New integrated approach to the problem of ranking and supplier selection under uncertainties

D Tadic[1], D D Milanovic[2], M Misita[2]*, and **B Tadic[1]**
[1]Department of Production and Industrial Engineering, University of Kragujevac, Kragujevac, Serbia
[2]Industrial Engineering Department, Unviersity of Belgrade, Belgrade, Serbia

The manuscript was received on 6 April 2010 and was accepted after revision for publication on 2 August 2010.

DOI: 10.1243/09544054JEM2105

Abstract: The problem of ranking and supplier selection in the uncertain environment is part of a purchasing plan and its relationship has a critical effect on the competitive advantage (high-quality products at lower cost with higher customer satisfaction) of each industrial organization. The considered problem can be stated as a multicriteria decision problem which includes both quantitative and qualitative criteria. The criteria present supplier performances which are defined by the purchasing Management Team depending on the size of industrial organizations and on production type. In this paper, the Management Team, using European Union (EU) recommendations, made a choice of criteria for supplier evaluation. The fuzzy rating weights of each pair of the considered criteria and uncertain criteria values are described by linguistic expressions which are modelled by triangular fuzzy numbers. The fuzzy extent approach for the synthetic extent values of the pairwise comparison for handling fuzzy analytic hierarchical process (AHP) is used to calculate the weight vector. The extension of the fuzzy technique for order preference by similarity to ideal solution (TOPSIS) is applied to rank the suppliers. The proposed model is illustrated by an example. It is shown that the developed model is highly suitable as a decision-making tool for reaching decisions about supplier selection.

Keywords: supplier selection, multicriteria analysis, AHP, TOPSIS

1 INTRODUCTION

Technological, political, economic, and environmental changes in the business world require managers of industrial organizations to develop new strategies which should lead to an increase in their competitive advantages (high-quality products at lower cost with higher customer satisfaction). One of these strategies implies developing purchasing management of raw materials and components (materials). According to reference [**1**] supplier selection is one of the most important functions of purchasing management.

Based on theory and the practice of purchasing management, it is well known that selection of the best supplier from the group of possible suppliers is always based on multicriteria whose objectives are conflicting; thus the selection of the appropriate suppliers is far from a trivial task. The common criteria regarding which best supplier is selected are unit cost and quality of material. If the supplier selection problem is related to the global sourcing, then it is necessary to consider many other criteria such as: political-economic situation, geographical location, infrastructure, financial background, performance history, risk factors, etc. The number and type of criteria according to which best supplier is selected are determined by purchasing managers and multiple criteria need to be carefully examined. The problem becomes significantly more complex when introducing the assumption, which is realistic one, that the considered criteria have different relative importance.

When companies outsource a significant part of their business and become more dependent on outsourcers, the company performance concerning quality and delivery totally depends on its outsources. The consequences of poor decision making

**Corresponding author: Industrial Engineering, Faculty of Mechanical Engineering, Kraljice Marije 16, Belgrade, Serbia. email: mmisita@mas.bg.ac.rs*