

Editorial

Special Issue “Recent Advances and Applications in Multi Criteria Decision Analysis”

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Over the last few decades, Multi-criteria Decision Analysis (MCDA) techniques have been successfully applied to complex decision-making problems in a wide range of fields, such as economics, finance, logistics, environmental restoration, health or industrial organization, to name but a few, and imprecision and uncertainty have been incorporated into the decision-making process and applied to group decision-making contexts. The goal of this Special Issue is to attract quality and novel papers in the field of MCDA, focusing on recent advances in both discrete and continuous techniques and significant applications in different fields.

The response of the scientific community has been significant, with many papers being submitted for consideration, and, finally, eleven papers were accepted, after going through a careful peer-review process based on quality and novelty criteria.

The paper by Sánchez Oro et al. [1] presents a hybridization of Strategic Oscillation with Path Relinking to provide a set of high-quality nondominated solutions for the Multiobjective k -Balanced Center Location problem. An extensive computational experimentation is carried out to compare the performance of our proposal, including the best method found in the state-of-the-art as well as traditional multiobjective evolutionary algorithms.

The paper authored by Jiménez-Martín et al. [2] deals with Aluminium Parts Casting Scheduling, a complex scheduling problem in which several constraints in which four objective functions have to be taken into account simultaneously (minimizing both the unmet demand at the end of the schedule, and the delays in the injection process with regard to daily demands; production costs and the total number of mold changes throughout the schedule). The simulated annealing metaheuristic has been adapted to solve this complex optimization process.

Salas-Molina et al. [3] propose an extension of the Efficient Market Hypothesis (EMH) that accommodates the foundations of multiple-criteria decision analysis on the basis of a family of parametric signed dissimilarity measures to assess multidimensional performance differences. Two novel theoretical results connecting different normalization techniques are presented. This multicriteria extension provides a common framework on which to add empirical evidence regarding the EMH testing.

The paper by García et al. [4] proposes the use of a goal programming model for the objective ranking of universities, allowing for an objective quantification of the importance of each variable in the performance of universities, which could be of great interest to decision-maker. The results are compared with the ranking proposed by two popular World University Rankings, and some insightful differences are outlined.

The aim of the paper authored by Vallejo-Rosero et al. [5] is to design a multiobjective model to explain the behavior among military expenditures (MEs), the human development index, and the global peace index in countries belonging to the North Atlantic Treaty Organization (NATO) for the study period 2008–2016. This work highlights the path followed by each country, such as the implementation of public budget policies in the health and education sectors, and for collected taxes and public debt, to achieve efficient solutions.



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Liou et al. [6] propose a novel failure mode and effects analysis (FMEA) model based on hybrid MCDM, which adopts neutrosophic set theory into the proposed model. A developed neutrosophic Best Worst method is used to evaluate the weights of risk factors and determine their importance, and the neutrosophic Weight Aggregated Sum Product Assessments method is utilized to calculate the Risk Priority Number of the failure modes. The proposed model improves the shortcomings of traditional FMEA and improves the practical applicability and effectiveness of the Best Worst method (BWM) and Weight Aggregated Sum Product Assessments methods. In addition, this study uses neutrosophic logic to reflect the true judgments of experts in the assessment, which considers authenticity, deviation, and uncertainty to obtain more reliable information.

The paper by Segura et al. [7] proposes models to solve real-world supplier evaluation problems and validate them with real data on fresh fruits in a supermarket chain. A multicriteria hybrid approach is proposed, using MAUT to assess the quality of products and PROMETHEE to complete their evaluation with strategic criteria to be included in the second phase. The results allow companies to rank suppliers by product and classify them according to the main criteria categories, such as product strategy, food safety, economic, logistic, commercial, green image, and corporate social responsibility. A sorting approach is also applied to obtain ordered groups of suppliers. Finally, the models proposed can form the core of a decision support system in order to create and monitor the supplier base in food distribution companies, as well as to inform sustainable decision making.

The paper authored by Álvarez-Miranda et al. [8] present an optimization framework that considers multiple criteria for drawing districts and assigning the number of representatives and introduce novel criteria for ensuring territorial equilibrium and incentives for candidates to deploy their representation efforts fairly during their campaign and period in office. The method is tested in a recent and a forthcoming reform of the Chilean electoral system.

Garcia-Bernabeu et al. [9] propose an integrated assessment methodology to evaluate regional innovation performance by using the Multi-Reference Point based Weak and Strong Composite Indicator (MRP-WSCI) approach, which allows defining reference levels and different degrees of compensability. The proposed technique is developed to measure the innovation performance of Spain's regions taking into account Spanish and European reference levels. The main features of the proposed approach are: (i) absolute or relative reference levels could be previously defined by the decision maker; (ii) by establishing the reference levels, the resulting composite innovation index is an easy-to-interpret measure; and (iii) the non-compensatory strong composite indicator provides an additional layer of information for policy-making (iv) a visualization tool called Light-Diagram is proposed to track the specific strengths and weaknesses of the regions' innovation performance.

There are a number of options making it difficult to choose the best application of gamification techniques, especially in circumstances where there is the usual uncertainty that real-life decision making involves. To address this problem, Carnero et al. [10] creates two models, one using a fuzzy analytic hierarchy process (AHP), and the other, which combines fuzzy AHP with the measuring attractiveness by a categorical-based evaluation technique (MACBETH) approach, to choose the best gamification application for the 'Operations Management' course, within a Masters in Industrial Engineering.

The paper authored by Labella et al. [11] introduces a novel approach to evaluate the inequalities in EU countries based on a sorting a multi-criteria decision-making method called AHPSort II. This approach allows to obtain a classification of the EU countries according to their achievements in reducing inequalities to subsequently carry out a deep performance analysis with the aim of drawing conclusions as to the evolution of inequality in them along the years. The results are consistent with the main international organizations' reports and academic literature.

As the Guest Editor of the Special Issue, I am grateful to all authors who contributed their articles. I would also like to express my gratitude to all reviewers for their valuable comments toward the improvement of the submitted papers. It is hoped that the inter-

national scientific community will find these selected research papers impactful and that these papers will motivate further research on MCDA for solving complex problems in various disciplines and application fields.

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