ANALYSING THE ACTUAL COST WORK PERFORMANCE (ACWP) IN THE EARNED VALUE CONCEPT (EVC)

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ABSTRACT: One of the important factors in The Earned Value Concept (EVC) or The Earned Value Management (EVM) is the Actual Cost Work Performance (ACWP). A Cost Variant (CV) is further produced from the ratio between ACWP and Budget Cost Work Performance (BCWP). This will assist in determining the condition of the project at the time of evaluation, its loss and profit and the forecast of expenses that will incurred to complete the project.

Keywords: Earned value, actual cost, work performance.

BACKGROUND

The use of EVC method in analyzing and evaluating both progress and target condition at each stage of a project, requires a special understanding in how to determine the ACWP of the project, so that the ratio between ACWP and BCWP can provide a clear picture and can be used to establish the future policies of the concerned project.

Several questions to be considered are:

1. Whether the execution of work is in accordance with the planned network diagram and that BCWS or Curve S needs to be revised to reflect the real situation at site,
2. Does the project fit the specified time (on schedule), or has it experienced intolerable irregularities and thus require acceleration through Crash Program,
3. Is the existing work speed will result in delays and if so, for how long the deviation will be,
4. Whether trade off analysis is needed so that when the crash program is applied, it does not result in deviations which are beyond the budgeted target plans,
5. Is the deviation between cost of production and product’s value is still as planned or already showing unplanned loss beyond the budgeted target plans,
6. What is the likely needed cost of production until the project is completed,
7. Whether the project is still within controlled plans and targets, or does it already experience uncontrolled implementation that it needs a critical handling in the form of rescheduling or crash program

THE EARNED VALUE CONCEPT

One of the general concepts which is used in managing a project is EVC. This concept helps to answer all the questions above so that the implementation of a project can be controlled and is able to reach the intended target.

Three main factors which are used by the concept of value are BCWS, BCWP, and ACWP. Together with time and cost variants, they are able to provide future forecasts.

Several of important and general definitions used are:

1. BCWS (Budget Cost Work Schedule): The sum of budgets for all work packages, etc scheduled to be accomplished (including in process work packages), plus the amount of level of effort and apportioned effort scheduled to be accomplished within a given time period.
2. BCWP (Budget Cost Work Performance): The sum of budgets for completed work packages and completed portions of open work packages, plus the applicable portion of budgets for level of effort and apportioned effort.
3. ACWP (Actual Cost Work Performance): The costs actually incurred and recorded in accomplishing the work performed within a given time period.
4. CV (Cost Variant): Earned value compared with the actual cost incurred (from contractor accounting systems) from the work. Cost variance = BCWP – ACWP (negative CV is “bad”).
5. SV (Schedule Variant): The difference between work actually performed (BCWP) and work scheduled (BCWS). The schedule variance is calculated in terms of the

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difference in dollar value between the amount of work that should have been completed in a given time period and the work actually completed.

6. **CPI (Cost Performance Index):**
   The ratio of cost of work performed (BCWP) to actual cost (ACWP), CPI of 1.0 implies that the actual cost matches to the estimated cost (ACWP).
   - CPI greater than 1.0 indicates work is accomplished for less cost than what was planned or budgeted.
   - CPI less than 1.0 indicates the project is facing cost overrun.

7. **Schedule Performance Index (SPI):**
   The ratio of work accomplished (BCWP) versus work planned (BCWS) for specific time period. SPI indicates the rate at which the project is progressing.

In our further analysis, we will not discuss about EVC or EVM. Rather, we will focus on the description of the components that become ACWP costs and the actual costs that cannot be deemed as ACWP costs yet, prior to the achievement of an approved product for BCWP value.

**THE INFLUENCE OF TECHNOLOGY ON PROJECT’S CONDITION**

An engineer will occasionally be scientific in trying to change or influence the condition that occurs in a project or product engineering activity. With his knowledge, he will try to create, innovate or use specific methods in order to be effective and efficient in using the main resources which are man, money, material and machine, to create products that meet the requirements which have been agreed in the employment contract.

Other factors such as time, quality, cost and safety also play a role and thus need to be considered. However, the key lies in the engineer himself, in that he have objectives and requirements and is able to achieve through the implementation of a controlled process.

Should there be deviation in the original plan, each phase of the work which provides data and information about current project’s condition, under the control of a project manager, must be able to be converted so that the project is back on track.

For example if there is a significant lapse of time or a negative deviation of budget execution, thus requiring a crash program, then the main resources used have to be changed in such a way (through trade off analysis), to enable both shortening of time and restoration of the execution for the remaining projects within a specified time back to the curve path, whilst also improving the existing performance to reduce losses incurred.

Of course all required resources experience change and need to be reviewed again. This is achievable as long as there are no additional costs incurred and/or the costs incurred are tolerable.

