# ELECTRE AND DECISION SUPPORT

Methods and Applications in Engineering and Infrastructure Investment

> Martin Rogers Michael Bruen Lucien-Yves Maystre

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# Electre And Decision Support Methods And Applications In Engineering And Infrastructure Investment

Öner, Sultan Ceren, Yüregir, Oya H.

## **Electre And Decision Support Methods And Applications In Engineering And Infrastructure Investment:**

Electre and Decision Support Martin Gerard Rogers, Michael Bruen, Lucien-Yves Maystre, 2013-03-14 ELECTRE and Decision Support focuses on the areas of engineering and infrastructure investment It begins with some general comments about the different decision components within the project planning process the definition of objectives the identification of alternative courses of action the establishing of criteria the evaluation of alternatives and the final recommendation The authors highlight the ability of Multicriteria Decision Aid to reconcile the economic technical and environmental dimensions of the projects for its planners. They emphasize the complexity of this process illustrating the importance of identifying the stakeholders within it as they greatly influence the definition of the decision criteria A brief case study illustrates these different aspects Following a comparison of Cost Benefit Analysis and Multicriteria Decision Aid the introductory chapter sets out the structure of the book with four subsequent chapters devoted to the methodology of ELECTRE and three outlining case studies involving different versions of ELECTRE The chapters concentrating on the ELECTRE methodology first give an overview of the main MCDA methods before presenting the ELECTRE method in detail Each chapter answers the following questions 1 In what context should the ELECTRE methods be chosen 2 Which version of the methods is most appropriate to apply to a given problem Another chapter deals with a critical and delicate problem within MCDA how to adequately assess the role played by each criterion in a given decision problem and how this translates into an appropriate weighting for it Each one covers a different civil engineering discipline and each uses a different version of ELECTRE The final chapter on methodology presents some accessories which when used with ELECTRE can greatly enhance its usefulness in practice This book is outstanding in many respects I am convinced that the simple clear and concise style of the authors will make this book accessible to very many readers No important aspect of the subject is neglected and the concise nature of this book does not hinder its originality Last but not least the manner in which the case studies are described allows the authors not only to demonstrate the validity of the approach and procedures presented but also to help the reader understand how to apply them in an effective manner Taken from the Foreword by Bernard Roy University Paris Dauphine Decision Support Martin Gerard Rogers, Michael Bruen, Lucien-Yves Maystre, 2013-01-07 ELECTRE and Decision Support focuses on the areas of engineering and infrastructure investment It begins with some general comments about the different decision components within the project planning process the definition of objectives the identification of alternative courses of action the establishing of criteria the evaluation of alternatives and the final recommendation The authors highlight the ability of Multicriteria Decision Aid to reconcile the economic technical and environmental dimensions of the projects for its planners They emphasize the complexity of this process illustrating the importance of identifying the stakeholders within it as they greatly influence the definition of the decision criteria A brief case study illustrates these different aspects Following a comparison of Cost Benefit Analysis and Multicriteria Decision Aid the introductory chapter sets out the structure of the

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illustrative examples for each fuzzy TOPSIS extension along with related MATLAB codes and case studies This book is for industrial engineers operations research engineers systems engineers and production engineers working in the areas of decision analysis multi criteria decision making and multiple objective optimization **Multicriterion Analysis in Engineering and Management** D. Nagesh Kumar, 2010 This book concentrates on the basic principles of multicriterion analysis and acquaints the reader with the recent trends in MCDM analysis It explains the basics of Structured Decision Making SDM and describes the various features of traditional optimization methods such as linear and non linear programming and dynamic programming as well as non traditional optimization methods such as genetic algorithms differential evolution and simulated annealing and guenching The text elaborates the normalization methods weight estimation methods and multiobjective optimization methods both in traditional and non traditional environments Classification approaches with cluster validation indices discrete MCDM methods both in deterministic and fuzzy approach and group decision making methods are discussed in detail Advanced topics in decision making such as data envelopment analysis Taguchi methodology ant colony optimization and particle swarm optimization are also covered In addition the book includes many case studies for better comprehension of the procedures involved in the methods **Advanced Studies in** Multi-Criteria Decision Making Sarah Ben Amor, Adiel Teixeira de Almeida, Joao Luis de Miranda, Emel Aktas, 2019-12-11 With contributions from some of the top academics and scientists in the field Advanced Studies in Multi Criteria Decision Making presents an updated view of the landscape of Decision Sciences current research topics the interaction with other sciences and fields as well as the prospects and challenges at an international level Given that Decision Sciences are recognized today as indispensable for confronting the major societal challenges in science and technology this book would be of interest to decision makers managers and researchers from academia and industrial services companies that would like a fresh insight into MCDM Features Integrates a wide range of scientific fields with a general reader approach including applied researchers from the social business enterprise sciences Suitable for academics and professionals Presents a broad coverage of MCDM tools either in industry or in services companies and systems Provides a fresh overview on MCDM studies promoted by prestigious R D institutions Engineering Project Appraisal Martin Rogers, Aidan Duffy, 2012-07-03 In most cases of civil engineering development a range of alternative schemes meeting project goals are feasible so some form of evaluation must be carried out to select the most appropriate to take forward Evaluation criteria usually include the economic environmental and social contexts of a project as well as the engineering challenges so engineers must be familiar with the processes and tools used The second edition of Engineering Project Appraisal equips students with the understanding and analytical tools to carry out effective appraisals of alternative development schemes using both economic and non economic criteria. The building blocks of economic appraisal are covered early leading to techniques such as net present worth internal rate of return and annual worth Cost Benefit Analysis is dealt with in detail together with related

