



# Multi-Criteria Decision Making Methods: A comparative Study (Applied Optimization, Volume 44)

By Evangelos Triantaphyllou

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## Multi-Criteria Decision Making Methods: A comparative Study (Applied Optimization, Volume 44) By Evangelos Triantaphyllou

Multi-Criteria Decision Making (MCDM) has been one of the fastest growing problem areas in many disciplines. The central problem is how to evaluate a set of alternatives in terms of a number of criteria. Although this problem is very relevant in practice, there are few methods available and their quality is hard to determine. Thus, the question 'Which is the best method for a given problem?' has become one of the most important and challenging ones.

This is exactly what this book has as its focus and why it is important. The author extensively compares, both theoretically and empirically, real-life MCDM issues and makes the reader aware of quite a number of surprising 'abnormalities' with some of these methods. What makes this book so valuable and different is that even though the analyses are rigorous, the results can be understood even by the non-specialist.

**Audience:** Researchers, practitioners, and students; it can be used as a textbook for senior undergraduate or graduate courses in business and engineering.

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### Editorial Review

#### From the Author

An extensive description of the Table of Contents, Table of Figures, Table of Tables, Subject Index, and Author Index and much more relevant information can be found in the personal web page of the author located at the Louisiana State University.

#### About the Author

Dr. Triantaphyllou did his graduate studies at Penn State University from 1984 to 1990. While at Penn State, he earned a Dual M.S. degree in Environment and Operations Research, an M.S. degree in Computer Science and a Dual Ph.D. degree in Industrial Engineering and Operations Research. Currently, he is an Associate Professor in the Industrial and Manufacturing Systems Engineering (IMSE) Department, and also the Associate Dean for Outreach and Development for the College of Engineering, at the Louisiana State University (LSU) in Baton Rouge, LA, U.S.A.

His research is focused in decision-making theory and applications, and data mining and knowledge discovery. Since the years he was a graduate student, he has developed new methods for data mining and knowledge discovery and also has explored some of the most fundamental and intriguing subjects in decision making. In 1999 he received the prestigious IIE (Institute of Industrial Engineers), O.R. (Operations Research) Division, Research Award for his research contributions in the above fields. Some of his graduate students have also received national awards and distinctions.

He always enjoys sharing the results of his research with his students and is also getting them actively involved in his research activities. He has received teaching awards and distinctions. His research has been funded by federal and state agencies, and the private sector. He has extensively published in the areas of decision-making and in the interface of operations research and computer science in some of the top refereed journals and made numerous presentations in national and international conferences.

Dr. Triantaphyllou has a strong inter-disciplinary background and research approach. He has always enjoyed organizing multi-disciplinary teams of researchers and practitioners with complementary expertise. These groups try to comprehensively attack some of the most urgent problems in the sciences and engineering. He is a strong believer of the premise that the next round of major scientific and engineering discoveries will come from the work of such inter-disciplinary groups. He can be reached by e-mail at: trianta@lsu.edu More details of his work, as well a very extensive description of this book, with an extensive table of contents, subject index, the preface, and much more, and also descriptions on other related publications, can be found in Dr. Triantaphyllou's web page at the Louisiana State University (LSU).

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The following is the Foreword of this book as written by Professor H.-J. Zimmermann, world renown Multi-Criteria Decision Making. It best captures why this book is an excellent contribution in this important field of decision analysis. \*\*\*\*\*

For word Multi-Criteria Decision Making(MCDM) has been one of the fastest growing problem areas during at least the last two decades. In business decision making has been changing over the last decades: From single person (the Boss!) single criterion (profit) decision environments have developed more and more to multi person multi criteria situations. Also the awareness of this development is growing in practice.

In theory very many methods have been developed and suggested since the sixty's to solve this problem in many various variants. Two main theoretical streams can be distinguished: Multi-objective decision making models which assume continuous solution spaces (and therefore base on continuous mathematics), try to determine optimal compromise solutions and generally assume, that the problem to be solved can be modeled as a mathematical programming model. This is primarily the realm of theoreticians since continuous mathematics is very elegant and powerful and allows many modifications of a basic model or method. Unluckily the majority of MCDM-problems in practice are not solved by mathematical programming and so these nice and powerful methods are only of limited value for the practitioner. The second stream focuses on problems with discrete decision spaces, i.e. with countable few decision alternatives and uses basically approaches from discrete mathematics, which are mathematically not as elegant as the former. This stream is often called "Multi-Attribute Decision Making". In this book the more general term MCDM is used. These models do not try to compute an optimal solution but they try to determine via ranking either a ranking of the relevant actions which is "optimal" with respect to several criteria or they try to find the "optimal" actions amongst the existing. Even though this type of problem is much more relevant and numerous in practice, there are much fewer methods available and their quality is much harder to determine than in the continuous case. The question "Which is the best method for a given problem?" has, therefore, become one of the most important but also most difficult to answer.

This is exactly where the book of Dr. Triantaphyllou has its focus and why it is that important: Rather than suggesting another MCDM method without any convincing justification he concentrates on the best known and most frequently used methods, compares them extensively and makes the reader aware of quite a number of "abnormalities" of some of the methods of which users are often not conscious. He also considers very critically the most touchy points in solving real MCDM problems, namely, quantification of qualitative data, deriving weights from ratio and difference comparisons, and especially sensitivity analysis of MCDM methods. This to me seems as valuable or even more important than suggesting a new method which may solve another variant of the MCDM problem. At the end of the book Fuzzy MCDM methods are described and evaluated.

What makes this book so valuable and different from other MCDM books is, that even though the analysis is very rigorous, the results are described very clearly and are understandable even to the non-specialist. Also very extensive numerical studies and comparisons are presented, which are hard to find in any other text that I know. This book, in fact, provides a unique perspective into the core of MCDM methods and practice. Theoretical and empirical analyses presented are complementary to each other, allowing the reader to gain a deep theoretical and practical insight into the topics covered in this book. In addition to this the author offers at the end of each chapter and at the end of the book suggestions for further research and I can only hope, that his suggestions will be accepted by many scientists.

Dr. Triantaphyllou has been involved in MCDM for almost two decades, he has become internationally known as one of the leading experts in this area and he is, therefore, qualified as hardly anybody else to write this book. I can only congratulate him to his achievement and hope that many practitioners will benefit from this excellent book and that scientist will accept his suggestions for further research as fascinating challenges. Aachen, February 2000 Hans-Jurgen Zimmermann

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