Chapter 113
Extended Earned Value Management Based on Fuzzy Multi-Criteria Decision Making

Hêriş Golpîra
Islamic Azad University, Iran

ABSTRACT

This paper proposes an extended earned value management (EEVM) as an integrated comprehensive project progress measurement technique. The method considers all of project key success factors, simultaneously. That is the method guaranties the realistic weights achievement to implement project control and scheduling. The weights are employed to publish a correct and comprehensive progress reports which can guarantee the future decisions for the project. It is noteworthy that the weighting approach is not just an earned value management (EVM), but it covers its concept. Since, the method is comprehensive and according to its ability to take any key success factors in to account, it can be used as a good alternative for the EVM approach, and can be called as an EEVM. The method combines the fuzzy group analytic hierarchy process (FGAHP) and fuzzy technique of order performance by similarity to ideal solution (FTOPSIS) to define activity weights according to some projects uncertain data. Taking to account the advantages of FGAHP for criteria weighting besides FTOPSIS for activity weighting provides a flexible method works with human habits and projects vagueness and uncertainty. Efficiency of the proposed method has been practically verified on a stadium in Kurdistan. The results illustrate superiority of the method in case of comprehensiveness and flexibility in comparison with the other methods.

1. INTRODUCTION

A project is a temporary work to produce a unique product with a defined start and finish. That is meet unique aims, typically to carry the useful change or added value (Nokes & Kelly, 2007). In recent years, project management and control becomes a very interesting research area (Colin & Vanhoucke, 2014) that is defined to achieve all of the project objectives (Turner, 2014) containing scope, time, quality and budget (Vanhoucke, 2013; Wenger, McDermott, & Snyder, 2002). That is, the project is a multi-

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objective multi-criteria subject needs some overall covering thinking to gain success (Hêriş Golpîra, 2011; H Golpîra & Moradi, 2011). In this point of view, a project manager should mitigate the effects of potential problems caused by key factors which are affecting project success and should make decisions on time relying on limited information, naturally (Wilson, Frolick, & Ariyachandra, 2013). For more information, more recently, Vanhoucke (2013) successfully introduces a review about project scheduling and integrating baseline scheduling and project control. One of the management techniques that measures project's performance, progress and success in an integrated objective approach is earned value management (EVM).

The EVM approach can be defined in the point of view of the earned value (EV). The idea of earned value (EV) is to assign a measure on what has actually been done. It relies on determining the physical work performed, what has actually been produced for the cost spent, and whether it is being produced at the planned rate. The EVM uses the EV metrics to automatically calculate independent estimates at completion. The latter are objective forecasts of the project's total cost intended by calculating its progress contrary to the approved predetermined plan. These statements reveal that EVM approach, considers three data sources, as the budget, actual costs and the earned value (Marshall, 2006). That is makes the method to be more reliable and practical. That is makes the EVM to be a technique which measures performance in a simple integrated way and easy to understand final outcomes based on the predetermined accepted plan of a project. In other words, it is a tool for measuring project performance by comparing the amount of work planned against the amount of actual work and cost (Marshall, Ruiz, & Bredillet, 2008) based on work breakdown structure (WBS) as the other basic component of the project management techniques (Johnson, 2014).

To have a better insight about the method and its advantages, it is more helpful to have comparison between the EVM and traditional project management technique. The traditional project progress and success measurement just compares the planned and actual data. This approach only shows planned and actual work, but it does not provide any idea about how much work has been done as the physical amount of work performed and also does not indicate what has been attained according to its cost. In other hand, EVM helps project managers to control the variance between planned and actual works and also predicts the total costs at completion and the project finish date. So, EVM technique is an in-time warning tool against cost overruns and schedule delays, and this ability makes it to be a good controlling technique (Wilson et al., 2013). Besides the advantages of using the EVM in project control which has been introduced in section 2, since, the three factors which are covered by EVM are only the scope, schedule and cost, some other key success factors are missed in the method.

Success is a more challenging word and it has many different means according to many different people. Project success has become a vague term and may be affected by many factors (Lientz & Rea, 2007). More recently, project success meant finishing a project on time, under budget, to meet the expected objectives (Black, 1996; Shrnhur, Levy, & Dvir, 1997). Baccarini (2005) introduces a cost performance as a key parameter especially for project sponsors. (Shrnhur et al., 1997) introduced thirteen success measures in four groups as: 1) meeting design goals, 2) customer benefit, 3) commercial success, and 4) future potential. Innovative technical solutions (Zantke & Mangels, 1999) and soft key success factors such as commitment (Kanter, 2015; Stonehouse, Hudson, & O'Keefe, 1996), social support (Frilet, 1997), and mutual benefit (Grant, 2010) also regarded as critical for portfolio project management. (Qiao, Wang, Tiong, & Chan, 2001) introduced (1) selection of suitable subcontractors, (2) stable political and economic situation, (3) attractive financial package, (4) acceptable tariff levels, (5) risk allocation, (6) appropriate project identification, (7) management control, and (8) technology transfer as the important