

94th EWG on MCDA 2022

September 15-17, 2022

Elounda Town, Agios Nikolaos, Crete, Greece

Programme and Book of Abstracts



Introduction

It is our great pleasure to invite you to the 94th meeting of the EURO Working Group on Multiple Criteria Decision Aiding (EWG-MCDA 94). The EWG-MCDA 94 is organized by the Department of Management Science and Technology, Hellenic Mediterranean University, and the School of Production Engineering and Management, Technical University of Crete.

It takes place at Elounda Town, in Agios Nikolaos Crete, Greece, September 15-17, 2022

The Meeting's theme is "Multiple Criteria Decision Aiding and environmental risk management". This theme emphasizes the strong foundation that is provided by using research to inform our everyday practices, policies, and research approaches. Environmental decisions are often complex and multifaceted and involve many different stakeholders with different priorities or objectives. Multicriteria Decision Aiding (MCDA) tools can be applied to assess value judgments of individual decision makers or multiple stakeholders regarding the environmental risk management. The 94th meeting of the EURO working group on Multiple Criteria Decision Aiding aims to pinpoint the potential of multiple criteria decision aiding methods as an ideal support methodology for the environmental risk management.

On behalf of the Scientific Program Committee, we have great pleasure in presenting this important event of the Scientific Community.

All abstracts were reviewed by members of the EWG-MCDA 94 Committee for rating of abstract quality and content.

We would like to thank you for your scientific contribution to the 94th EWG on MCDA 2022 and look forward to having the opportunity to showcase and disseminate your research.

Special thanks also to the organizing committee, and all the people that worked hard, to bring in light this considerable event.

Yours sincerely,

Prof. Constantin Zopounidis,

Assist. Prof. Christos Lemonakis.



Sponsors



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**EW
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MCDA
MULTIPLE CRITERIA
DECISION AIDING



TECHNICAL
UNIVERSITY
OF CRETE

94th EWG on MCDA 2022

September 15-17, 2022

Elounda Town, Agios Nikolaos, Crete, Greece

Prof. Constantin Zopounidis

Technical University of Crete, Greece

Audencia Business School, France

Assist. Prof. Christos Lemonakis

Hellenic Mediterranean University, Greece

Crete, Greece, 2022

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94 EWG on MCDA, Elounda, Crete, Greece. CONFERENCE PROGRAM

Venue:

Aegean Conference Hall – Porto Elounda Golf & Spa Resort, Elounda Town, Agios Nikolaos, Crete, Greece

The meeting will be held exclusively on site

Directions (Google Maps)

1. 94 EWG venue, see the following link:

<https://goo.gl/maps/FTvwwjkZHW3vBTNL9>

2. The route from Heraklion International Airport to the conference venue (Porto Elounda Golf & Spa Resort) can be found at the following link:

<https://goo.gl/maps/t7kzWKKPdux75zFw7>

3. The route from the Port of Agios Nikolaos (Bus start/end route) to the conference venue (Porto Elounda Golf & Spa Resort) can be found at the following link:

<https://goo.gl/maps/GnYcmXNUA9UQ5z3U6>

CONFERENCE PROGRAM

Thursday, September 15, 2022

12.00 – 13.00 Registration

13.00 – 13.30 Conference opening

Opening session – Organizers: Constantin Zopounidis, Christos Lemonakis

13.30 – 14.30 Session I

Chair: Yannis Siskos

The first session on Thursday is devoted to the Bernard Roy Award, where the laureate presents a 45min lecture.

Discussion papers

I.1.D.1. Multicriteria assessment of future scenarios for the implementation of agroforestry in cereal systems

Odile Phelpin, Francis Macary, Laurence Denaix

I.1.D.2. Determinants of Foreign Direct Investments: Empirical Evidence from the Global Developing Economies

Manolis I. Skouloudakis

I.1.D.3. Time-Driven activity-based management in ecotourism (A hotel implementation model)

Ioannis Karagiannis

I.1.D.4. Exploring the behavioral intentions of food tourists who visit Western Crete

Georgios Angelakis, Christos Lemonakis, Constantin Zopounidis, Periklis Drakos, Georgios Baourakis

14.30 – 15.00 Coffee break

15.00 – 16.30 Session II

Chair: Salvatore Greco

II.1.1. Intelligent Decision Support Systems Combining Operations Research and Artificial Intelligence

S. Greco, V. Mousseau, J. Stefanowski, C. Zopounidis

II.1.2. Active learning with additive value models

Grzegorz Miebs, Matteo Brunelli, Jonas Gehrlein, Miłosz Kadziński

- II.1.3. Regularization and Aggregation of Multiple Recommendations in Multicriteria Decision Problems with Reference Sets*
Andrzej M.J. Skulimowski

Discussion papers

- II.1.D.1. APOLLO: A Decision Support System for Climate Change Policy Making*
Álvaro Labella, Diego García-Zamora, Bapi Dutta, Luis Martínez
- II.1.D.2. Agricultural water management decisions in the context of water-energy-land-food nexus using an enriched UTASTAR method*
Alexandros Psomas, Isaak Vryzidis, Athanasios Spyridakos, Maria Mimikou
- II.1.D.3. Programs for optimal development of disadvantaged young children: Vulnerability evaluation and budget allocation using MCDA*
Irène Abi-Zeid, Roxane Lavoie, Jérôme Cerutti, Morgane Bousquet, Sophie Métivier

16.30 – 18.00 Session III

Chair: Andrej M.J Skulimowski

- III.1.1. Modelling optimism and pessimism in Stochastic Multicriteria Acceptability Analysis*
Salvatore Greco, Sally Giuseppe Arcidiacono, Salvatore Corrente
- III.1.2. Consistent approximations of pairwise comparisons*
Jacek Szybowski, Waldemar W. Koczkodaj, Ryszard Smarzewski
- III.1.3. A multicriteria approach for building sustainability composite indicators*
António Xavier, Maria de Belém Costa Freitas, Rui Manuel de Sousa Fragoso

Discussion papers

- III.1.D.1. An interactive mathematical programming approach for buildings' energy efficiency-related decisions*
Christina Diakaki, Evangelos Grigoroudis
- III.1.D.2. Time-varying firm cash holding and economic policy uncertainty nexus: a quantile regression approach*
Konstantinos Gkillas, Chistos Floros, Efstathios Magerakis
- III.1.D.3. A Multiobjective Approach to Collaborative Facility and Fleet Sharing Among Suppliers in Horizontal Supply Chain Collaboration*
Mirna Abou Mjahed, Fouad Ben Abdelaziz, Hussein Tarhini

20.30 Gala dinner

The Gala dinner will be held on Thursday, September 15, 2022. The dinner will be organised in a traditional Cretan restaurant in Plaka, a fishing village on the bay of Elounda, see the following link (<https://www.giorgos-plaka.gr/#>). The restaurant is 10 minutes from the conference venue (by bus) and about 25 minutes from the port of Agios Nikolaos (by bus). There will be a bus available to take participants from the port of Agios Nikolaos to the restaurant and back (free of charge).

