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Proposed model to improve the forecast of the planned value in the estimation of the final cost of the construction projects

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Abstract

The productivity of an engineering project is determined by the value assigned to the PV (Planned Value). Since the PV is not precise, mathematical models are used to obtain a final cost forecast and control the project. In this work, the PV value is improved to reduce the error of the forecasts. Statistical confidence intervals were used to determine the standardization of work process times. As a result, this brings a more accurate PV, with a more accurate and lower difference between PV and EV (Earned Value). Two projects of two Mexican companies have been monitored. The resources used were 30 analysts during a two-year period. The proposed model proves to be more accurate at all stages of the project.

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Keywords: Finishing cost accuracy; Working hours; Earned value; Planned value; standardization.

1. Introduction

Any Project has a determined number of time and cost activities assigned to a specific number of workers. During its progress, the return value or project progress must be close to the planned value or the project's budget so that the cost on any cut-off date does not surpass the estimated cost for that date, and the additional costs are only allocated to the increments of unplanned activities from the original project. In terms of construction, extra jobs are denominated, meaning that the impact of these needs to be conformed in the same way as the original activities, without decontrolling the project costs, given that every extra job will need to be charged. Despite the extra Jobs, the effect of

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a smaller planned value is a smaller returned value and a greater value of the actual cost. Given that the planned value is not precise, the use of techniques and mathematical models is necessary to obtain a forecast of the final cost of the project, to determine various actions that allow having an optimal control. The purpose of this work is to improve the planned value to decrease the forecast error. For this objective, a new model is proposed, which implies the standardization of the jobs' cycle time by monitoring and considering upper and lower control limits with high statistic confidence intervals. This means that if it would be possible to standardize the cycle times, the planned value would be more precise and the difference between this and the return value would be minimal. In order to prove the activities standardization, a monitoring in two projects of two Mexican enterprises has been done. The used resources were integrated by 30 analysts during a two year period [1]. The proposed model shows more precision in the estimation of the project's cost in all its stages.

2. Basic concepts

Below is the definition of some terms used throughout this paper [4]

EV – Earned value of the project or work progress (some authors call it as the Budgeted Cost of Work Scheduled (BCWS).
PV – Planned Value of the project
AC – Actual cost or monetary value of the completed job to a determined cutoff date

The PV of a project plays an important role due to its restrictive relationship with the AC and its productive relationship with the EV. The more accurate the PV value, the smaller the difference with the AC, and the final cost forecast will be closer to the real cost. Unfortunately there are no studies to obtain more precise PV values. Generally these values are established conjunctly in a theoretical and experimental way according to each enterprise. In order to calculate the PV, that is, the budget, the monetary value of all materials to be used and all workforce involved in the installation, is required as an input. Normally, to obtain the list of all the necessary materials for the project's development, a visit is required to the place where the work will be done is required, along with the use of isometrics.

The isometrics span little pieces such as a joint, to large pieces that can weight even tons. Once the list of material is finalized, the prices are obtained, and the percentage of gain is added. Nevertheless, to obtain the value of the required workforce, the cycle time of the installation of each component is required in order to add the gain percentage.

To obtain this part of the budget, an estimation of the invested time in other projects is used, without considering the productivity. Practically it would be possible to obtain a correct value of the budget only in case of a productivity of 100%, which is unusual in practice. All in all, one of the main reasons of the need of PV forecasts of a project consists in the fact of not recognizing the real time used in the completion of a determined operation. The objective of our work is to determine the activities productive value, so that when quoted with the conventional methods mentioned before, the standardized values of productivity or unproductivity (whichever is the case) are considered and in this way the differences between the budget and the upfront payment is decreased.

Although there have been no studies to obtain more precise values for the PV, there has been progress in the topic of the EC, for more than 40 years, including the mathematical models to adjust the AC curves [5]. The given adjustments are used to forecast the final cost in order to take the corresponding actions in a determined moment of the Project.

The prevision of the final cost of a project is has a high importance to control and manage a project. In the latest years the development has been centered in terms of the EV. Data series selection and simulation through time and cost series have been used to obtain the final project cost. This technique has some weakness where one of the most outstanding ones is the data relevance and its prolonged monitoring. The obtention of a close forecasts to the real value not only depends on the EV curve, but also on the value that was originally assigned to the PV. A new methodology for the PV assignment is proposed in the next pages, which consists measuring and standardizing each assigned value to the PV so that the distance between curves is minimal.