Editorial

Multi-Criteria Decision-Making Techniques for Improvement Sustainability Engineering Processes

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Abstract: The success of any activity and process depends fundamentally on the possibility of balancing (symmetry) needs and their satisfaction. That is, the ability to properly define a set of success indicators. The application of the developed new multi-criteria decision-making (MCDM) methods can be eliminated or decreased by decision-makers’ subjectivity, which leads to consistency or symmetry in the weight values of the criteria. In this Special Issue, 40 research papers and one review study co-authored by 137 researchers from 23 different countries explore aspects of multi-criteria modeling and optimization in crisp or uncertain environments. The papers proposing new approaches and elaborate case studies in the following areas of applications: MCDM optimization in sustainable engineering, environmental sustainability in engineering processes, sustainable multi-criteria production and logistics processes planning, integrated approach for modeling processes in engineering, new trends in the multi-criteria evaluation of sustainable processes, multi-criteria decision-making in strategic management based on sustainable criteria.

Keywords: multi-criteria decision-making; sustainability; engineering; optimization

1. Introduction

Decision making on complex engineering problems including individual process decisions requires an appropriate and reliable decision support system. Fuzzy set theory, rough set theory and neutrosophic set theory which belong to MCDM techniques are very useful for modeling complex engineering problems with imprecise, ambiguous or vague data. Sustainability in engineering is one of the most discussed topics in recent years and represents one of the key factors in engineering sustainable development and optimization. Sustainable multidisciplinary approaches based on MCDM techniques enable easier process technology in the future.

Engineering is the application of scientific and mathematical principles for practical objectives such as the processes, manufacture, design and operation of products, while accounting for constraints invoked by environmental, economic and social factors. There are various factors needing to be considered in order to address engineering sustainability, which is critical for overall the sustainability of human development and activity. In these regards, in recent decades, decision-making theory has
been a subject of intense research activities due to its wide applications in different areas, such as sustainable engineering and environmental sustainability. The decision-making theory approach has become an important means of providing real-time solutions to uncertainty problems, especially for sustainable engineering and environmental sustainability problems in engineering processes. This Special Issue have stimulated both theoretical and applied research in the related fields of sustainability engineering processes. It is certainly impossible to provide in this short editorial a more comprehensive description for all articles in this Special Issue. However, we can with sure say that effort in compiling these articles have enriched our readers and inspire researchers with regard to the seemingly common, but actually important issue of decision-making and fuzzy decision-making approaches for sustainable engineering processes.

2. Contributions

The Special Issue collects 40 original research papers and one review paper written by Guest Editors. The papers contribute to various fields above mentioned. A lot of the research have proposed new methodologies treating uncertainty.

The topics of the Special Issue attracted attention of a wide scientific community: 137 researches from 23 countries contributed to the Issue. Distribution of authors according to countries is shown in Figure 1.

![Figure 1. Number of authors from different countries.]

The largest number of authors were from Serbia (29 authors). China has 21 authors, while 18 researches come from Lithuania and 17 from India. Bosnia and Herzegovina and Poland contributed almost equally, with 11 and 9 authors, respectively. Next came Iran, with six authors, while five contributors were Malaysia, four from Slovenia and three from Taiwan. Two authors come from Hungary and two from Austria. Authors from the following eleven countries contributed with one paper: Australia, Chile, Denmark, Finland, Pakistan, Russia, Saudi Arabia, South Africa, UAE, USA and Vietnam. It is important note that one researcher contributes with different affiliations from two different countries. He has published three different papers.

Distribution of papers according to authors’ affiliations is presented in Table 1. Authors and co-authors from Lithuania contributed 12 papers, five papers without international collaboration [1–5]
and seven papers with international cooperation: Bosnia and Herzegovina–Lithuania–Serbia–Malaysia [6], Lithuania–Bosnia and Herzegovina–Serbia [7], Iran–Lithuania [8], China–Lithuania [9], Malaysia–Lithuania [10], Serbia–South Africa–Lithuania–Bosnia and Herzegovina [11] and Chile–Iran–Lithuania–Australia [12]. Authors from China contributed in total eight papers, four without international collaboration [13–16] and four more in international cooperation: [9], China–USA [17], China–Pakistan [18] and Russia–China–Serbia [19]. Authors from Poland contributed four papers, but only to a national cooperation [20–23]. Researchers from Serbia have published 15 papers: three without international cooperation [24–26], four with authors from Bosnia and Herzegovina [27–30], three with authors from India [31–33], mentioned [6,7,11,19], India–Finland–Serbia [34]. Authors from India have published seven papers. Apart from mentioned [31–34] they have cooperated as follow: India–UAE [35], Chile–India [36] and India–Denmark–Vietnam–Saudi Arabia [37]. Authors from Slovenia and Taiwan contributed without international cooperation, two papers from Slovenia [38,39] and one from Taiwan [40]. In addition, one study is result of cooperation authors between Hungary and Austria [41]. Two papers come from Malaysia and Chile, while the authors from the following countries contributed per one study in collaboration aforementioned: UAE, Iran, Chile, South Africa, Finland, USA, Pakistan, Australia, Denmark, Vietnam, Saudi Arabia and Russia.

| Countries | Number of Papers |
|-----------|------------------|
| Lithuania  | 5                |
| China      | 4                |
| Poland     | 4                |
| Serbia–Bosnia and Herzegovina | 4 |
| Serbia     | 3                |
| India–Serbia | 3 |
| Slovenia   | 2                |
| Bosnia and Herzegovina–Lithuania–Serbia–Malaysia | 1 |
| Lithuania–Bosnia and Herzegovina–Serbia | 1 |
| India–UAE  | 1                |
| Iran–Lithuania | 1 |
| Chile–India | 1 |
| China–Lithuania | 1 |
| Malaysia–Lithuania | 1 |
| Serbia–South Africa–Lithuania–Bosnia and Herzegovina | 1 |
| Taiwan     | 1                |
| India–Finland–Serbia | 1 |
| China–USA  | 1                |
| China–Pakistan | 1 |
| Chile–Iran–Lithuania–Australia | 1 |
| India–Denmark–Vietnam–Saudi Arabia | 1 |
| Russia–China–Serbia | 1 |
| Hungary–Austria | 1 |

3. Conclusions

Guest Editors are very happy that the Special Issue on multi-criteria decision-making techniques for improvement sustainability engineering processes has interested researchers from Europe, Asia and America; papers involving 137 researchers from 23 countries were published.

The Special Issue showed that MCDM techniques are an important tool for solving various problems in the field of sustainability engineering processes. Decision making in real systems requires flexible decisions and respect for the mutual influence between the attributes of the decision.
Therefore, the authors have shown the importance of aggregation operators for information fusion in MCDM problems. Through 40 published papers, the authors have shown the possibilities of applying multicriteria techniques for processing information represented by crisp values, as well as various theories of uncertainty. Uncertainty theories applied in this special edition include traditional fuzzy sets, intuitionistic type-2 fuzzy sets, q-rung orthopair fuzzy sets, q-rung interval-valued orthopair fuzzy sets, rough sets and rough numbers, probabilistic linguistic term sets and neutrosophic sets. The application areas of the proposed MCDM techniques mainly covered production/manufacturing engineering, logistics and transportation and construction engineering and management.

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