The Gala dinner is optional and has a fee which is paid by the participants (50€ per person)

Friday, September 16, 2022

09.30 – 11.00 Session IV

Chair: Jean-Philippe Waaub

IV.2.1. Parametric and non-parametric models to induce a probability distribution in the space of compatible value functions

Salvatore Corrente, Sally Giuseppe Arcidiacono, Salvatore Greco

IV.2.2. MCDA methods used in different approaches to find optimal corridors and paths for linear infrastructure projects

Jean-Philippe Waaub

IV.2.3. Rating Ecosystemic design actions to plan urban projects

Alessandra Oppio, Marta Dell'Ovo

Discussion papers

IV.2.D.1. Ensemble decision making tool in sustainable logistic system

Morteza Yazdani

IV.2.D.2. Applications of different multicriteria analysis methods for water resources management – A case study for Crete

Constantin Zopounidis, Christos Lemonakis, Alexandros Garefalakis, Petros Asmargiannakis

IV.2.D.3. A multi-criteria approach for optimizing the placement of electric vehicle charging stations in Egnatia highway

Panagiotis Skaloumpakas, Vangelis Spiliotis, George Stravodimos, Dimitris Sarigiannis, Alexis Lekidis, Ioanna Makarouni, Vangelis Marinakis, John Psarras

11.00 – 11.30 Coffee break

11.30 – 13.00 Session V

Chair: Salvatore Corrente

V.2.1. Location of radioactive waste deposit according to ministerial directives
Antonino Scarelli, Vincenzo Piscopo

V.2.2. Is random pricing useful for policy aiding process for Health
Christine C Huttin

V.2.3. A decision-making toolbox for climate mitigation and adaptation at municipal level in Greece
George Stravodimos, Apostolos Arsenopoulos, Nektarios Matsagkos, Anastasia Spanou,
Sofoklis Strompolas, Ioannis Georgizas, Savvas Louzidis, Andrinopoulou Theodora

Discussion papers

V.2.D.1. Evaluating the Performance of Local Municipalities on Sustainable Development Goals: An Application to France
Michalis Doumpos, Alexis Guyot, Emiliios Galariotis, Constantin Zopounidis

V.2.D.2. Financial literacy and economic decisions supported by MCDA models
Elżbieta Kubińska, Magdalena Adamczyk-Kowalczyk, Anna Macko

V.2.D.3. Firms' Credit Assessment using the fuzzy set Qualitative Comparative Analysis method
Evangelia Krassadaki, Constantin Zopounidis, Christos Lemonakis

13.00 – 14.30 Lunch

Lunch will be organized at the balcony of the Conference Hall, with the view of Mirabello Bay

14.30 – 15.10 Group activities

15.10 – 16.00 Session VI

Chair: Evangelos Grigoroudis

VI.2.1. Multi-Criteria Decision Analysis to support masterplan scheduling: an application of ELETRE TRI-B for sorting regeneration activities for an industrial area in Northern Italy
Marta Bottero, Federico Dell'Anna

VI.2.2. Multicriteria evaluation of new agricultural practices scenarios in field crops to reduce pesticide use and associated risks
Francis Macary, Elisa Jurine

Discussion papers

VI.2.D.1. A Multi-Criteria Methodology for Market Segmentation based on the Criteria Analysis
Nikolaos Matsatsinis, Fotini Kalafati, Garyfallia Matsatsini, Efstathios Gerampinis

VI.2.D.2. Reputation multi criteria rating system for users of EV charge point applications
Christos Stefanatos, George Stravodimos, Dimitris Sarigiannis, Alexis Lekidis, Ioanna Makarouni,
John Psarras

VI.2.D.3. Application of Multi Criteria Optimal Stopping Theory to Pandemic Policies
Noura El Hassan, Bacer Maddah, Fouad Ben Abdelaziz

VI.2.D.4. A decision support system (DSS) for the design and selection of ICS devices using fuzzy logic
Nektarios Arnaoutakis, Christos Lemonakis, Manolis Souliotis, Spyridon Papaefthymiou

16.00 – 16.30 Coffee break

16.30 – 18.00 Session VII

Chair: Michalis Doumpos

VII.2.1. How tertiary education can explain the differences in GDP per capita among EU NUTS2? Portugal as a case study.

Marco Marto, João Lourenço Marques, Mara Madaleno

VII.2.2. A Management Procedure to take Advantage of Minorities
Artsidakis Stylianos, Liapis Konstantinos, Rozakis Stelios

VII.2.3 Applying MCDA Disaggregation – Aggregation Approaches to the assessment of a global Products Environmental footprint Index: The case study of Refractory products
Athanasios Spyridakos, Nikolaos Tsotsolas, Dimitrios Alexakos, Isaak Vryzidis, George Varelidis, Euthimios Kagiaras, Spyros Aggellis

Discussion papers

VII.2.D.1. Accelerating Power Purchase Agreements: A valuable tool for managing corporate green energy needs
Marios Stanitsas, Konstantinos Kirytopoulos

VII.2.D.2. Maximizing benefit of doubt through the lens of MCDA
Takis Varelas, Dimitris Kaklis, Artemis Flori

VII.2.D.3. Public health interventions in the face of pandemics: Network structure, social distancing, and heterogeneity

Mohammad Ghaderi

VII.2.D.4. Modeling the economic impact of COVID-19

Moawia Alghalith, Christos Floros, Konstantinos Gkillas

Saturday, September 17, 2022

10.00 Vai Palm Beach Day Trip

The meeting will be at 09:45 and the bus will be waiting at the harbor of Agios Nikolaos. The first visit will be to the town of Ierapetra. From Ierapetra we will drive to the eastern part of the island via Makrigialos. Then we will visit Sitia, a town on the beach where you can enjoy your coffee and observe the local street market and buy local products. Our third stop is Toplou Monastery, where you will have the opportunity to visit this magnificent monument, take photos and taste the famous local wine. Our trip ends at Vai Palm Beach with its beautiful scenery and crystal-clear waters.

Estimated return time: 19:30'-20:00'

The tour is optional and has a fee which is paid by the participants (60€ per person)

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I.1.D.1. MULTICRITERIA ASSESSMENT OF FUTURE SCENARIOS FOR THE IMPLEMENTATION OF AGROFORESTRY IN CEREAL SYSTEMS

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Abstract

During the last decades of intensive agriculture, the woods, groves and hedges were destroyed to enlarge the cultivated parcels, as a result of the expansion of farms and the use of increasingly powerful agricultural equipment. This is in order to increase agricultural productivity, without taking into account the major negative impacts and environmental risks of such upheavals.

However, trees play an active role in combating erosion, especially in sensitive agricultural parcels, as well as in soil conservation by storing carbon and allowing a rich biological life in the soil. Tree rows also play an important role as windbreaks and barriers to the atmospheric diffusion of pesticides. Trees create habitat for crop pest auxiliaries, especially in areas where hedgerows and groves have long since disappeared, but they can also be a reserve for fungal or bacterial pathogens.