The impact of method of execution as well as his creativity and innovation to change are the main aspects that must be owned by engineers who are involved, to reach the final product of the related project.

**ACTUAL COST WORK PERFORMANCE**

The one thing which needs deep evaluation from the theory of Earned Value Concept is ACWP. Mainly because occasionally, existing actual costs cannot be converted to ACWP yet, before assessing its relationship with BCWP value that has been approved by the project owner.

Contract between project owner and contractor most often specify ACWP costs. As an illustration, outlined below is an agreement clause within the contract which determines ACWP value:

1. **Material on site is not yet considered as work product before final product.** For example, cement, iron rod, wood, sand, crushed stone, are not considered as job performance for BCWP before it becomes a concrete bone. As such, the expenses incurred for the procurement of these materials cannot be established yet as ACWP.
2. **Mobilization of equipment and recognized labor classified as work item can be regarded as incurred ACWP costs.** However, if these are not segregated as a separate item, then the mobilization and indirect cost for mobilization performed can only be classified as ACWP when these resources have already been used upon the work item which then becomes BCWP value.
3. **Indirect costs, insurance, taxes, profit, contingency, overhead and others beside the direct costs, have to be analyzed in terms of what form and agreement is there within the contract clauses of the existing budget plans.** If that particular component is included in the unit price of each work item, then the existing ACWP is also already included in the above value.
4. **Cooperation with sub-contractor that produces final product and have not yet been settled by the main contractor, but is considered already as BCWP by the owner, thus resulting in the contract value with the sub-contract be accounted as ACWP.** In other words, the existing ACWP and BCWP will need to be assessed together.

As explained above, the ratio between BCWS vs. BCWP and BCWP vs. ACWP can provide future predictions on project’s completion time and its final costs. Therefore, ACWP value, when analyzed and
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evaluated correctly and accurately, can become one of the decisive elements for forecasting the EVC.

IMPORTANT POINTS TO ACCURATELY DETERMINE THE COST COMPONENTS OF ACWP

Analysis is required in whether all costs incurred with the presence of equipment at site becomes ACWP costs or does it requires separation between the actual costs of the products that are considered as BCWP and costs which are not associated with the product’s cost.

This analysis is crucial remembering that there will be cost difference in deciding in matters such as lease, ownership and subcontracting of products which are calculated based on BCWP’s weight.

As an example, a tool which is stored in unfavorable condition, when it requires repair or spare parts’ replacement, its costs should not have been charged against cost of product of the particular project. Adding it to the product cost will result in an added cost on the product produced by the project. It should instead remain as the product cost of the previous project, or becomes an overhead that can be distributed among other projects from the contractor’s company.

So in other words, for every costs incurred, be it actual, are costs associated with one of the project’s activities. However, the costs need to be analyzed first prior to classifying it as an ACWP of a project.

Cost Component of Material in ACWP

Every cost incurred for the procurement of material, be it for the material itself or indirect costs from the material have to be analyzed prior to classifying it as AWCP costs.

Examples of such costs are:
1. Expenditures for material on site cannot be considered as ACWP if there is no statement in the contract about payment for that material, 2. Unused materials purchased on credit and have not yet been approved by the owner, which are necessary for the final product, are not ACWP, 3. If the contract does not recognize payment for outstanding of the on-site material, and that the materials are still in a state of ‘raw materials’, it cannot be considered as ACWP 4. Loan against used material for the final product and is already counted into BCWP but has not yet been settled, is to be regarded as cost component of ACWP, 5. Material transportation and other costs cannot be specified as ACWP if it has not yet been counted as part of BCWP product,
6. Taxes, insurance and other direct costs from the procurement of material are calculated as ACWP if those costs are related to BCWP product, 7. In the final calculation of costs, if BCWP has already reached 100%, despite of the actual material that has not yet been counted as ACWP, then such costs must be counted as ACWP or a portion in reducing gross income to result in a net income, 8. Excess of materials that are redeemable or can still be sold as income are not counted as ACWP but as an additional income against the net income, 9. Costs arise from the repair and maintenance of equipment which are on-site overheads are not to be included in ACWP. However, it remains as a component towards calculation of gross profit / loss to net profit / loss.

Cost Component of Equipment to ACWP

Every cost incurred for equipment and expenses for indirect costs should be assessed first before specifying it as ACWP costs. Actual costs of the equipment which need analysis before becoming ACWP, among others, are:
1. Cost of ownership of equipment must be counted, in addition to both repair and spares replacement costs. This requires special attention since ACWP cost without ownership cost would be detrimental to the value of inventory and creates quite a significant difference between ACWP and BCWP. Cost of ownership should be considered as a depreciation expense in the calculation of the tool’s cost for ACWP, 2. The condition of tools sent to the site have to be in top condition, to prevent the adding of possible actual costs onto both repair and spares’ replacement costs that are not supposed to be counted as ACWP against currently running project, 3. Relatively small work volume will result in huge ACWP costs due to transportation and indirect costs. This needs to be anticipated during the BCWS value calculation, 4. Insurance, overhead, taxes and other costs must be calculated against ACWP if the value of BCWP and BCWS have already been included, 5. The value of ACWP and BCWP often results in a relatively big difference if the method of implementation on the offer value is not the same as the method of execution at work. This affects the type of tool, its capacity, quantity so that the relative actual cost deviates from planned tool cost on BCWP.
6. The value of ACWP and BCWP will also be relatively different if both field and social conditions differ from the previous condition. An example would be unforeseen circumstances like rural areas with unique tradition.

