

Interpreting Weights in Multiple Criteria Decision Making

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Abstract

Many decision making problems of business and management are formulated in terms of Multiple Attribute Decision Making (MADM): given a set of alternatives evaluated with multiple criteria, find the alternative which according to the Decision Maker (DM), has the most preferred combination of criteria values (attributes), or rank alternatives from the most preferred one to the least preferred one. The MADM methods incorporate mechanisms of building preference models based on information obtained from the DM. In a wide variety of such methods, the DM is supposed to provide information in terms of weights of criteria, usually understood as criteria's priorities. These weights serve as parameters of the method-specific preference models.

The DM can define weights directly, or by using special weight elicitation techniques such as AHP, MAVT and others. Our concerns are that when using weight-based methods, the DM cannot ensure the correctness of the preference model. First, different weight-based methods use different kinds of preference models, which prioritize criteria based on weights in different manners. Second, interpretation of weights in some MADM methods is far from intuitive. Thus, a situation may occur when an inexperienced DM thinks of weights differently than they actually work in the method, and expresses the preference information incorrectly.

In this paper we demonstrate the differences between how weights are interpreted in several methods: simple additive weighting, TOPSIS, VIKOR and PROMETHEE. We do it by comparing rankings produced with methods based on randomly generated data. We demonstrate that differences of interpreting weights significantly contribute to differences in produced rankings. A solution to this problem could be twofold: first, increasing awareness of differences between method-specific weight-based prioritizing mechanisms, and second, providing interpretations of weights for popular methods in the language understandable by the DMs.

Keywords: MADM, preference modeling, weighting, TOPSIS, VIKOR, PROMETHEE.

1. Introduction

A problem of multiple attribute decision making (MADM) is formulated as follows [3]. There is a finite set of alternatives and a Decision Maker (DM), for whom alternatives