As part of a new TETRAE-AC²TION research project, it is proposed to evaluate the effects of tree planting in rows or around cereal plots, in the form of a multicriteria analysis to help decide the overall performance of such a system (environmental and socio-economic). This is an innovative collaborative research programme that investigates unknown environmental and socio-economic development levers for agroforestry pathways. Qualitative and quantitative criteria will make it possible to understand the impacts of such a device on the microclimate, the biodiversity, on the enrichment of the soil for the mineral nutrition of plants. However, agroforestry should also make it possible to reduce crop pathogens with a view to reducing the use of plant protection products, and to avoid the transport of pesticide molecules beyond rows of trees.

Different research teams will be mobilized to work on each of these criteria. Our multicriteria evaluation using the Electre Tri-nC and Electre III methods will allow to carry out this global evaluation of agroforestry driven systems performances, compared to conventional «intensive» systems. This study will be able to provide socio-professional stakeholders in the field with

decision-making support for their change of management system, particularly those in purely conventional mode.

Keywords

Agroforestry, Field crops, Performances, Environmental risks, Multicriteria Decision Aiding

I.1.D.2. DETERMINANTS OF FOREIGN DIRECT INVESTMENTS: EMPIRICAL EVIDENCE FROM THE GLOBAL DEVELOPING ECONOMIES

Manolis I. Skouloudakis

Hellenic Mediterranean University

Abstract

The purpose of our research is to examine the effects of traditional and institutional determinants of FDI inflows in Global Emerging Countries. We used annual data from 18 developing countries while the sample period runs from 2002 to 2020. Previous empirical evidence proves the significant effect of the traditional determinants, including GDP growth, inflation, trade openness and population growth. Furthermore, certain institutional determinants, such as level of corruption, voice and accountability, political stability and rule of law, are considered as important regarding the attractiveness of the host countries. The Panel OLS and Dynamic OLS methods used in this paper demonstrate interesting results regarding the importance of the selected independent variables. For instance, according to our empirical findings, it is suggested that political stability has positive and significant effect on FDI inflows, while voice and accountability was found to have negative and significant effect on the dependent variable.

All the other institutional determinants were found to have insignificant effect on FDI inflows. Moreover, inflation was also found to have positive and significant effect on the attraction of FDI inflows.

On the contrary, population growth was found to have negative and significant effect on the dependent variable, while trade openness was found to have insignificant effect. Our empirical findings suggest that policy makers should implement certain reforms focusing on the extroversion of each economy, decrease of corruption and infrastructure improvements.

Future empirical evidence could focus on certain countries which leverage similar policies around the attraction of FDI inflows.

Keywords

Developing Economies, FDI, GDP Growth, Inflation, Political Stability, Rule of Law

I.1.D.3. TIME-DRIVEN ACTIVITY-BASED MANAGEMENT IN ECOTOURISM (A HOTEL IMPLEMENTATION MODEL)

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Department of Applied Informatics, University of Macedonia Thessaloniki Greece

Abstract

The growth of Tourist Sector in Greece consists of well-organized hotels and apartments similar to the best of the world. Hence, the need of information about costing is essential and crucial. Especially, the Eco-Touristic enterprises that provide extra services to their customers, such as interaction activities with biotic components of the natural environments, and, activities that promote energy efficiency, water conservation, recycling.

The present research analyses the newly method of costing accounting and management, the one known as Time-Driven Activity-Based Management (TDABM). This method overcomes the difficulties of implementing and maintaining conventional Activity-Based Management. The theoretical model, that has been applied in a touristic enterprise, along with new technologies in computing, provides information of great detail regarding the operations, the bottlenecks, and assists management to take action to solve the problematic areas and feel confident for future decisions.

Time-Driven ABM has the following advantages. It is easier and faster to be built with great accuracy. Integrates well with data now available from ERP systems and CRM systems. It drives costs to transactions and orders using specific characteristics of particular orders, processes, suppliers, and customers. Provides visibility to process efficiencies and capacity utilization. Forecasts resource demands, allowing companies to budget for resource capacity. It is easily scalable to enterprise-wide models via enterprise-scalable applications software and database technologies. Enables fast and inexpensive model maintenance. Supplies granular information to assist users with identifying the root cause of problems. And, can be used in any industry or company with complexity in customers, products, channels, segments, and processes and large amounts of people and capital expenditures.

Having adopted the basics of design and implementation of the Time-Driven ABM model from Kaplan and Anderson (2007), an attempt is made to apply this model directly to an eco-touristic hotel. The method used starts with a schematic plan of the flow of costs in the hotel. It pictures the departments, the sections, the functions and the activities that take place in the company. Sets the cost objects (such as the cost of services provided) and the questions to be answered such as which services are profitable. The analysis continues with the understanding of the general ledger that determines capacity cost rate. Then, this rate is used to drive departmental resource costs to cost objects by estimating the demand for resource capacity (typically time, from which the name of the new approach was chosen) that each cost object requires. Simulates the actual processes used to perform work throughout the enterprise. Then, the cost of the

processes is analyzed using multiple criteria. The outcome can be used for management decision making and further simulation models or “what-if” scenarios.

Keywords

Time-Driven Activity-Based Management in Hotels, Time-Driven Activity-Based Costing in Tourist Sector, Eco-Tourism in Greece, Costing of Tourist Services.

I.1.D.4. EXPLORING THE BEHAVIORAL INTENTIONS OF FOOD TOURISTS WHO VISIT WESTERN CRETE

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Abstract

Food tourism is growing globally in the last years. Food tourism is considered as an alternative form of tourism, attracting highly interested tourists. Tourists spend a significant percentage of their budget on the purchase of local food products and related food activities, also contributing to the sustainable development of the touristic destination. The survey took place at the Airport of Chania, Crete throughout the touristic period of 2021 and almost 4000 valid questionnaires were completed by tourists. For the data analysis, multicriteria analysis and the Theory of Planned Behavior, based on subjective norms, attitudes and perceived behavioural control, were used to better understand the consumers' intentions to buy local agricultural products, visit food establishments and revisit the Region of Crete. Moreover, in this paper, the importance of motives and food experiences in the final decision for tourists to choose Crete is highlighted, the degree of satisfaction regarding characteristics of the products is pinpointed, their participation in food activities is being explored, their willingness to recommend those products is mentioned and the percentage of their budget spent on those products during their stay in the Region of Crete is estimated.

Keywords

Food tourism, subjective norms, attitude, perceived behavioural control, satisfaction, motives, intentions

II.1.1. INTELLIGENT DECISION SUPPORT SYSTEMS COMBINING OPERATIONS RESEARCH AND ARTIFICIAL INTELLIGENCE

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C. Zopounidis

Technical University of Crete, Greece
& Audencia Business School, Nantes, France

Abstract

We present the genesis and the development of some relevant scientific research contributions in Operations Research, Multiple Criteria Decision Aiding, and Artificial Intelligence in the perspective of Intelligent Decision Support Systems. We try to reproduce the vision of intelligent decision support systems that this research largely initiated in the scientific community, as well as the ideas and achievements in this field. The impact of personal contacts and collaborations was important in creating the field. On the one hand, it was formed on the interaction with great scientific personalities, and on the other hand, it was developed during the years with a very large and diversified network of research teams distributed in many different countries. In addition, we provide an in-depth bibliometric analysis of published papers.

