# Chapter 10
# TOPSIS vs. VIKOR:
## A Case Study for Determining Development Level of Countries

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## ABSTRACT

*Evaluating multiple criteria and selecting and/or ranking alternatives is called Multi Criteria Decision Making (MCDM). These methods which are considered important decision-making tools for decision makers due to their multidisciplinary nature have been developed over the years. As a result, there are many MCDM methods in the literature. In this chapter, TOPSIS and VIKOR, widely used in the literature, will be discussed. The major reason for examining these two methods is that the aggregating function used by both methods is similar because VIKOR method uses linear normalization and TOPSIS method uses vector normalization. The process of the methods is shown on a data set that includes the Human Development Index (HDI) indicators, which have been developed to measure the development levels of countries as well as the unemployment indicator. It was observed that the methods yielded similar results.*

## INTRODUCTION

It is possible to define decision making as the process of choosing the best among various alternatives, which is an indispensable behavior that we exhibit in almost every moment of our lives. This process can become quite complex when evaluating the many alternatives we have to choose among many criteria. Various methods have been developed to minimize the complexities to be encountered as much as possible, and to help decision makers make the right and effective decision.

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In the literature, decision making process can be defined by different methods and procedures since it is used by various disciplines such as operational research, computer science, cognitive science, sociology, decision theory, economics, psychology, management, political science, statistics (Berger (1990), Edwards and Fasolo (2001), Hastie (2001), Matlin (1998), Wilson and Keil (2001)).

Decision-making processes with multiple criteria are called MCDM. MCDM has been developing since the beginning of 1960s. Then, researchers have developed various methods to solve such decision problems and they still continue to develop. Because in real life, whether in our daily lives or business, we are constantly faced with many criteria and alternatives. MCDM is a very important area whose main objective is to keep the decision-making mechanism under control and make the decision-making process as easy and fast as possible when the number of alternatives and criteria is too high. Although there are many MCDM methods in the literature, none of them has any superiority over the other. The validity and reliability of the methods can vary according to the decision problem. At this point, it can be the right approach to evaluate the results of MCDM methods which can be applied to the same decision problem altogether and to suggest the most appropriate one (or ones) according to the results obtained. Churchman et al. (1957) performed the first known method in the field of MCDM which is called SAW (Simple Additive Weighting). Then, various studies for MCDM were performed. It is possible to list the most used ones as follows: TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) (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 (Vlse Kriterijumska Optimizacija 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. Apart from these methods, there is also a large number of methods in the literature where fuzzy structures are tested, hybrid methods are created by combining different methods together and methods have been modified.

In this chapter, TOPSIS and VIKOR methods will be discussed. The most important reason for the comparison of various MCDM methods, especially TOPSIS and VIKOR, is that the two methods are similar. Namely: Both methods are based on an aggregating function that represents closeness to the ideal solution. However, for eliminating decision-making units, VIKOR method uses linear normalization while TOPSIS method uses vector normalization. TOPSIS method is based on the principle of choosing the alternative that has the shortest distance to the positive ideal solution and the longest to the negative ideal solution. VIKOR method is based on the principle of determining a possible solution closest to the ideal solution. This method lists alternatives by considering the maximum group benefit and minimum regret. VIKOR is also known as the Compromise Ranking Method.

In the following sections, first, TOPSIS and VIKOR methods will be discussed in detail. Their similar and different aspects will be emphasized. Then, the process steps of the methods will be carried out on the data that is used to compare countries' level of development. And finally, the results obtained will be compared.