

Probabilistic Control of Projects Based on Earned Value Management

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Abstract

Earned value management (EVM) is a project control system that considers technical performance, schedule and budget. It offers an early warning method to find out gaps between the planning and the real performance. It is a cost-based method but it currently includes the schedule performance.

However, it has a deterministic approach to identify gaps, this means that any variation from the plan triggers a decision. The purpose of this research was to propose a method based on EVM to control projects considering risks. Considering normal variations in performance allows the project manager to make decisions when the project is really out of control. This means that may be found performance measurement under the planned value that may not be considered a problem that needs a decision.

The proposal is based on four phases: identification of potential risks, identification of critical risks, identification of critical project activities and building control limits. The first step is conducted through a literature review to build a general risk list from researches on construction projects in developing countries. Critical risks are identified through a Modal Analysis of Effects and Failures (MAEF). Critical activities are identified by establishing the relationship or influence among critical risks, already identified, and every activity of the project. Finally, the control limits are built. The risk profile for every activity and the desirable control level are the inputs for a Monte Carlo Simulation (MCS) conducted for every control moment decided for the project.

The proposed method was applied in a building construction project. A preliminary list of 519 risks from the literature was reduced to 106 risks by identifying duplicated and some included in others. It was later reduced to 53 through an expert panel analysis and finally reduced to 18 risks when the MAEF analysis was conducted. From the activity list of the project, were identified preliminaries, excavation, foundation, and slabs as the critical activities. For the risk profile of critical activities, it was supposed a normal

distribution and the duration and cost information were built by the three value method with information provided by experts. The simulation was conducted for two control scenarios, P10-90 and P70-30. The simulation was also conducted using all activities.

Applying the method to critical activities showed advantages over applying it to all activities. The method found specific out of limit situations when monitoring the project, however other situations were not considered out of control because they were inside the limits established. Advantages and disadvantages of the method are discussed.

Keywords

Project Management, Risk Management, Earned Value Management, Monte Carlo Simulation

Biographies

Lady Vanessa Rangel had a B.Sc. in Industrial Engineering from Universidad del Valle, Cali, Colombia. She currently works in process development in information technology projects.

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Alvaro Cuadros is currently a PhD. student in Engineering Doctoral program at Universidad del Valle. Mr. Cuadros holds a B.Sc. in Industrial Engineering and MBA degrees from Universidad del Valle, Cali, Colombia. Member of PMI and PMI Pacífico chapter, and of the Iberoamerican network of Project Engineering. Full time professor since 2010. His research interests include risk management, earned value management, project scheduling, and project management maturity models.