Keywords

Multiple Criteria Decision Aiding, Artificial Intelligence, Intelligent Decision Support Systems

II.1.2. ACTIVE LEARNING WITH ADDITIVE VALUE MODELS

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Abstract

We propose an active learning approach enhancing the UTA method for solving a ranking problem in multiple-criteria decision analysis. Within this framework, an optimal question for a pairwise comparison maximizing information gain is calculated and presented to a decision-maker. By using carefully selected questions, the number of required iterations with the user is reduced. When searching for an optimal question previous choices of the decision-maker are taken into account, and thus the selection of questions is done sequentially and individually for each decision-maker. What is more, by using an optimization algorithm fictitious alternatives can be created to increase information gain even further. Our approach is tested on a real-world problem in the realm of cryptocurrency. In such an environment, so-called "nominators" need to select "validators" on the ground of their reliability, decentralization, and profitability. In particular, validators, representing alternatives, are assessed with respect to six criteria.

Keywords

Active learning, UTA, blockchain

II.1.3. REGULARIZATION AND AGGREGATION OF MULTIPLE RECOMMENDATIONS IN MULTICRITERIA DECISION PROBLEMS WITH REFERENCE SETS

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Abstract

Inconsistent expert judgments hinder the application of group recommendations in multicriteria decision support, particularly in multiple reference points and reference set based methods. When experts define the reference points based on well-grounded experience, typical consensus-reaching procedures may be troublesome and need not converge. For example, this is the case where recommendations correspond to several scenarios derived from independent experts observations. This paper proposes an approach to correct or aggregate inconsistent recommendations of experts involved in multicriteria decision support with multiple reference points grouped in several reference sets. The proposed algorithm yields a consistent set of reference points transforming an arbitrary initial collection of them. By assumption, N mutually independent agents are involved as consultants in a decision-making process of K other agents. Experts recommendations are communicated to decision makers as reference points from four predefined characteristic reference sets in the criteria space, each one of them with a different meaning to decision makers. The independence of agents' judgments may cause different types of recommendation inconsistency: the internal, mutual, and plausibility inconsistencies, in weak and strong variants. Internal consistency requires all reference points in a given class to be non-comparable. The mutual consistency is the requirement implied by the monotonicity of utility function, namely the reference points in each pair of neighboring classes should be ordered in such a way that each element of the subordinated class is dominated by an element of the superordinated class and vice-versa. The third kind of inconsistency is the property of a single reference point termed the plausibility inconsistency. It determines whether the meaning assigned by an expert to this point is consistent with its situation with respect to the set of attainable criteria values. Therefore, plausibility may affect the choice of an operation to regularize other inconsistencies. All aforementioned inconsistencies may occur simultaneously in the same decision problem. The overall reference set will be regularized by a class of verification-regularization-aggregation procedures. These can be represented as a superposition of elementary operations on reference points, such as reference point averaging, merging or splitting the reference classes, moving a reference point between classes, or removing it from

the merged class. It is assumed that the regularization-aggregation operator applied in a certain step of the procedure to a class or to a pair of reference classes does not alter the remaining classes and that internal consistency of each class is verified exactly once in each instance of the process. This approach can be applied to preprocess reference points in multiple reference point extensions of MREF, TOPSIS, RefSet, and other reference-point based methods. A relevant application area of automated reference point regularization and aggregation are autonomous decision procedures, where both the recommenders and/or decision makers are autonomous agents such as intelligent mobile robots.

Keywords

Group recommendation, Group decision making, Multiple reference points, Reference set method, Preference aggregation, Multicriteria optimization

II.1.D.1. APOLLO: A DECISION SUPPORT SYSTEM FOR CLIMATE CHANGE POLICY MAKING

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Abstract

The use of decision models driven by experts' knowledge is still very popular for the resolution of decision-making (DM) problems. A DM problem always comprises a set of possible alternatives/solutions and often a group of several experts with different views who rate the alternatives to choose the best solution. In a multi-criterion decision-making (MCDM) problem, the experts evaluate the alternatives on several criteria. Nowadays, most of real-world MCDM problems have relation with sustainability issues. Climate change and its impact in our society it is one of the most important problems to be tackled now and in the near future. However, the experts are often overwhelmed and unable to make an appropriate decision without supporting. Our research focuses on the development of a software tool to support decisions in the resolution of MCDM problems related to climate change policy. This tool, so-called APOLLO, aims to facilitate a consensus process of a group of stakeholders toward reaching the best solution for a MCDM problem based on climate change and policies issues. APOLLO is able to detect and smooth disagreements in the initial experts' assessments and provide a ranking of the alternatives. Furthermore, its performance has been evaluated in the resolution of a real case study carried out in Austria, in the context of assessing the risks embedded in pathways for decarbonizing the country's iron and steel sector.

Keywords

Multi-criterion group decision making, Climate policy, APOLLO

II.1.D.2. AGRICULTURAL WATER MANAGEMENT DECISIONS IN THE CONTEXT OF WATER-ENERGY-LAND-FOOD NEXUS USING AN ENRICHED UTASTAR METHOD

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Abstract

Agricultural water management decisions in the context of Water-Energy-Land-Food Nexus (WELF nexus) are associated with multiple, conflicting and incommensurable objectives, including those related with the management of water quantity, water quality, soil erosion, energy and food production. Furthermore, specific management schemes have important economic dimensions, such as the required investments for their implementation or the energy costs for their operation. The current research demonstrates the application of an MCDA framework that aims at estimating an additive value model for the evaluation of alternative water management schemes in an agricultural river basin. The MCDA framework follows a disaggregation-aggregation approach, which utilises an enriched variation of UTASTAR method. The Decision Maker is required to provide information concerning the global ranking of alternatives in a reference set with selected agricultural management schemes. The alternatives of the reference set are then sorted by their ranking and the Decision Maker is asked to provide additional information on the strength of his/her preferences between successive pairs of alternatives, expressing the degree he/she prefers an alternative from the next one. Strength of preferences is determined by a range of values $[z_{min}, z_{max}]$, which is identified through interactive visual techniques. The robustness analysis of the Decision Maker's value model is performed by using the Average Stability Index (ASI). The Decision Maker is allowed to provide additional feedback, which may update his/her value model. The final value model is extrapolated to the full set of alternatives to determine their ranking. The above MCDA framework is applied to a specific decision problem related to agricultural water management in the Pinios river basin (Central Greece), where water scarcity, hydro-morphological alterations and pollution are key issues.