methods such as Cost Effectiveness and the Goal Achievement Matrix The text also details three multi criteria models which have proved useful in the evaluation of proposals in the transportation solid waste energy and water resources fields the Simple Additive Weighting SAW Model the Analytic Hierarchy Process AHP technique and Concordance Analysis There is a full discussion dealing with risk and uncertainty in these models With many worked examples and case studies Engineering Project Appraisal is an essential text for both undergraduate and postgraduate students on professional civil engineering courses and it is expected that students on planning and construction management courses will find it a valuable addition to Decision Sciences Raghu Nandan Sengupta, Aparna Gupta, Joydeep Dutta, 2016-11-30 This handbook is an endeavour to cover many current relevant and essential topics related to decision sciences in a scientific manner Using this handbook graduate students researchers as well as practitioners from engineering statistics sociology economics etc will find a new and refreshing paradigm shift as to how these topics can be put to use beneficially Starting from the basics to advanced concepts authors hope to make the readers well aware of the different theoretical and practical ideas which are the focus of study in decision sciences nowadays It includes an excellent bibliography reference journal list information about a variety of datasets illustrated pseudo codes and discussion of future trends in research Covering topics ranging from optimization networks and games multi objective optimization inventory theory statistical methods artificial neural networks times series analysis simulation modeling decision support system data envelopment analysis queueing theory etc this reference book is an attempt to make this area more meaningful for varied readers Noteworthy features of this handbook are in depth coverage of different topics solved practical examples unique datasets for a variety of examples in the areas of decision sciences in depth analysis of problems through colored charts 3D diagrams and discussions about software

Optimizing Big Data Management and Industrial Systems With Intelligent Techniques Öner, Sultan Ceren, Yüregir, Oya H., 2018-12-07 In order to survive an increasingly competitive market corporations must adopt and employ optimization techniques and big data analytics for more efficient product development and value creation Understanding the strengths weaknesses opportunities and threats of new techniques and manufacturing processes allows companies to succeed during the rise of Industry 4 0 Optimizing Big Data Management and Industrial Systems With Intelligent Techniques explores optimization techniques recommendation systems and manufacturing processes that support the evaluation of cyber physical systems end to end engineering and digitalized control systems Featuring coverage on a broad range of topics such as digital economy fuzzy logic and data linkage methods this book is ideally designed for manufacturers engineers professionals managers academicians and students

Life Cycle Sustainability Assessment for Decision-Making Jingzheng Ren, Sara Toniolo, 2019-11-19 Life Cycle Sustainability Assessment for Decision Making Methodologies and Case Studies gives readers a comprehensive introduction to life cycle sustainability assessment LCSA methodology for sustainability measurement of industrial systems proposing an efficiency methodology for stakeholders and

