



# A fuzzy approach for supplier evaluation and selection in supply chain management

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## Abstract

This paper is aimed to present a fuzzy decision-making approach to deal with the supplier selection problem in supply chain system. During recent years, how to determine suitable suppliers in the supply chain has become a key strategic consideration. However, the nature of these decisions usually is complex and unstructured. In general, many quantitative and qualitative factors such as quality, price, and flexibility and delivery performance must be considered to determine suitable suppliers. In this paper, linguistic values are used to assess the ratings and weights for these factors. These linguistic ratings can be expressed in trapezoidal or triangular fuzzy numbers. Then, a hierarchy multiple criteria decision-making (MCDM) model based on fuzzy-sets theory is proposed to deal with the supplier selection problems in the supply chain system. According to the concept of the TOPSIS, a closeness coefficient is defined to determine the ranking order of all suppliers by calculating the distances to the both fuzzy positive-ideal solution (FPIS) and fuzzy negative-ideal solution (FNIS) simultaneously. Finally, an example is shown to highlight the procedure of the proposed method at the end of this paper. This paper shows that the proposed model is very well suited as a decision-making tool for supplier selection decisions.

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## 1. Introduction

Recently, supply chain management and the supplier (vendor) selection process have received considerable attention in the business-management

literature. During the 1990s, many manufacturers seek to collaborate with their suppliers in order to upgrade their management performance and competitiveness (Ittner et al., 1999; Shin et al., 2000). The material flow in a supply chain is shown in Fig. 1. The purchasing function is increasingly seen as a strategic issue in organizations. Buyer and supplier relationships in manufacturing enterprises have received a great deal of attention. When it is built

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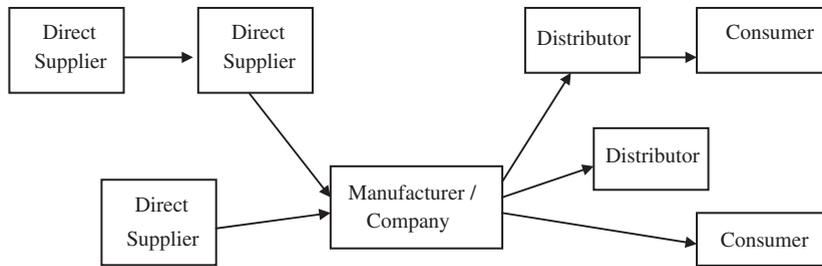


Fig. 1. Material flow in supply chain.

on long-term relationships, a company's supply chain creates one of the strongest barriers to entry for competitors (Briggs, 1994; Choi and Hartley, 1996). In other words, once a supplier becomes part of a well-managed and established supply chain, this relationship will have a lasting effect on the competitiveness of the entire supply chain. Therefore, the supplier selection problem has become one of the most important issues for establishing an effective supply chain system. The overall objective of supplier selection process is to reduce purchase risk, maximize overall value to the purchaser, and build the closeness and long-term relationships between buyers and suppliers (Monczka et al., 1998).

In supply chains, coordination between a manufacturer and suppliers is typically a difficult and important link in the channel of distribution. Many models have been developed for supplier selection decisions are based on rather simplistic perceptions of decision-making process (Boer et al., 1998; Lee et al., 2001). Most of these methods do not seem to address the complex and unstructured nature and context of many present-day purchasing decisions (Boer et al., 1998). In fact, many existing decision models only quantities criteria are considered for supplier selection. However, several influence factors are often not taken into account in the decision making process, such as incomplete information, additional qualitative criteria and imprecision preferences. According to the vast literature on supplier selection (Boer et al., 1998; Choi and Hartley, 1996; Weber et al., 1991), we conclude that some properties are worth considering when solving the decision-making problem for supplier selection. First, the criteria may consider quantitative as well as

qualitative dimensions (Choi and Hartley, 1996; Dowlatshahi, 2000; Verma and Pullman, 1998; Weber et al., 1991, 1998). In general, these objectives among these criteria are conflicted. A strategic approach towards supplier selection may further emphasize the need to consider multiple criteria (Donaldson, 1994; Ellram, 1992; Swift, 1995). Second, several decision-makers are very often involved in the decision process for supplier selection (Boer et al., 1998). Third, decision-making is often influenced by uncertainty in practice. An increasing number of supplier decisions can be characterized as dynamic and unstructured. Situations are changing rapidly or are uncertain and decision variables are difficult or impossible to quantify (Cook, 1992). Fourth, the types of decision models can be divided into compensatory and non-compensatory methods (Boer et al., 1998; Ghodsypour and O'Brien, 1998; Roodhooft and Konings, 1996). The compensatory decision models leading to an optimal solution for dealing with supplier selection problems. The non-compensatory methods are that use a score of an alternative on a particular criterion can be compensated by high scores on other criteria. From the literature it can be concluded that in supplier selection the classic concept of "optimality" may not always be the most appropriate model (Boer et al., 1998). Overall speaking, we can conclude that supplier selection may involve several and different types of criteria, combination of different decision models, group decision-making and various forms of uncertainty. It is difficult to find the best way to evaluate and select supplier, and companies use a variety of different methods to deal with it. Therefore, the most important issue in the process

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