Chapter 9
Modified TOPSIS Method With Banking Case Study

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ABSTRACT

In this chapter, an alternative measure to Euclidean distance measurement is proposed which is used to calculate positive and negative ideal solutions in the traditional TOPSIS method. Lp Minkowski family and L1 family distance measures were used for this purpose. By taking the averages of the distance measurements in the Lq and L1 families, more general and accurate level units were tried to be obtained. Thus, it was shown that TOPSIS method can give different results according to the distance measure used. The importance of the distance measurement unit was emphasized to rank the alternatives correctly. The implementation and evaluation of the proposed method was carried out through the financial performance of the deposit bank operating in the Turkish Banking Sector. It was seen that the rankings of the alternatives changed according to the distance measurements used. By referring to the distance measurements that can be used in the TOPSIS method, it was shown that the rank of the alternatives can vary according to the preferred distance measure.

INTRODUCTION

We have to make a choice among alternatives for actions we think we are doing or are considering to do in many of our lives. The selection process starts with the formation of at least two alternatives, the process works and one of the alternatives is selected. This selection process is one of the simplest definitions of decision making. Decision making is called Multi Criteria Decision Making (MCDM), which has a lot of criteria in particular. The development of MCDM dates back to the 1960s. The objective of

the MCDM is to make the decision-making process as easy and quick as possible, in cases where the alternative and criterion numbers are far too many.

MCDM is actually a part of real life, in which we face many problems and have to make decisions. When things get complicated, people have a hard time in making a decision and they may need help. In that case, applying some simple rules and procedures to the problem rather than adding too much information and trying to make a decision will lead to a more rational decision and the final decision will be more appropriate in a given condition (Taha, 1997).

There are various MCDM methods in the literature and they do not have superiority over the other. Evaluating quantitative and qualitative criteria together is the most significant advantage of these methods..

There are many methods developed in the literature to solve MCDM problems. Although none of these methods is superior to the other, they can provide advantage or disadvantage according to the problem structure discussed. Often the results of several methods are evaluated before the final decision is made. ELECTRE, TOPSIS, PROMITHEE, VIKOR MCDM methods are the most basic methods known. Numerous MCDM methods have been introduced into the literature since the beginning. There are also studies in the literature on the modification of these and other methods, or the development of hybrid methods consisting of a combination of several MCDM methods.

In this study, TOPSIS, one of the MCDM methods, was tried to be modified. For this purpose, the Euclidean distance used to rank alternatives in the traditional TOPSIS method is focused. An alternative measure for Euclidean distance has been developed. This unit of measure is composed of distances in L_p Minkowski family (Sorensen, Gower, Soergel, Kulczyynski, Canberra, Lorentzian) and L_1 family (Euclidean, City block, Chebyshev). Thus, a more powerful unit of measurement was tried to be obtained.

In the following sections, firstly the steps of TOPSIS method will be elaborated. Then, the distances in L_p Minkowski family and L_1 family which are mentioned with emphasis on distance concept will be discussed in detail.

BACKGROUND

The first known application in the field of MCDM was performed Churchman et al. (1957). In this application for solving a decision-making problem the Simple Additive Weighting (SAW) method was used. Then, various studies for MCDM were performed. It is possible to list the most used ones as follows: TOPSIS (Technique for Order Preference ny Similarity to an IdealSolution) (Hwang and Yoon, 1981; Deng et al., 2000), AHP (Analitic Hierarchy Process) (Saaty 1980, 2000; Belton and Gear 1983; Lootsma 1999), ELECTRE (Elimination Et Choix Traduisant La Realite´-Elimination and Choice Expressing The Reality) (Roy 1989, 1991; Roy and Vincke 1981), VIKOR (Visekriterijumska Optimizacija I Kompromisno Resenje - Multicriteria Optimization and Compromise Solution) (Yu, 1973; Zeleny, 1982; Opricovic 1998; Tzeng and Huang, 2011), PROMITHEE (Preference Ranking Organization Methods for Enrichment Evaluation(Brans et al., 1984), etc.

In order to solve the problems of uncertainty, blurred states of MCDM methods have been discussed (Bass and Kwakernaak, 1977; Chen et al., 1992; Figueira et al., 2004, etc.). Additionally, different versions and modifications of these MCDM methods have been studied for solving various decision problems (Deng et al.,2000; Olson,2004; Vommi,2017, etc.).

The TOPSIS method is a MCDM method aiming at getting closer to the most ideal alternative while getting away from the least ideal solution. Some of these are as follows:

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