Chapter 90
Fuzzy Quantitative and Semi-Qualitative Risk Assessment in Projects

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ABSTRACT

Before initiating a project, risks assessment, is a process that its importance has felt in past two decades and has taken a position in project activities. Project's managers apply risk assessment as a preventive method for highly possible risks having an unfavorable influence on project objectives. Risk assessment has implemented in three ways: qualitative, semi-qualitative (semi-qualitative) and quantitative. In this paper, the author reviews quantitative and semi-qualitative risk assessment methods in associated with fuzzy sets theory (FST). Moreover, considering three steps of risk assessment process, namely: definition and measurement of parameters, fuzzy inference and defuzzification, the author classified presented articles into three groups of giving opinion methods, assessment methods and defuzzification methods. It is avoided mentioning articles with same assessment methods in this paper. Although giving opinion methods and defuzzification methods have the potential to be worked on, late risk assessment surveys, demonstrate increasing attempt on developing comprehension and reality adjustment in project risk assessment methodologies.

INTRODUCTION

Identifying, prioritizing and considering risks represent common management activities. For a long time, hazard risks, as well as financial ones have been actively managed. But, the variety, number and interactions between risks are continually increasing. Nowadays assessing risks is used in many fields such as technology (Li and Zhang, 2011), decision making (Zhang et al., 2011) and engineering (Bao et al., 2011, Hsu and Wang, 2011). On the other hans fuzzy logic is one of the most useful methods that has been used in different areas such as engineering (Xu and Zhao, 2012, Zhang et al., 2012, Zhang ET AL., 2011, Sung et al., 2011, Zhai et al., 2011), decision making (Zhiqiang, et al., 2012, Kilincci et al.,

2011, Chamodrakas et al., 2011, Xianzhang et al., 2012) and medicine (Gadaras and Mikhailov, 2011, Lekkas and Mikhailov, 2010, Uzoka et al, 2011). The operational and strategic risks have increased due to the failure of the control mechanisms in a very dynamic business environment. In these circumstances, the organizations admit the importance of managing all risks, including the standard and the new risks. (Bodea and Dascalu, 2009).

In risk management, often, managing and reacting to all identified risks is not possible, so prioritizing risks based on their importance seems inevitable. Therefore, risk assessment process is used for this purpose. (Salehi Sedghiani, 2009).

After risks identification, next step is to evaluate likelihood and effect of them to risk management activities. This makes risks managed due to their priorities. This process relates identification of systematic risks with logical management based on importance of risks. (Raz & Michael, 2001).

LITERATURE REVIEW

Project Risk and Risk Assessment

According to PMBOK standard, project risk is an uncertain event or situation that has a positive or negative effect on project objectives, if it occurs. A risk has a cause and a consequence, if it happens. Thus, risk is usually defined as likelihood of an event that may result in loss and its potential intensity. Hence, the more an event likelihood and potential loss intensity (event consequences) is, the more risk increases (Muhlbauer, 2004). So, in risk assessment, we mostly use likelihood and effect (effect severity) as two criteria for evaluating each risk factor.

Boehm (1991), defined risk assessment as first step of two steps risk management: "Risk assessment includes identification, analysis and prioritizing risks". Galway (2004) mentioned that risk analysis is the process of quantitatively or qualitatively assessing risks. This involves an estimation of both the uncertainty of the risk and of its impact. Zeng et al. (2007) defined risk assessment as a process that evaluates likelihood of an event (favorable or unfavorable) and its effect magnitude.

There are three approaches to assessing project risks: quantitative, semi-qualitative and qualitative risk analysis methods. Most of the real-world risk analysis problems contain a mixture of quantitative and qualitative data; therefore quantitative risk assessment techniques are inadequate for prioritizing risks (Nieto-Morote and Ruz-Vila, 2011). When dealing with a real world problem, we can rarely avoid uncertainty. At the empirical level, uncertainty is an inseparable companion of almost every event (Kovacs, 2003). Therefore, using fuzzy sets theory (Zadeh, 1965) for risk assessment becomes prevalence in order to take real world uncertainty into account and makes assessment results more realistic and management activities more effective. The use of fuzzy sets to describe the risk factors and fuzzy-based decision techniques to help incorporate inherent imprecision, uncertainties and subjectivity of available data, as well as to propagate these attributes throughout the model, yield more realistic results. (Takacs, 2010).

A Review on Fuzzy Quantitative and Semi-Qualitative Project Risk Assessment Methods

Beginning of 80's was the time for primitive attention to risks and probabilities and rudimentary attempt to calculate them. For example Kaplan and Garrick (1981) presented three sets of triplets of scenario,

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