Keywords

MCDA, UTA methods, WELF Nexus, Agricultural Water Management

II.1.D.3. PROGRAMS FOR OPTIMAL DEVELOPMENT OF DISADVANTAGED YOUNG CHILDREN: VULNERABILITY EVALUATION AND BUDGET ALLOCATION USING MCDA

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Abstract

For many years, the Integrated University Health and Social Services Centres (CIUSSS) in the province of Quebec, Canada have been implementing actions through the Integrated Perinatal and Early Childhood Services (SIPPE) program. This program finances and accompanies projects that promote the optimal development of young children and supports parents who are vulnerable in their roles as caregivers. It is positioned as a prevention service with the aim of reducing the risk that families end up in a youth protection process, a process that can be traumatic both for parents and children.

In order to implement actions related to the SIPPEs, a CIUSSS must allocate its budget among its different territories, to be managed by community organizers who have hands on experience with their populations. However, this allocation is currently based on criteria that are more than 15 years old and do not necessarily reflect today's local realities. Some territories are overfunded while others are underfunded, which results in inequitable access to services. An internal CIUSSS committee had recently examined this issue and concluded that the use of various population data to rank the territories' needs was a major challenge. Furthermore, it became clear to the committee that qualitative data had to be integrated in the analysis, namely experiential knowledge of those working with families on the ground. This prompted the CIUSSS de la Capitale Nationale in Québec City to call upon our research team's expertise in multicriteria decision aiding to conduct a collaborative project that guarantees a transparent, inclusive and rigorous process. The aim was to design a multi-criteria decision aiding tool that provides an accurate and representative portrait of the vulnerability of young children and their families and that ensures an equitable allocation of SIPPE resources among the various territories.

The specific objectives of the projects were: 1) to co-construct a multi-criteria diagnostic model and evaluate the territories' vulnerability levels with respect to families with children between 0 and 5 years old, based on quantitative and qualitative data and taking into account the experience of community organizers (territorial actors); 2) to use this model as a decision-aiding tool for the equitable allocation of budgets; and 3) to ensure that the actors concerned understand and take ownership of the process and results.

Our research project was conducted through facilitated online decision conferences with multiple actors, using the MACBETH method. The results are visualized through a geographic

information system that provides a portrait of vulnerability, for which we developed a computer application to automatically interface the M-MACBETH software with ARCGIS. In this talk, we describe our MCDA process, the hurdles met, the criteria constructed, the aggregated vulnerability index and the proposed funding structure.

Keywords

Multi-criteria Decision Aiding model, Resource Allocation, Vulnerability Index, MACBETH

III.1.1. MODELLING OPTIMISM AND PESSIMISM IN STOCHASTIC MULTICRITERIA ACCEPTABILITY ANALYSIS

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Abstract

We propose a methodology to take into account optimism and pessimism of a Decision Maker that, using Stochastic Multicriteria Acceptability Analysis (SMAA), evaluates alternatives based on a plurality of weight vectors. With this aim, we introduce for the first time in SMAA non-additive probability distributions in the space of the feasible weight vectors. We discuss the results obtained through our methodology in the domain of composite indicators.

Keywords

Multiple Criteria Decision Aiding, Stochastic Multicriteria Acceptability Analysis, Non-additive probability distribution, Choquet integral

III.1.2. CONSISTENT APPROXIMATIONS OF PAIRWISE COMPARISONS

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Abstract

Multiplicative pairwise comparisons matrices can be transformed by a logarithmic mapping into a linear space and the set of consistent matrices into its subspace. The structure of a Hilbert space is obtained by using an inner product. Such a space is complete with respect to the norm corresponding to the inner product. In such a space, we may use orthogonal projections as a tool to produce a consistent approximation of a given pairwise comparison matrix.

This procedure has been used by Crawford and Williams in 1985 in a case of the standard norm induced by the Frobenius inner product. The resulting matrix allows to obtain the priority vector, whose coordinates are geometric means of elements in each row.

We generalize the Geometric Means Method for other inner products in the space of additive pairwise comparisons matrices and using the Gram-Schmidt orthogonalization process. This allows not only to obtain the priority vector but also to express the approximation matrix as a linear combination of a given basis in the space of pairwise comparisons matrices.

Keywords

Pairwise comparisons, orthogonal projections, consistency



III.1.3. A MULTICRITERIA APPROACH FOR BUILDING SUSTAINABILITY COMPOSITE INDICATORS

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Abstract

The aggregation of composite indicators is a complex problem and has been tackled in different studies and there are numerous MCDA approaches to address this issue. One approach in the literature to find a natural system sustainability index considers the balance or compromise between an engineering solution of “maximum aggregate sustainability” and an ecological solution of “most balanced sustainability”, by analysing the most displaced indicator. This approach was proposed initially in a way that was generalized to all composite indicators and it was the basis for the studies which implemented Extended Goal Programming and Compromise Programming for building sustainability rankings. Despite these approaches having several operational advantages, some problems were identified, namely situations in which the natural systems or decision units present equal positions in the ranking but have different in reality sustainability levels. Thus, this paper proposes an approach for dealing with these problems, considering a new indicator for the most balanced sustainability using normalized entropy and integrating both measures mentioned before. One example of the literature was used to illustrate the functioning of the approach proposed, which provided promising results.

Keywords

Sustainability, composite indicators, multicriteria decision analysis, sustainability rankings, normalized entropy.

III.1.D.1. AN INTERACTIVE MATHEMATICAL PROGRAMMING APPROACH FOR BUILDINGS' ENERGY EFFICIENCY-RELATED DECISIONS

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Abstract

The improvement of energy efficiency in buildings is a major priority and challenge worldwide. The measures employed, which include a variety of innovative technologies, materials and building designs vary in nature, and the decision maker faces a complex decision problem comprising numerous decision variables and multiple, usually competitive objectives. The solution of such multi-objective problems involves typically some sort of objectives' aggregation, which reflect the preferences of the involved decision maker. However, the elicitation of the decision makers' preferences is a difficult task, and it is the aim of this discussion to present an interactive framework that can assist in this respect.

More specifically, the ADELAIS multi-objective programming method is applied. It is an interactive mathematical programming approach, which assists the development of a multi-objective decision model that incorporates decision maker's preferences, elicited via the assessment of his/her utility function with the assistance of the UTASTAR method.

The feasibility and efficiency of the proposed approach is examined via the case of a simple building, suggesting that the proposed approach can indeed help the decision maker to select energy measures that satisfy, as much as possible, his/her preferences, without having to precisely prescribe them beforehand.

Keywords

Buildings, energy efficiency, energy efficiency improvement, multi-objective optimization, preference disaggregation, preference elicitation, value system, utility function

III.1.D.2. TIME-VARYING FIRM CASH HOLDING AND ECONOMIC POLICY UNCERTAINTY NEXUS: A QUANTILE REGRESSION APPROACH

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Abstract

This paper examines the time-varying nature of various decisive factors on cash holding decisions. First, we revisit the issue of cash holding determinants of U.S. corporations and argue that firm cash holding predictability is time-varying. To this end, this research proposes a novel empirical framework that builds on the impact of business cycles on firm cash holding's predictability. Using a three-stage empirical analysis, we also posit that the conventional argument on the relationship EPU-CASH is dependent on the time-varying market structure. Earlier studies have shown that economic policy uncertainty may increase the propensity of cash holding at the firm level. To estimate the theoretical assumption and capture different dynamic relationships, we convert monthly EPU data to annual and develop a cash quantile regression model including several financial characteristics. Employing a large sample of U.S. non-financial firms and non-utilities, we initially estimate six-year rolling fixed window quantile regressions during the 1970 to 2016 period. The resulting series of beta estimates are regressed on economic policy uncertainty. The main results confirm the time-varying nature of determinants related to corporate liquidity management.

