Weighted average vs TOPSIS: a comparison of aggregation methodologies for AHP

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Abstract

Starting from the observation of an ever increasing number of publications in the field of supplier selection problems utilising multi-criteria decision making methodologies, this paper aims at providing a critical comparison of some of the most utilised approaches in this context.

According to Bruno et al. (2012), Analytical Hierarchy Process (AHP) (and its variant, Analytical Network Process, ANP) (Saaty, 1980) is, by far, the most popular methodology for dealing with the supplier selection problem, that represents one of the quintessential multi-criteria decision making problems. The main strength of AHP lies in the possibility of combining it with a large variety of other methodologies, for obtaining flexible, customised and tailored solution approaches. This has led to a plethora of approaches being available in the literature; however, often it is not clear what are the advantages and the disadvantages of specific techniques, both in terms of performances related to both computational results and decision support. The result is a strikingly growing body of literature, whose practical contribution, apart from technical aspects (related to the development of new methodologies), may be questionable

Considering this evidence, the goal of this paper is to provide a structured comparison of two of the most popular methodologies employed in combination with the Analytic Hierarchic Process (AHP) in solving supplier selection and similar multi-criteria decision making problems: the Weighted Average and TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) (Lima et al., 2014). Both these methods, indeed, are often utilised as aggregation modes for multi-criteria decision making frameworks, in which AHP (or ANP) is utilised in order to derive weights of involved criteria.

In particular, we compare the performance of these two aggregation methodologies on the basis of a set of randomly generated numerical instances of a hypothetical supplier selection problem. Supplier rankings will be produced by employing AHP in combination with TOPSIS and Weighted Average techniques; concordances and discrepancies of the resulting rankings obtained by using the different methodologies will be evaluated according to appropriate statistical measurements and tests. A discussion about practical implications of the study will be then developed, along with conclusions and future research perspectives.

References

Bruno, G., Esposito, E., Genovese, A., Passaro, A. (2012). AHP-based approaches for supplier evaluation: Problems and perspectives. *Journal of Purchasing and Supply Management*, 18, 159-172.

Lima, J., Osiro, L., Carpinetti, L.C.R. (2014). A comparison between Fuzzy-AHP and Fuzzy-TOPSIS methods to supplier selection. *Applied Soft Computing*, 21, 194-209.

Saaty, T.L., 1980. *The analytic hierarchy process: planning, priority setting, resources allocation*. McGraw-Hill International, New York.