to the U.S. private sector by the U.S. Department of Defense. Since then, in the project management practice, earned value management has been the main method of project control and has been widely used by department managers and project managers. However, despite the widespread adoption of earned value in project management practices, its implementation efficiency has been questioned by the project management community. There have been articles that point out a series of problems in the use of earned value: such as high implementation costs, too complicated and excessive text work, and a lot of time. The high implementation cost does not make the earned value analysis its due value. In the foreign project management academic community, many scholars have studied the related issues of earned value management, including the following aspects.

3.1 Research on the Effectiveness of Earned Value Management

Thamhain surveyed 400 managers working on 180 projects. As a result, 41% of project managers admitted that they use earned value analysis in project management, which is more than the critical path method and rush work. Vargas et al. consider that earned value is a powerful tool for performance evaluation through case studies. William et al., by email, randomly selected 2,500 individuals from approximately 30,000 members of the American Project Management Institute (PMI) and the former Performance Management Association (PMA) to conduct surveys. The survey results showed that % of project managers are using or have used earned value management and strongly accepted it. At the same time, earned value management has not only achieved great success in the project management of the company, but also applied to the project management of the public project management department.

3.2 Factors Affecting the Successful Implementation of Earned Value Management

Waggs and others believe that the implementation of earned value management depends on the following factors: the nature of the project, the scope, the informality of management, the resistance to change, the value of technology, training, and the support of the organization. Earned value management is effective in projects that have clear and clear goals, simple direct scope, less resistance to change, good training, and organizational support. At the same time, the effect of Earned Value Analysis is not obvious in the short term, but it is significant in the long run, especially in the reduction of the cost of operational and repetitive work. William et al.'s survey shows that the implementation of earned value management mainly depends on four elements: Earned value management users, earned value management methods, project environment, and implementation process. Senior managers should be experienced or well-trained, need to provide greater support for the management of earned value, and give the lower-level project managers greater flexibility in the management process. At the same time, the organization should use the key path method as a supplementary tool for project schedule management, use computer systems and project management software to improve data collection and information processing capabilities. The successful implementation of earned value management not only involves the introduction of a project management methodology into the organization, it requires the organization's overall support, a team-based organizational culture, and a high level of cross-team communication capabilities.

3.3 Problems to Consider in Earned Value Calculation

When calculating the earned value, it is necessary to establish the work breakdown structure WBS of this project. According to the WBS and its coding, the labor time and expenses are decomposed into the lowest level accounting units. Flemming and Koppleman believe that WBS is a difficult point in the calculation of earned value. If the project is decomposed into small units of work, there will be high control costs and textual work in project control and text work, but if the partition is too thick, it means inaccuracies in the cost and progress data. Therefore, the WBS decomposition level needs to be determined in the earned value calculation. In addition, the calculation of earned value requires an estimate of unfinished work. Fleming and Kabmann believe that there are four most commonly used methods at present: Milestone technology, fixed formula method, percentage of completion method and equivalent method. Foreign countries often use the fixed formula method (such as 25/75, 50/50, 75/25, 0/100, etc.) and the percentage of completion method. Different types of projects and organizations of different sizes have different WBS decomposition levels and project completion percentage calculation requirements when they manage earned value.

4. Inspiration to Cost Management in China

From the empirical research on foreign earned value management, we can see that earned value management is indeed an advanced project management tool, and through the integrated management of costs and schedules, the project cost can be effectively controlled. China's project management started relatively late and should pay attention to the following points when applying the value-added method.

4.1 Conduct Scientific Management and Accelerate Project Management Information Construction

Strict project management techniques are the basis for the control of the earned value method. The earned value method works on certain checkpoints based on the resource allocation of the WBS's schedules and budgets. It needs to be analyzed based on a large amount of data and information in the progress control, cost control, and quality control processes. Without strict scientific project management, it is not possible to use the earned value method for quantitative assessment. Therefore, using this method, there is no meaningful level of project management and project control. The only way is to expedite the construction of the computer management information system for project management so that the acquisition and processing of basic data can be completed immediately and the monitoring results can be reflected in a timely manner, so that the earned value method can truly become an excellent project management method in China.

4.2 To strengthen organizational culture construction and create a good organizational environment for the implementation of earned value management

The implementation of the earned value management organization shall be centered on the project team, create an appropriate system environment with appropriate rights and responsibilities, and support, help and monitor all projects under the conditions permitted by laws and regulations. At the same time, senior management should give necessary support for the implementation of earned value management. China's project environment is different from foreign project environment. Project managers have little power and responsibility. If there is no necessary institutional adjustment or department coordination, the traditional functional organizations may not be able to give the project team the best support. Therefore, administrative and economic methods should be used to authorize the project manager to ensure that the project manager has the right and responsibility; to use the economy as a lever to establish a supporting service system centered on the project team; to provide necessary training to employees engaged in earned value management; and to establish Scientific assessment system, timely assessment of the completion of the project, rewards and punish fine.

4.3 Improve project management external operating environment and improve the overall level of China's cost management

Although the earned value method is currently recognized as the most successful and comprehensive management tool in the management world, there are few domestic reports on successful cost management using the earned value method. This has a lot to do with the current overall poor level of domestic project management, the incomplete internal operating system of the engineering company, and the lack of applicable project management software. In addition, the lack of special talents for cost management is also a major factor that affects the implementation of the earned value law in project management in China. Although there are tens of thousands of projects in our country that have implemented project management, most project managers have technical backgrounds and are not professional cost management personnel. Therefore, it is particularly important to cultivate talents who understand both technology and cost management, especially project managers who have team spirit, professional ethics, and social responsibility in project management. Many authors of the academic and business communities now believe that the "Earned Value Management System" will become one of the leading methods for project management in the 21st century. At present, many countries have already established their own earned value management systems. China should also establish a suitable value management system for itself and accelerate the pace of integration with the international community.

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