Cost Performance Estimation in Construction Projects Using Fuzzy Time Series

Mostafa Salari, Department of Industrial Engineering, Sharif University of Technology, Tehran, Iran

Nooshin Yousefi, Department of Industrial Engineering, Iran University of Science and Technology, Tehran, Iran

Mohhmad Mahdi Asgary, Department of System Engineering, University of Economic Sciences, Tehran, Iran

ABSTRACT

In this paper, the authors develop a model to estimate future performance of construction projects. For the purpose of estimation, fuzzy times series models are used as an effective approach in estimation process. Furthermore, linguistic terms are applied to interpret the fuzzy-based results. The proposed model can assists project managers to develop their knowledge concerning the future aspects of project cost performance. It also provides the early warning of weak upcoming performance of project and extends the feasible time for corrective actions. Eventually, a small example has been provided to illustrate how the new model can be implemented in reality.

Keywords: Earned Value Management, Estimation, Fuzzy Time Series, Information Systems, Project Management

INTRODUCTION

Earned value management (EVM) is a project management technique which can measure project performance from different viewpoints. When EVM is properly applied, it provides an early warning of performance problems. The PMBOK Guide initially defines EVM as "a management methodology for integrating scope, schedule, and resources for objectively measuring project performance and progress" (PMI, 2012). The introduced indices of EVM make this measurement possible. Due to the simplicity and application of EVM systems in different situations, many researchers applied the EVM in various organizations and projects (Al-Jibouri, 2003; Bagherpour et al., 2010; Baumeister and Floren, 2011; Moselhi et al., 2004). On the other hand, there other researchers discussed and improved the efficiency of EVM

in real case projects (Anbari, 2003; Cioffi, 2006; Jacob, 2003; Lipke, 2003; Moslemi Naeni et al., 2011).

One significant feature of EVM relates to the cost management. Actually, there are two distinctive viewpoints for cost management in an EVM system: Initially, it looks backward, measuring the past cost performances of project and using cost performance index (CPI). Secondly, it looks forward, proposing a process called estimate at completion process (EAC) for estimation of project final cost. Regarding the second viewpoints, EVM is a method for assisting project managers to reach reasonable decisions concerning the future. However, there some situations in real case project that project managers require obtaining the cost future performance of project in the upcoming milestones or to observe the future trend of cost performance for taking necessary actions. Hence, being aware of final cost is not enough for taking managerial decisions. It seems that it would be an appropriate idea to bridge the gap between these backward and forward viewpoints of EVM which means to employ CPI for prediction of project performance. However, there are many studies that just addressed the estimation of project final cost and attempted to improve their obtained estimation. In this regard, Anbari (2003), Lipke (2003) and Jacob and Kane (2004) used as planned value (PV), earned schedule (ES) and earned duration (ED) to develop their models for prediction of project total cost. Moreover, Barraza et al. (2004) utilized stochastic S-curves for forecasting of project performance. In another study, Dillibabu and Krishnaiah (2005) discussed cost estimation method in terms of effort spent on a software project. Lipke et al. (2009) introduced a final time and cost forecasting method applying statistical approach. Warburton (2011) developed a model for estimation of project final cost concerning how to exceed the convergence to the appropriate result with less variation than typical model for estimate at completion calculations. Feylizadeh et al. (2012) discussed a fuzzy neural network to estimate at completion costs of construction project. Azman et al. (2012) studied the accuracy of preliminary cost estimation in public work departments. Recently, Caron et al. (2013) proposed a Bayesian approach to improve estimate at completion in earned value management.

To the best of authors' knowledge, none of the researches in EVM area of research attempted to take the advantage of CPI for periodic estimation of project performance from cost view point. Hence, the main contribution of this study is to concentrate on this available lack in EVM technique. The rest of this paper is organized as follows. The cost performance metric in EVM is introduced initially. It is followed by the introduction of fuzzy time series. Then, the illustrative case and obtained results are provided. Finally, discussion and conclusion are presented.

COST PERFORMANCE MANAGEMENT IN EVM

Cost performance index (CPI) measures the variability of cost performance through the whole life cycle of project. There is a certain way for assessment of CPI. Though, recent studies have been discussed novel approaches for more efficient assessment (Aliverdi et al. 2013, Naeni et al., 2011). According to the traditional approach, If CPI is less than unity then it indicates the cost weak performance. Moreover, if it becomes equal or greater than unity, it can reveal the point that project is performed in almost normal condition and according to the planned budget. The following equation indicates the mathematical approaches in which CPI can be obtained:

$$CPI = \frac{EV}{AC} \tag{1}$$

where, EV and AC stand for earned value and actual cost of project up to the data date. In the following subsection, we are going to describe the method that we utilize to predict the future performance of project.

8 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/article/cost-performance-estimation-in-construction-projects-using-fuzzy-time-series/123466

Related Content

An Approach to Optimize Multicast Transport Protocols
Dávid Tegze, Mihály Orosz, Gábor Hosszúand Ferenc Kovács (2009). *Encyclopedia of Information Science and Technology, Second Edition (pp. 206-211).*
www.irma-international.org/chapter/approach-optimize-multicast-transport-protocols/13574

Methodology of Creating Ontology of Information Science (OIS)
Ahlam F. Sawsaaand Joan Lu (2017). *Ontologies and Big Data Considerations for Effective Intelligence (pp. 510-517).*
www.irma-international.org/chapter/methodology-of-creating-ontology-of-information-science-ois/177401

Developing a Telecommunication Operation Support Systems (OSS): The Impact of a Change in Network Technology
James G. Williamsand Kai A. Olsen (2006). *Journal of Cases on Information Technology (pp. 35-54).*
www.irma-international.org/article/developing-telecommunication-operation-support-systems/3188

Analyzing the Evolution of End User Information Technology Performance
John Saccoand Darrene Hackler (2002). *Annals of Cases on Information Technology: Volume 4 (pp. 195-208).*
www.irma-international.org/article/analyzing-evolution-end-user-information/44507

Improving Virtual Teams through Creativity
Teresa Torres-Coronasand Mila Gascó-Hernández (2009). *Encyclopedia of Information Science and Technology, Second Edition (pp. 1893-1898).*
www.irma-international.org/chapter/improving-virtual-teams-through-creativity/13836