decision makers Featuring the latest methods and case studies the book will assist researchers in environmental sciences and energy to develop the best methods for LCA as well as aiding those practitioners who are responsible for making decisions for promoting sustainable development The past current status and future of LCSA Life Cycle Assessment method LCA Life Cycle Costing LCC Social Life Cycle Assessment SLCA the methodology of LCSA typical LCSA case studies limitations of LCSA and life cycle aggregated sustainability index methods are all covered in this multidisciplinary book Includes models for assessing sustainability in environmental energy engineering and economic scenarios Features case studies that help define the advantages and obstacles of real world applications Presents a complete view from theory to practice of a life cycle approach by exploring the methods and tools of sustainability assessment analysis and design of sustainability assessment Smart Cities and Smart Spaces: Concepts, Methodologies, Tools, and Applications Management Association, Information Resources, 2018-09-07 As populations have continued to grow and expand many people have made their homes in cities around the globe With this increase in city living it is becoming vital to create intelligent urban environments that efficiently support this growth and simultaneously provide friendly and progressive environments to both businesses and citizens alike Smart Cities and Smart Spaces Concepts Methodologies Tools and Applications is an innovative reference source that discusses social economic and environmental issues surrounding the evolution of smart cities Highlighting a range of topics such as smart destinations urban planning and intelligent communities this multi volume book is designed for engineers architects facility managers policymakers academicians and researchers interested in expanding their knowledge on the emerging trends and topics involving smart cities **Introduction to Sustainability Analytics** Raghavan (Ram) Ramanan, 2018-07-04 The roles of corporate and public stewards and the nature of their social contract with society have been changing over the past two centuries and those changes have accelerated in recent decades Moreover with increasing focus on sustainability factors from the marketplace regulators investors financiers and consumers corporate sustainability disclosure is shifting from voluntary to vital Corporate and public stewards are now responsible for their performance and services from cradle to grave they must properly manage corporate social responsibility and integrate it into their global strategies rather than consider it as merely a moral obligation or a risk reputation management exercise Sustainability analytics the critical link between sustainability and business strategy helps professionals track trend and transform sustainability information into actionable insights across the value chain and life cycle to enhance their sustainability performance and its disclosure This book Introduction to Sustainability Analytics provides corporate and public stewards with a comprehensive understanding of how to determine which sustainability metrics are material to them and relevant to their business and how to incorporate them into corporate strategy resource allocation and prioritization Focusing on practical decision making needs it explains how to value and prioritize initiatives and how to best allocate necessary resources through several real case studies and practical examples Features Examines pressing issues such as

climate change water scarcity and environmental justice Explains how to develop a business case and global strategy for social responsibility Includes both corporate and public policy perspectives on sustainability economics Covers emerging Multicriterion Decision in Management Jean-Charles regulations on sustainability disclosure and responsible investing Pomerol, Sergio Barba-Romero, 2012-12-06 Multicriterion Decision in Management Principles and Practice is the first multicriterion analysis book devoted exclusively to discrete multicriterion decision making Typically multicriterion analysis is used in two distinct frameworks Firstly there is multiple criteria linear programming which is an extension of the results of linear programming and its associated algorithms Secondly there is discrete multicriterion decision making which is concerned with choices among a finite number of possible alternatives such as projects investments decisions etc This is the focus of this book The book concentrates on the basic principles in the domain of discrete multicriterion analysis and examines each of these principles in terms of their properties and their implications In multicriterion decision analysis any optimum in the strict sense of the term does not exist Rather multicriterion decision making utilizes tools methods and thinking to examine several solutions each having their advantages and disadvantages depending on one s point of view Actually various methods exist for reaching a good choice in a multicriterion setting and even a complete ranking of the alternatives The book describes and compares these methods so called aggregation methods with their advantages and their shortcomings Clearly organizations are becoming more complex and it is becoming harder and harder to disregard complexity of points of view motivations and objectives The day of the single objective profit social environment etc is over and the wishes of all those involved in all their diversity must be taken into account To do this a basic knowledge of multicriterion decision analysis is necessary The objective of this book is to supply that knowledge and enable it to be applied The book is intended for use by practitioners managers consultants researchers and students in engineering and business

Bridge Safety, Maintenance and Management in a Life-Cycle Context Dan M. Frangopol, Sunyong Kim, 2022-02-16 During the past two decades it has been generally acknowledged that life cycle bridge analysis can be a systematic tool to address efficient and effective bridge management under uncertainty life cycle management at the bridge network level can lead to an improvement in the allocation of limited financial resources ensuring the safety and functionality of the bridge network life cycle management of bridges and bridge networks based on resilience and sustainability can improve their resistance and robustness to extreme events such as earthquakes tsunamis floods and hurricanes bridge management should consider the impact of environmental conditions and climate change This book addresses important concepts and approaches developed recently on bridge safety maintenance and management in a life cycle context Bridge life cycle performance and cost analysis prediction optimization and decision making under uncertainty are discussed The major topics include bridge safety and service life prediction bridge inspection and structural health monitoring bridge maintenance life cycle bridge and bridge network management optimum life cycle bridge management planning resilience and sustainability of bridges and

bridge networksunder hazards and bridge management considering climate change By providing practical applications of the presented concepts and approaches this book can help students researchers practitioners infrastructure owners and managers and transportation officials to build up their knowledge of life cycle bridge performance and cost management at bothproject level and network level under various deteriorating mechanisms hazards and climate change effects

