Trapezoidal Hesitant Fuzzy TOPSIS method in Multi-criteria Group Decision-Making

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The proposed study develops a decision support methodology for multi-criteria group decision-making problem (MCGDM). The methodology is based on the TOPSIS (Technique for Order Performance by Similarity to Ideal Solution) approach in the hesitant fuzzy environment. The main idea of decision-making problem is selection of one, best alternative or several ranked alternatives among a set of feasible alternatives. Typically, the process of decision-making is based on an evaluation of certain criteria. In many MCGDM problems, the process of decision-making involves experts' assessments. These assessments frequently are expressed in fuzzy numbers, intuitionistic fuzzy values, hesitant fuzzy elements and so on. However, a more natural representation of experts' assessments may be lingual expressions (linguistic terms). In the proposed methodology the values of the criteria are given initially in linguistic terms. Then, these assessments are expressed in trapezoidal fuzzy numbers. Decision is made using TOPSIS method. Hence, proposed approach is based on trapezoidal hesitant fuzzy TOPSIS decision-making model. Following the TOPSIS algorithm, first the fuzzy positive-ideal solution (FPIS) and the fuzzy negative-ideal solution (FNIS) are defined. Then the ranking of alternatives is performed in accordance with the proximity of their distances to the both FPIS and FNIS. An example of the alternatives' ranking using the Trapezoidal Hesitant Fuzzy TOPSIS method is presented for an illustration of application of the offered approach.

Keywords: Fuzzy TOPSIS approach, linguistic term, multi-criteria group decision-making, trapezoidal hesitant fuzzy set.