

Preface

Operational Research (OR) combines tools from different disciplines and generates a new set of knowledge for decision making. The broad applicability of its main topics places OR at the heart of many crucial current problems. Therefore, OR entails the construction and application of new quantitative and qualitative modeling methods to real management and economics problems. OR analysts use a range of mathematical methodologies to solve such management decision problems.

Multicriteria Decision Analysis (MCDA) is rooted in OR and it constitutes a broad term and it describes a collection of various methods and tactics explored when multiple criteria should be taken into consideration aiming to result in a decision for a group or for an individual. This book constitutes the first handbook for students to cover multicriteria analysis for total ranking and clustering classification techniques and their application in the agri-environmental sector. It is the only book dealing with the use of OR results as it brings together a group of examples on the much debated issue of decision-making process of enterprises in the agrifood and environmental sector.

Agricultural and environmental decisions will classically comprise multiple criteria, objective and subjective, such as entrepreneurial, biological and social criteria, all important in these decisions. MCDA provided in the book deliver a proper, numerical means of assessing and evaluating those agricultural and environmental decisions taking into account all available parameters. The identification of the highest priority case, as presented in total ranking method of PROMETHEE II and the various types of typology creation through classification with cluster analysis techniques are evaluated among the most important of MCDA and they were selected to be thoroughly presented.

The book is divided into four chapters, as an introduction, presentation of methodologies, detail presentation of whole case studies and finally a concluding chapter.

Chapter 1, “Introduction”, provides an introduction to the operational research, focuses on the need for analysis and the ways of use of research results. Operational research intermixes theories and methodologies from mathematics, management

science, computer science, operations management, decision support and many more. Multicriteria decision aid, an advanced field of operations research, provides decision-makers and analysts a wide range of methodologies, which are well suited to the complexity of decision problems in various fields. So, the main objective of many classification methodologies is to develop “optimal” classification models, where the term optimal is often restricted to the statistical description of the alternatives, or to the classification accuracy of the developed model given a training sample. Furthermore, the particularities of operational research in the agrifood and environment sector are referred.

Chapter 2, “Methodologies”, presents the statistical techniques in broad conceptual terms. It provides a complete coverage of the most common multicriteria ranking technique, PROMETHEE II method and two of the most common cluster generation methods, hierarchical cluster analysis and K-means analysis, are explored. The PROMETHEE II method is part of the outranking relations theory and is based on the construction of an outranking relation that is used to compare the alternatives with some reference profiles characterizing each class. Hierarchical cluster analysis produces a unique set of nested categories or clusters by sequentially pairing variables, clusters, or variables and clusters. K-means cluster analysis is an example of a nonhierarchical cluster analysis method, where k is equal to the number of clusters the researcher wishes to impose upon the data. Additionally, the combination of the two methods for ranking and classification is presented.

Chapter 3, “Applications in Various Agricultural, Food and Environmental Issues” presents and discusses ten examples in order to understand how operational research is used in the agricultural, food and environment sector. PROMETHEE II method is used for ranking skiing centers, agrotourism enterprises and aquaculture units according to certain characteristics. Hierarchical cluster analysis is implemented for the classification of wood enterprises and enterprises that promote renewable energy sources, while K-means analysis is applied for the classification of government agencies in national parks, the typology of prefectures according to agricultural exploitations and the classification of agrifood entities. Finally, the combination of PROMETHEE II method and clustering is applied for ranking and classification of enterprises that promote nature activities in national parks and of enterprises that promote rural production. Basic guidelines for interpreting the results are included to clarify further the methodological concepts.

Finally, Sect. 3.5, “Concluding Remarks and Future Research” contains discussions, comparisons and necessary recommendations for their use. Each of the presented examples assists in gaining a thorough understanding of both statistical and applied issues underlying these techniques. Potential applications of these techniques in problem solving and decision making in agrifood and environment sector research are numerous. The use of these techniques will continue to grow as increased familiarity with the benefits of cases ranking and classification is gained by researchers.

We are confident that the book will be a useful aid for scientists and decision-makers in the agricultural and environmental sector while reading the book

will stimulate a fruitful discussion within scientists and experts and will enhance the employment of the methods as well. We trust the book will advance the methods described in new directions and resolutions with both theoretical and practical insights and applications.

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Multicriteria and Clustering

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