Multi-Criteria and Multi-Dimensional Analysis in Decisions Kesra Nermend, 2023-10-31 A new era is emerging in which a group of quantitative methods featuring characteristics of multidimensional comparative analysis MCA and multi criteria decision making analysis MCDA can be used to automate objective decision making processes This book introduces the character of the criteria desirable non desirable motivating demotivating and neutral to MCDA and MCA methods It presents the author's own developed methods the preference vector method PVM for solving multi criteria problems in decision making and vector measure construction method VMCM which is dedicated to solving typical problems in the field of multidimensional comparative analysis All methods are explained step by step with relevant examples primarily in the fields of economics and management Methods in Sustainability Science Jingzheng Ren, 2021-08-05 Methods in Sustainability Science Assessment Prioritization Improvement Design and Optimization presents cutting edge detailed methodologies needed to create sustainable growth in any field or industry including life cycle assessments building design and energy systems. The book utilized a systematic structured approach to each of the methodologies described in an interdisciplinary way to ensure the methodologies are applicable in the real world including case studies to demonstrate the methods The chapters are written by a global team of authors in a variety of sustainability related fields Methods in Sustainability Science Assessment Prioritization Improvement Design and Optimization will provide academics researchers and practitioners in sustainability especially environmental science and environmental engineering with the most recent methodologies needed to maintain a sustainable future It is also a necessary read for postgraduates in sustainability as well as academics and researchers in energy and chemical engineering who need to ensure their industrial methodologies are sustainable Provides a comprehensive overview of the most recent methodologies in sustainability assessment prioritization improvement design and optimization Sections are organized in a systematic and logical way to clearly present the most recent methodologies for sustainability and the chapters utilize an interdisciplinary approach that covers all considerations of sustainability Includes detailed case studies demonstrating the efficacies of the described methods Multicriteria Decision Aiding Interventions Maria Franca Norese, María A. De Vicente y Oliva, Irène Abi-Zeid, 2023-06-21 This book introduces readers to multicriteria decision aiding MCDA interventions used in complex situations In each chapter expert analysts propose a piece of the puzzle while the final complete puzzle offers an interesting reflection of the main challenges and difficulties associated with decision aiding interventions as well as the different tools adopted in response Particular attention is given to the approaches used to identify and overcome specific difficulties Designed for analysts familiar with

several multicriteria methods but seeking detailed information and experience this book helps to elaborate and validate MC models in real life decision aiding interventions In addition it helps novice analysts appreciate the difficulty of decision aiding and use the available methods to reduce or control them with the help of socio technical approaches *Intelligent Support* Systems for Marketing Decisions Nikolaos F. Matsatsinis, Y. Siskos, 2012-12-06 Intelligent Support Systems for Marketing Decisions examines new product development market penetration strategies and other marketing decisions utilizing a confluence of methods including Decision Support Systems DSS Artificial Intelligence in Marketing and Multicriteria Analysis The authors systematically examine the use and implementation of these methodologies in making strategic marketing decisions Part I discusses the basic concepts of multicriteria analysis vis vis marketing decisions and in new product development situations Part II presents basic concepts from the fields of Information Systems Decision Support Systems and Intelligent Decision Support Methods In addition specialized categories of DSS multicriteria DSS web based DSS group DSS spatial DSS are discussed in terms of their key features and current use in marketing applications Part III presents IDSS and a multicriteria methodology for new product development Further chapters present a developmental strategy for analyzing designing and implementing an Intelligent Marketing Decision Support System The implementation discussion is illustrated with a real world example of the methods and system in use **Multi-Objective Programming and Goal Programming** Tetsuzo Tanino, Tamaki Tanaka, Masahiro Inuiguchi, 2013-11-11 This volume constitutes the proceedings of the Fifth International Conference on Multi Objective Programming and Goal Programming Theory Applications MOPGP 02 held in Nara Japan on June 4 7 2002 Eighty two people from 16 countries attended the conference and 78 papers including 9 plenary talks were presented MOPGP is an international conference within which researchers and prac titioners can meet and learn from each other about the recent development in multi objective programming and goal programming. The participants are from different disciplines such as Optimization Operations Research Math ematical Programming and Multi Criteria Decision Aid whose common in terest is in multi objective analysis The first MOPGP Conference was held at Portsmouth United Kingdom in 1994 The subsequent conferenes were held at Torremolinos Spain in 1996 at Quebec City Canada in 1998 and at Katowice Poland in 2000 The fifth conference was held at Nara which was the capital of Japan for more than seventy years in the eighth century During this Nara period the basis of Japanese society or culture established itself Nara is a beautiful place and has a number of historic monuments in the World Heritage List The members of the International Committee of MOPGP 02 were Dylan Jones Pekka Korhonen Carlos Romero Ralph Steuer and Mehrdad Tamiz

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