ABSTRACT

The supplier selection process attracted a lot of attention in the business management literature. This process takes into consideration several quantitative and qualitative variables and is usually modeled as a multi-attribute decision making (MADM) problem. A recognized shortcoming in the literature of classical MADM methods is that they don’t permit the identification of interdependencies among attributes. Therefore, the aim of this study is to propose a model for selecting suppliers of telecommunications equipment that includes the interaction between attributes. This interaction can model the hidden knowledge needed for efficient decision-making. To model interdependencies among attributes the authors use a recently proposed consistent fuzzy logic, i.e. interpolative Boolean algebra (IBA). For alternatives ranking they use the classical MADM method TOPSIS. The proposed model was evaluated on a real-life application. The conclusion is that decision makers were able to integrate their reasoning into the MADM model using interpolative Boolean algebra.

Keywords: Fuzzy Logic, Generalized Boolean Polynomial, Interpolative Boolean Algebra, Logical Aggregation, Supplier Selection Problem, Technique for Order Performance by Similarity to Ideal Solution

1. INTRODUCTION

The world is becoming an increasingly global marketplace, and thus, in such conditions, global environment requires companies when making business decisions to take into account almost all aspects of the business at the same time. One of the most important aspects of business is the selection of suppliers. The selection of suppliers is a process which essentially involves a large number of both quantitative and qualitative attributes. Therefore, in order to select the best suppliers it is necessary to take into account both tangible and intangible factors, which are usually conflicted.

This is certainly the case in the telecommunications industry, a sector which has had to cope with rapidly changing standards and...
requirements for at least 2 decades. In these circumstances, it is essential that businesses choose the suitable supplier in order to remain competitive in the market-place. The main objective of any company is to choose a supplier that will provide the right quality products at the right price, at the right quantity and at the right time. In most cases, the strengths and weaknesses of suppliers vary over time, so that decision makers are in a position to have to make complex decisions in the selection of suppliers.

The objective of this paper is to analyze the problem of supplier selection in the Serbian telecommunications sector. The telecommunications industry in Serbia records a constant growth both in the investments and income domain. Therefore, the telecommunication equipment manufacturers seek new ways and new approaches to maintaining and improving their businesses. In such cases, companies demand accurate assessments of investment risks in order to deliver the right strategic decisions. With strong competition, there is a constant need to improve and expand product ranges, reduce prices and to respond to moves made by competitors. New technologies constantly evolve and old technologies improve. It is therefore essential for every modern Serbian telecommunications company to respond to the requests of its clients by offering guaranteed quality and reliable functionality of a wide and diverse range of products. Globalization and the increasing uncertainty of businesses has prompted a growth of outsourcing services. Under these circumstances, much more attention is paid to the decision making related to the supply process. Such decisions require large-scale investments within the telecommunications industry and influence the strategic positioning of companies in this sector. Selection of an appropriate supplier in these conditions is one of the most important problems businesses face today.

The selection of suppliers is a critical and challenging task for companies that participate in the telecommunications market. Therefore, this paper aims to propose a MADM model for supporting the selection of suppliers in the telecommunications sector. The proposed model combines a logical aggregation method, Interpolative Boolean Algebra (IBA), for expressing attributes relations and co-dependencies and the famous MADM method TOPSIS. IBA aims to model logical interactions between attributes and sub-attributes, while the TOPSIS method ranks alternatives. In this study we explore the practical use of the proposed model using the example of a telecommunications company that operates on Serbia.

In real situations, the problem of selecting of suppliers means that decision makers often want to integrate their knowledge into a decision support model which often requires setting up logical relationships among attributes. As classical fuzzy methods of MADM do not allow setting of logical interactions among attributes, i.e. they do not obey all Boolean laws. The consistent fuzzy logic is introduced by Radojevic, 2000a. The basis of the proposed approach is the interpolative realization of Boolean algebra (IBA) that transforms logical conditions among attributes/sub-attributes into a generalized Boolean polynomial, then aggregates logical conditions using a logic aggregation function (Radojevic, 2000b). In this paper we will show how linguistic requirements of decision makers in a telecommunications company can be modeled using Boolean polynomials.

Finally, the ranking of suppliers based on the proposed model is provided using the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) proposed by Hwang & Yoon (1981). TOPSIS represents one of the most used classical MADM method. This method ranks alternatives according to their distance from the positive and the negative ideal solution. The optimal alternative is the one that is geometrically closest to the positive ideal solution and furthest from the negative ideal solution.

The originality and contribution of this paper is reflected in the fact that to our knowledge this is the first time that a hybrid model for supplier selection that combines IBA and TOPSIS method has been proposed. What makes this model more flexible and efficient,
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