7. Reimbursement or dispensation from company must take place in the case of negligence from subcontractor labor which causes damage or loss of equipment. If not performed, it will be treated as ACWP cost.

**Cost Component of Labor in ACWP**

Actual labor costs which serve as indirect costs to ACWP are:

1. With the exception of BCWP product has been produced and there is already a payback or settlement due to payment from finished work, receivables or loans by labor are not ACWP costs,
2. Labor savings due to surplus from worker’s salary is not accounted in the EVC,
3. Insurance or labor employment taxes paid by workers are not included in ACWP unless if covered by company,
4. Health insurance and safety cost component on separate offer is not counted as ACWP cost according to appropriate work stages, unless such charges is calculated directly on each work unit that the incurred actual costs can be deemed as ACWP,
5. There must be an effort by the sub-contractor to reduce or replace the cost of damage caused by labor’s negligence before the loss is counted as ACWP,
6. Actual labor costs incurred are not directly accounted as ACWP for sub-contractor’s labor, unless payment of achievement has been recognized at BCWP product. This is because evaluation is needed as to whether such costs will be company or sub-contractor’s responsibility,
7. Health and safety expenses should be segregated between labor and sub-contractor, unless there is a prior agreement within employment contract with the sub-contractor,
8. Responsibility for both transportation and other security costs has to be clarified with the sub-contractor. Such costs will be counted as ACWP if it is for company’s labor,
9. Accident costs that are not covered by workers’ compensation insurance are ACWP unless, stated in the contract, that it is sub-contractor’s responsibility.

**Cost Component of Working Capital on ACWP**

Resource funds as working capital often serve as indirect costs or overheads which are calculated on ACWP according to appropriate stage that has been reached in BCWP. Costs which need evaluation are:

1. Transfer and escort security funds that need certain safekeeping can be counted as ACWP as project’s indirect costs,
2. Used temporary third-party funds or interim debt at site must be considered as ACWP if it is already used to generate weight on BCWP. These loans must be counted in the balance sheet as temporary loan,
3. Funds used to support project’s major work execution, like the opening of a new road, social and security costs are all indirect costs which are added onto ACWP costs or calculated in the profit and loss.

**Cost Component of indirect Costs, Overheads, Insurance, Taxes and Unforeseen Work**

To obtain the difference between BCWP and ACWP, factors such as indirect costs, overheads, insurance, taxes and unforeseen work must be accounted for. This is because besides providing an overview about of the project’s condition, EVC is able to provide predictions on time and cost by analyzing graphs between BCWS, BCWP and ACWP.

As such, the above explanation may help in looking more detail at a scope of problem and to prevent an inaccurate ACWP graph.

If interpretation from ACWP and BCWP provides an inaccurate analysis, for sure the making of decision to anticipate undergoing project’s development will also result in things that do not fit the purpose of EVC.

**CONCLUSION**

1. EVC helps control the project by providing an overview of the ongoing project’s condition at a specified time,
2. Description given from BCWS vs. BCWP graph helps to determine the pace of work, whether it is on schedule or delayed. This is derived by looking at the difference between planned and actual weight. The benchmark is that the existing work item on BCWP must follow the order of network, which is determined by Time Schedule that form BCWS graph as Planned S Curve,
3. BCWP curve as actual S curve is derived from weight of work which has been approved by the project’s owner. This serves as weight value in the owner or his representative’s calculation of invoice to be made by the executor. Once approved by the
owner, the work becomes eligible and can be further made as product’s provision that meet the term of contract.

4. Existing network diagram on time schedule must be used as guidelines. If there are changes within the pace of work at site, then the changes in BCWS, BCWP and ACWP have to be reviewed,

5. Any changes in work plan and method of implementation will affect time and cost which further impacts on EVM. Therefore, analysis and evaluation at every stage of work become crucial,

6. Comparison against BCWP is one of the main targets from project implementation activities, and an incorrect ACWP cost component will leads to wrong interpretation. As such, it is important to analyze carefully all potential elements towards the ACWP value,

7. If the EVC’s prediction towards costs incurred is negative, it can be improved through creativity, innovation and implementation methods as elements owned by technocrats in scientific practice within their profession.

8. Efficiency and Effectiveness measures are crucial elements within management of project.

REFERENCES