Again, the study discovers that EPU is a critical determinant of firm's cash holding; thus, U.S. corporations increase their cash position when economic policy uncertainty increases. Consistent with the precautionary-saving motive, the evidence of predictability is stronger for firms with higher EPU. This study expands the relevant strand of literature by focusing on a time-varying quantile regression analysis to investigate the behavior of firm-level and macroeconomic factors across all quantiles of cash ratio.

Given the recent rise in policy uncertainty and the acute interest in promoting business growth and job creation amid Covid-19, our results provide timely implications for corporate managers, investors, and policymakers. Our findings should add a new dimension to the existing literature and therefore be important to the market participants for portfolio allocation in the developed markets.

Keywords

Macroeconomic uncertainty; Economic policy uncertainty; Cash; liquidity; Precautionary motives; Time-varying; Rolling quantile regressions; EPU index

III.1.D.3. A MULTIOBJECTIVE APPROACH TO COLLABORATIVE FACILITY AND FLEET SHARING AMONG SUPPLIERS IN HORIZONTAL SUPPLY CHAIN COLLABORATION

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Abstract

Companies performing same type of activities are recently leaning to exploit situations to improve their performance. By collaborating horizontally, companies are expected to achieve considerable improvement. Cooperative game theory has been widely used to model coalition formation and profit distribution among horizontal collaborators. Most optimization approaches in coalition-based supply chain collaboration are single objective targeting cost reduction or profit maximization. Real-world decision problems usually require the investigation of more than one criterion to achieve a sustainable progress. Cooperative multiobjective games incorporate in the analysis all the different objectives simultaneously and can be used to realistically model cooperation between players or agents in the problem.

One approach to generate solution concepts for multiobjective cooperative games is to adapt the cooperative games' classical solution concepts, such as the core, to the multiobjective setting. Fernandez et al. (2002) studied cooperative games where coalitions of agents can obtain rewards in different objectives and then these rewards are divided among all the agents of a coalition, in which each agent will receive individual rewards that can be different for each agent. These vector-valued games are transferable utility games analyzed from a multiobjective perspective. The individual and collective rationality principles in cooperative games are extended using two different orderings in payoff space. The classical domination concept in scalar games is extended to two different domination concepts in the multiobjective cooperative games. More general forms of vector-valued games have been investigated in which worth of a coalition is not a vector but rather given as a set (Fernandez et al., 2004).

Based on set-valued approach (Fernandez et al., 2004) to cooperative games with several objectives, Hinojosa et al. (2004) presented an application of the model to a bank ATM network model. In a similar approach, we are applying the same solution concepts for multiobjective

cooperative game to study collaborative facility and fleet sharing among firms at the same horizontal layer of the supply networks. The problem is coalition formation modeled as a cooperative multiobjective game. The aim is to explore the benefits of forming coalitions and to generate payoff distribution in multiobjective settings. We consider the case of suppliers' collaboration in a two- echelon setting and introduce multiple firms operating multiple distribution centers and serving multiple retailers. The first echelon represents production allocation and transportation activities between firms and the distribution centers. The second echelon represents transportation activities and deliveries from distribution centers to retailers. In our case, the suppliers do not only have incentives to minimize their operational costs but also wish to maintain as much as possible the contact with their own retailers and maximize the number of orders they can fulfill by their privately owned fleets. The quality of logistic service is measured in terms of maximizing the use of firm's own private fleet as possible. We aim to investigate the trade-off between the first objective, minimizing the cost of warehousing and transportation, and the second objective, maximizing customer satisfaction and loyalty by keeping, when possible, delivery service internal to each firm. The purpose is to help these firms determine whether they should join coalitions and propose the best payoff scheme to distribute savings among the coalition members.

Keywords

Collaborative facilities, Fleet sharing, Coalition formation, Multiobjective cooperative games

IV.2.1. PARAMETRIC AND NON-PARAMETRIC MODELS TO INDUCE A PROBABILITY DISTRIBUTION IN THE SPACE OF COMPATIBLE VALUE FUNCTIONS

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Abstract

Ordinal Regression (OR) is a popular methodology of multiple criteria decision aiding that induces a value function representing the preferences of a Decision Maker (DM). Based on the remark that, in general, there is an infinite plurality of value functions compatible with the preferences expressed by the DM, Robust Ordinal Regression (ROR) has been proposed extending OR. Conjugating ROR with a Stochastic Multicriteria Acceptability Analysis, a probability distribution has been considered in the space of the value functions compatible with the DM's preferences. In this context, we propose a methodology to induce a probability distribution in the space of the compatible value functions through parametric and nonparametric models. We also test the reliability of the obtained results in a set of experimental computations.

Keywords

Decision Support Systems, Multiple Criteria Decision Aiding, Indirect preference information, Probability distribution

IV.2.2. MCDA METHODS USED IN DIFFERENT APPROACHES TO FIND OPTIMAL CORRIDORS AND PATHS FOR LINEAR INFRASTRUCTURE PROJECTS

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Abstract

The optimal location of corridors and linear infrastructure routes such as high-voltage electricity transmission lines, pipelines, gas pipelines, roads, etc. has been the subject of numerous publications. In addition, consulting companies, ministries, and public service companies have developed and/or use IT tools for this purpose. This location must consider not only technical and economic criteria but also environmental and social criteria. These infrastructures most often give rise to major social controversies. For better legitimacy, the methods proposed and implemented in software must be transparent and accessible. They involve the use of geospatial databases, a geographic information system, a multi-criteria decision support approach, one or more mathematical optimization algorithms, tools for analysis and visualization of results, and at need, work and communication tools with stakeholders. The proposed approaches are more or less open to stakeholder participation. This presentation reviews the multi-criteria tools used, their place in solving the problem and their openness to participatory and contributory use by stakeholders. The strengths, weaknesses, opportunities, and constraints of these tools are discussed. Multi-criteria tools make it possible to obtain summary information on all the criteria. It is indeed a question of overlaying and combining layers of geospatial information. Most of the approaches use data in raster mode which must be processed and classified according to the issues relevant to the problem. The idea is to produce resistance maps or “cost surfaces” for each criterion, and then to combine them to obtain a cumulative resistance map or “cumulative cost surface”. This map constitutes a graph, and an algorithm makes it possible to find the least cost path for a corridor or a route between two points on a given territory. The multi-criteria tools used are most often a simple weighted sum of criteria approach using a direct weighting method, sometimes automated, sometimes discussed between experts or sometimes with stakeholders: Weighted Linear Combination (WLC); Simple additive weighting (SAW); Ordered weighted averaging (OWA) – fuzzy logic, Max - Min). The AHP approach is also often used to establish weights. More innovative tools offer other methods such as ELECTRE-TRI, PROMETHEE, TOPSIS, etc.

