

Preface to the Special Issue on Multiple Criteria Decision Making: Current Challenges and Future Trends

The pioneers of South Carolina: The genesis of MCDM

It seems suitable to introduce this special issue by giving a few brushstrokes to frame the Multiple Criteria Decision Making (MCDM) paradigm within a historical perspective. In this direction, we consider that the starting point of the MCDM movement was possibly in 1951, when Koopmans established the concept of efficient or non-dominated vector that was later developed by Kuhn and Tucker to obtain the optimality conditions for the existence of non-dominated solutions. Following another direction, Charnes and Cooper, in 1955 and 1961, introduced the basic idea of goal programming, first within a constrained regression context, and second for addressing the issue of incompatibilities among constraints of linear programming problems. There are also remarkable precursors to this paradigm, like the introduction in 1968 of the outranking relationships as a foundation of the ELECTRE methods by Roy, as well as the publication one year later by Raiffa of a memorandum of the RAND Corporation, where the seminal ideas of the multi-attribute utility theory were introduced. These fundamental contributions clearly indicate that since its origins MCDM is firmly rooted with the classic optimization principles, which the new paradigm aims to extend and to increase its empirical corroboration capacity. In other words, MCDM aims to increase the understanding of how people make decisions, as well as to provide decision makers with sound analytical tools to aid in making sensible decisions.

During the 1960s, the above outlined seminal ideas evolved slowly. However, there was not a lot of enthusiasm for MCDM during that decade. The crucial moment or turning point for MCDM was October 1972 when the First International Conference on MCDM was held at the University of South Carolina. The actual pioneers of the MCDM movement attended this historical conference. They were young scientists in their early thirties presenting results derived from their PhD dissertations. Besides these young scientists, some big figures in classic optimization also attended and contributed to this memorable conference. A non-exhaustive list of the “Young Turks” (understanding by this term a group of young intellectuals, including John Maynard Keynes, who were graduate students at King’s College, Cambridge, and who led, in the early 20th century, a protest movement aiming to change the Victorian norms ruling the King’s) would include, among others in alphabetic order, Dyer, Ignizio, Ijiri, Keeney, Steuer, Yu, and Zeleny. And among the big

names were Churchman, Evans, Fishburn, Roy, and Zadeh. The contributions of these authors have had a huge seminal value. Many of these researchers are still active and “productive”, and their works are still highly cited.

The conference proceedings were published in 1973 in the book edited by Cochrane and Zeleny, *Multiple Criteria Decision Making*, published by the University of South Carolina Press. This historical work can be considered, in Kuhnian terms, as the acceptance of MCDM as a “normal science”. One of the resolutions accepted at the South Carolina Conference was to set up the Special Interest Group on Multiple Criteria Decision Making. This was to become the International Society on Multiple Criteria Decision Making in 1979. This society has currently around 2,300 members. The Special Interest Group, first, and the International Society, later, have organized an international congress every two years. The last conference was held in Ottawa (Canada) in June 2017.

Since the “Pioneers of South Carolina” conference, an impressive number of papers on the subject of MCDM have been published chiefly in operational research/management science journals (OR/MS). Nowadays, it is difficult to find an issue of any of these journals that does not include a paper on the theoretical or applied aspects of MCDM. Similarly, several journals have published a significant number of special issues focusing entirely on the subject of MCDM. Köksalan, Wallenius and Zionts, in their book *Multiple Criteria Decision Making-From Early History to the 21st Century*, published in 2011, indicated that the annual number of MCDM papers published in ISI-indexed journals is currently close to 2,000.

Concerning the future trends in the MCDM movement, without being exhaustive and in a tentative way, the following lines seem of applied and theoretical interest:

- The study of behavioral issues, emphasizing the challenge represented by fixing the parameters of the models.
- The development of adequate dynamic MCDM approaches, taking into account the influence of time in evolving decision processes.
- The development of hybrid methodologies and applications combining traditional MCDM ideas with evolutionary and heuristic approaches.
- To strengthen the links between the mainstreams in economics and MCDM.
- To establish links and connections between different MCDM methods.

This special issue was initially promoted as a research activity of the Spanish Group in MCDM and was open to the entire community of academic and practitioners in the field. It has taken us more than two years to coordinate the whole reviewing and editing process. We received 29 submissions, of which 14 were finally accepted for publication. All contributions were blindly reviewed by at least two referees. We anticipate that the set of papers in this issue will provide useful insights to academic and practitioners about the challenges faced by the MCDM paradigm.

This volume contains 14 papers covering different theoretical and methodological aspects of MCDM, including several aspects related to uncertainty (like uncertain information given by the decision maker, fuzzy or stochastic models), connections between MCDM and game theory, theoretical aspects of multiobjective optimization, or connections between equity and utilitarianism. In addition, the volume contains a wide range of applications to several fields like personnel selection, feature selection, humanitarian logistics, waste collection, and corporate sustainability ranking.

We would like to thank all the authors for their understanding and patience during the refereeing process that sometimes took longer than we desired. We must also thank all the reviewers for their generosity and invaluable collaboration. Without their help this special issue would not have been possible. Finally, we would like to thank the General Editor of the *International Transactions in Operational Research*, Celso Ribeiro, for his initial support to the project of this special issue, and for his help during the whole editing process.

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