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A Study of Behavioral Considerations based on Prospect Theory for Group Decision Making

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Abstract

For managing the behavioral effect of the risk preference of decision makers (DMs) in a group decision, this study adapts the TODIM (an acronym in Portuguese of Interactive and Multi-criteria Decision Making) to deal with risk decision and combines with incremental analysis (IA) and group ranks to construct an integrated multi-criteria group decision support model. In consideration of the ordinal rank of each DM using IA and the relative weights of DMs, the approaches for converting the ordinal data to cardinal data and determining the weights of DMs based on the eigenvector of their ranking distance comparison matrix are also compared and discussed. Furthermore, sensitivity analyses of the parameters of the value function and different weights of DMs demonstrate the robustness of the integrated model. An example proves the proposed model to be feasible.

Keywords: GDM, TODIM, Incremental Analysis, risk attitude, DM's weight.

1. Introduction

Since the 1960s, a wide range of multi-criteria decision-making (MCDM) methods have been developed. Some of these methods are applied in group decision-making (GDM); however, few of these methods consider the effects of risk on the behavior of individuals or groups in the decision-making environment. In this paper, we propose a three-stage hybrid MCDM method for solving GDM problems under risk. In the first stage, we propose a generalized TODIM with a generalized power value function based on prospect theory. This approach involves an engineering economics method, incremental analysis (IA), in which linear and nonlinear preference functions are proposed for benefit and cost criteria, respectively. We began by determining the ranking of each member in a decision group by using IA. A suitable benefit-cost ratio is used to rank each decision maker (DM), and the original performance matrix of each DM is then presented as a group ordinal ranking matrix with respect to the order of alternatives. The ordinal matrix can then be handled conventionally to obtain the final rankings in the decision group by using a social choice function, such as the Borda function in cases where all members of a decision group have equal importance weights. DMs often have unequal