Fuzziness is sometimes introduced (Fuzzy AHP). The alignment with the problem-solving algorithm is different depending on the approach used: LCP (Dijkstra's algorithm), linear optimization combined with a "valley" search algorithm, bi-objective or multi-objective optimization, genetic algorithm, metaheuristic algorithm (Ant colony optimization). Avenues for future development are proposed and discussed to better use multi-criteria decision-making methods and to meet the social demand for contributory participation from stakeholders.

Keywords

Multi-criteria decision aid, corridors, routes, linear infrastructures

IV.2.3. RATING ECOSYSTEMIC DESIGN ACTIONS TO PLAN URBAN PROJECTS

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Abstract

Starting from the Millennium Ecosystem Assessment (MEA) several fields of research have focused the attention on the complex relationship that exists between natural resources, the built environment and the human well-being with reference both to theoretical and operational approaches.

According to the notion of Ecosystem Services (ESs), including decision support systems within the design process could be strategic for maximizing direct and indirect benefits urban projects and for mitigating the environmental risk. ESs could provide multidimensional effects both tangible, as carbon sequestration and climate regulation, and intangible as cultural services. Within this context the objective of the current contribution is to propose a rating system for supporting the design phase according to an ecosystemic approach. The evaluation of the design actions has been carried out by interviewing a group of experts which have been asked to assign to each action a score according to the provision of ESs with reference to the hierarchical framework proposed by the MEA. By combining the scores and the importance of each service elicited by the experts, it has been possible to rate the design actions and to propose possible combinations for the development of new sustainable alternatives. The rating system can be used to rank, score and compare different projects with the aim of generating new alternatives.

Keywords

Ecosystem Services, Multidimensional benefits, Rating system, Design process

IV.2.D.1. ENSEMBLE DECISION MAKING TOOL IN SUSTAINABLE LOGISTIC SYSTEM

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Abstract

Logistic infrastructures are very important in supply chain design and can aid economy and reduce considerable cost if they will be established under sustainable rules. In Spain there are many industrial hubs that transmit cargo operations along the country and conduct huge transport and logistics activities. Each infrastructure should contain specific condition and specification. Rather than its economic advantages it must sustain environmentally to avoid harmful waste for the society, maintain its social impact and value humanitarian index. Therefore, we have developed a study that choose several logistic infrastructures among available options under several variables like energy consumption, environmental management system, employee right & condition, waste management system etc for a cold supply chain. In this work we present a combined model of two multi attribute decision making techniques as MARCOS and CoCoSo. Many decision-making methods can be utilized for special reason for example, TOPSIS, VIKOR, COPRAS etc to rank alternatives, while other tools are designed to find the weight of the criteria. The idea in the current study is to combine the two recent developed methods and validate its efficiency by several tests and comparison. The consequences of this study can be implemented and implicated to supply chain experts and executives.

Keywords

Ensemble MCDM, CoCoSo, MARCOS, sustainable logistics infrastructure

IV.2.D.2. APPLICATIONS OF DIFFERENT MULTICRITERIA ANALYSIS METHODS FOR WATER RESOURCES MANAGEMENT – A CASE STUDY FOR CRETE

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Abstract

The present study attempts a review of the basic techniques of MCDA and their application to a problem of Environmental Resource Management. Two main methods are examined, in order to compare and evaluate them and their results.

More specifically, five alternative policies are evaluated, taking into account the water balance, the net profit from agricultural activity and the cost of water. Initially, there is an introduction to MCDA problems and a literature review on the main research approaches that have been formulated for water resources management. Subsequently, the MCDA is linked as a tool for supporting decisions for relevant topics.

Thus, once the foundations have been laid, study examines a detailed description of the theoretical methodological framework of the outranking methods used: ELECTRE and TOPSIS.

The study analyzes the relationship of MCDA with Water Resources Management, its usefulness and applications.

Keywords

MCDA, ELECTRE, TOPSIS, Environmental Resource Management, Water Resources Management

IV.2.D.3. A MULTI-CRITERIA APPROACH FOR OPTIMIZING THE PLACEMENT OF ELECTRIC VEHICLE CHARGING STATIONS IN EGNATIA HIGHWAY

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Abstract

Although the electric vehicle (EV) industry has made significant progress, in many countries there are still some barriers holding back its further advancement. A key issue is the range anxiety caused by the limited range the current EV models offer and the inadequate access the EV drivers presently have in charging stations in long distance trips, as it is the case in highways. This paper presents an intuitive multi-criteria approach that can be used to optimally place EV charging stations in highways that may partially or completely lack EV charging points. The proposed approach, which is applied in an iterative fashion to dynamically evaluate the various alternatives, considers a set of practical criteria related to the relative location of highway exits, interchanges, major cities, and existing charging stations, among others, thus supporting decisions in a pragmatic way. Moreover, the optimal locations are defined after taking into account constraints about the current average EV driving range, required reserves, and installation preferences to reduce the anxiety of the EV drivers, while facilitating the operation of the highway and ensuring reasonable costs of investment. The proposed approach is showcased in the Egnatia Highway, the longest highway of Greece that runs a total of 670 km but currently involves a single EV charging point. The results illustrate the flexibility of the proposed approach and highlight its merits as a decision support tool.

Keywords

Multicriteria Analysis, Electric Vehicles, Charging Stations, Highways

Acknowledgement

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V.2.1. LOCATION OF RADIOACTIVE WASTE DEPOSIT ACCORDING TO MINISTERIAL DIRECTIVES

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Abstract

Sogin (company appointed by the Ministry for the location of the deposit of radioactive waste in Italy) in its proposal drawn up regarding the suitability of the possible sites, has followed analytical procedures that do not find any confirmation in the scientific field of MCDA. In fact, the structure of a decision tree is missing and there is a remarkable mixture of factors and criteria in it, without any weighting of them and their values are summarized in the irrational and schematic dichotomy of favorable and unfavorable. Moreover, Sogin's proposal is in clear contradiction with the provisions of art. 27 of Legislative Decree n. 31/2010, in which the technical and socio-environmental characteristics of the areas are expressly put on the same level, without any quantification of the potential direct benefits to stakeholders operating in the area. This paper, taking into account the ministerial directives of the Legislative Decree, aims to highlight how, taking into account the requested ministerial directives, the decision could be pointed out according to the procedures of the MCDA, with the quantification of the criteria in their physical, environmental and social-economic values, in particular as regarding the seismic aspect through the introduction of specific veto thresholds, spreading the areas in more or less high eligibility bands. Especially the stakeholders who in the Sogin proposal were completely ignored, are also taken into account through GDSS operating procedures, well cataloged at international level and also completely disregarded by Sogin. All this is done with an analysis of the robustness of the results as required by the directives imposed by the Legislative Decree.

Keywords

Legal requirements, sustainability, criteria, thresholds, robustness.

