Chapter 12

A Short Review on Supplier Selection Problem Methods Under Uncertainty

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ABSTRACT

In today’s globally competitive environment, firms give great attention for selecting right suppliers in the context of their supply chain management. Choosing right suppliers helps to reduce the purchasing costs and improve the quality of final products and services. Supplier selection problem is one of the multi-criteria decision-making problems which includes both qualitative and quantitative factors like unit cost, delivery on time, service quality, etc. Handling imprecise information is one of the most important problems for modeling supplier selection problem. In order to overcome this problem, many scientific researchers have been published during the years, and many mathematical theories have been used to handle uncertainties in supplier selection problem such as fuzzy set theory, stochastic theory, rough set theory, and some hybrid techniques, etc. This chapter aims to provide short review on SSP methods under uncertainty. The sources used for the study consist of scientific refereed journals and books and are selected with respect to their citation rate and the ability of presenting the contained technique well. Also, the publications in languages other than English and non-refereed professional ones are not included.

INTRODUCTION

Supplier Selection Problem (SSP) is a multi-criteria decision-making problem, which includes both qualitative and quantitative factors. The supplier is vital to ensure that the final product to be delivered to the customer can be produced at the best quality. The fact that inputs such as raw materials, semi-finished goods and services to be procured from suppliers are included in the production process in the best quality, on time and at a reasonable cost are directly related to the SSP. This critical decision-making processes also includes evaluation process of suppliers in terms of their variety of attributes.

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Decision-making is a part of daily human life, and the nature of the decision-making involves numerous and often contradictory criteria. A number of criteria must be considered in the selection of the appropriate mathematical method to address the SSP. The most important of these criteria is the handling of uncertain and unfavorable information that often arises in real life situations. This chapter is organized as follows. In the literature review for SSP methods under uncertainty section, we first introduced the papers that are presented for selecting the criteria of SSPs. Also, we examined the most interesting of decision-making techniques such as fuzzy decision making, stochastic decision making and robust decision-making techniques which are presented to address the uncertainty inherent in the SSP. Finally, we take into account the integrated techniques that are mostly applied to SSP. Literatures show that neural networks present better performance than traditional statistical methods. Recent studies include the applications of neural networks integrated with other approaches in supplier evaluation and selection.

LITERATURE REVIEW FOR SSP METHODS UNDER UNCERTAINTY

In the literature on this problem exist some researches (i) focused on SSP criteria, and (ii) proposed methods for supplier selection process.

Many researchers identified several criteria for selection process for example Dickson (1966) identified 23 criteria and Dempsey (1978) described 18 criteria. Weber et al. (1991) reviewed, annotated and classified 74 related articles, which have appeared since 1966, and specific attention is given to the criteria and analytical methods used in the supplier selection process.

Even if the criteria to be used in the SSP are determined properly, it is a fundamental problem to deal with the uncertainty in the process. In this study, we aim to provide a short review on SSP methods under Uncertainty. The sources used for our study consist of scientific refereed journals, books, and are selected with respect to their citation rate and the ability of presenting the contained technique well. Also, the publications in languages other than English and non-refereed professional ones are not included.

Fuzzy Decision Making

Due to the complexity and uncertainty involved in real world decision problems, decision makers may be insufficient to make crisp evaluations. Moreover, even if they do the same evaluations, the meanings they upload to the same words may be different. For these reasons, fuzzy numbers and fuzzy sets have been introduced to describe linguistic variables. Therefore, the fuzzy set theory emerges as a good tool to deal with uncertainty in SSP.

Kahraman et al. (2003) informed that to deal with vagueness of human thought, Zadeh (1965) first introduced the fuzzy set theory, which was oriented to the rationality of uncertainty due to imprecision or vagueness. A major contribution of fuzzy set theory is its capability of representing vague data. The theory also allows mathematical operators and programming to apply to the fuzzy domain. A fuzzy set is a class of objects with a continuum of grades of membership. Also, Kahraman et al. (2003) pointed that the Analytic Hierarchy Process (AHP) is one of the extensively used multi-criteria decision-making methods. One of the main advantages of this method is the relative ease with which it handles multiple criteria. In addition to this, AHP is easier to understand and it can effectively handle both qualitative and quantitative data. The use of AHP does not involve cumbersome mathematics. AHP involves the principles of decomposition, pairwise comparisons, and priority vector generation and synthesis. Though