V.2.2. IS RANDOM PRICING USEFUL FOR POLICY AIDING PROCESS FOR HEALTH

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Abstract

This paper presents a research stream on choice modelling for medical markets to be useful for policy decision aiding (Huttin, Ispor 2021; Huttin and Hausman, 2021). It uses especially recent statistical tests on heterogeneity of demand to verify the independence of irrelevant alternatives at an individual level (Hahn, Hausman and Lustig, 2020). First, choice models use a mixed logit model and random parameters for prices, an implementation of the new generalization of the Hausman-McFadden test.

Discrete choice models are particularly appropriate to explore providers or patients' decisions shifts under different economic conditions and to capture large heterogeneity of demand, from diversity of value judgements and preferences among providers of care and populations. The health domain is therefore particularly suitable to identify when it is appropriate or needed to run such specification test at an individual level. Such choice models need to be applied on comprehensive number of choice sets, with the appropriate specification tests, to be user tools for national policies. The paper discusses why it is important to include such specification test at individual level, since most studies using either latent class models, logit or probit, mixed logit with random parameters consider that models are sufficiently specified with the generalization of the Hausman-McFadden test. Another discrete choice model is also explored in this paper, with developments of a supply and demand model, called the Berry Levinsohn Pakes (BLP) model, for oligopolistic markets. It is designed for differentiated product markets and uses a method called "Mean Utility Method" with inversion of the function to define market share, it uses an approach with the structure of the demand system.

The structural characteristics of the economic model proposed with the incorporation of such choice modeling, the ways to examine the heterogeneity of demand at individual level and not only at group level, and the discussion on when it seems appropriate to add the new specification tests to verify the IIA, will be highlighted, since they may not be similar in all health systems especially in relation with the prescription drug market.

Keywords

Choice model, medical markets, random price parameters, tests for IIA, mixedlogit, BLP models

V.2.3. A DECISION-MAKING TOOLBOX FOR CLIMATE MITIGATION AND ADAPTATION AT MUNICIPAL LEVEL IN GREECE

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Abstract

In accordance with the European effort to tackle climate change, and heading towards decarbonisation, Greece has already been striving to move towards climate-neutrality and sustainability, partly by incorporating European directives into national legislative framework. However, Greece seems to lag behind in meeting the specified targets regarding its carbon footprint reduction, with the public sector being spotted as the “great patient”. Therefore, there is no doubt that it is of great importance to support the public sector in implementing actions aiming at mitigating and getting adapted to climate change.

In this respect, this paper aims to provide municipal enterprises with a toolbox, comprising four discrete software tools, that will facilitate the decision-making process regarding the implementation of integrated actions focused at: (a) mitigating climate change by reducing their carbon footprint and (b) adapting to climate change. These tools are designed in such a way that fosters interconnection with each other, forming an integrated analysis framework for extracting holistic solutions, however, without preventing a standalone use of the tools where necessary. Specifically, the ECO SENSE Footprint tool focuses on calculating and monitoring the carbon footprint of municipal enterprises, thus being a data inventory. The ECO SENSE Resilience tool falls within the scope of multicriteria analysis and, through leveraging ECO SENSE Footprint data and results and employing multicriteria analysis method VIKOR, calculates the resilience of municipal enterprises against the effects of climate change. ECO SENSE Forecasting, being a forecasting tool, supports the action planning of municipal enterprises for maintenance purposes regarding the production and consumption equipment. Finally, the ECO SENSE Roadmap tool aims to define a detailed roadmap, by utilizing the multicriteria analysis method TOPSIS, based on which each municipal enterprise will become more climate resilient.

The toolbox will provide significant added value in tackling climate change at local level, allowing municipal enterprises to select the most effective courses of actions towards reaching sustainability, in the context of enhancing their carbon footprint as well as their resilience against climate change.

Keywords

Climate change; decision making; multicriteria analysis; resilience; toolbox

Acknowledgement

This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code: T2EDK-00241).

V.2.D.1. EVALUATING THE PERFORMANCE OF LOCAL MUNICIPALITIES ON SUSTAINABLE DEVELOPMENT GOALS: AN APPLICATION TO FRANCE

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Abstract

Sustainable development is at core of global public policy making for ensuring peace, prosperity, and well-being. It is a multifaceted and complex issue that encompasses multiple economic, environmental, and social aspects. Since 2015, the United Nations (UN) has adopted the 2030 Agenda for Sustainable Development as a global call for action towards sustainable development. While this issue is usually considered at the country level, local governments have a crucial role in the implementation of specific actions and policies in local communities. This study presents a multicriteria framework and methodology to assess the performance of local municipalities across a rich set of criteria and indicators defined based on the 17 sustainable development goals (SDGs) that have been set in the UN Agenda. The proposed MCDA approach is applied to a large data set of French municipalities over the period 2013-2020.

Keywords

Sustainable development, Municipalities, Multiple criteria decision aid

V.2.D.2. FINANCIAL LITERACY AND ECONOMIC DECISIONS SUPPORTED BY MCDA MODELS

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Abstract

In recent literature financial literacy has been measured on three different dimensions: knowledge about financial market, investors' educational level as an ability to process gathered information and sources used by investors as a basis of their financial decisions (Abreu, Mendes, 2010). Allgood and Walstad (2016) used the 2009 NFCS survey data and found out that perceived financial literacy score comparing to objective one has bigger predictive value in explaining financial decisions in the areas of investments, mortgages and loans, credit cards, and insurance. It occurs that, the higher perceived literacy score, the better financial choices, independently of financial literacy level (Allgood and Walstad 2016). The differences between perceived and objective literacy can be explained by the Dunning-Kruger effect, a bias in which people with low ability may be unable to recognize their lack of ability and subsequently overestimate it (Kruger & Dunning, 1999; Ehrlinger et al. 2008). Different forms of literacy have been used to model actual choices of investment alternatives by means of PT-PROMETHEE. This method, including the status quo effect and loss aversion, is in line with research developing numerical methods to show the impact of heuristics on decisions. The advantage of using PT-PROMETHEE is on the one hand, the inclusion of common cognitive processes in the analysis and the evaluation of alternatives, and on the other hand can immerse factors influencing financial literacy and overconfidence bias, which would allow creating a realistic ranking of the considered solutions in the case of individual's saving and investing decisions.

Keywords

Financial literacy, overconfidence bias, framing, prospect theory, PROMETHEE

V.2.D.3. FIRMS' CREDIT ASSESSMENT USING THE FUZZY SET QUALITATIVE COMPARATIVE ANALYSIS METHOD

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Abstract

Firms' credit assessment is based on various methodological tools. In the current paper the methodological approach is based on fuzzy sets and Boolean logic, namely, the fuzzy set Qualitative Comparative Analysis (fsQCA) method, which explores all the necessary conditions and sufficient combinations in a dataset for the presence or the absence of an outcome. The fsQCA method focuses on linguistic summarization of "if-then" type rules, providing all necessary/sufficient combination of conditions (rules), which lead to the outcome. Necessary causal conditions are those which produce the outcome, while sufficient combination of conditions are those that always lead to the given outcome. The rules which are connected to the outcome by the logical OR are the possible paths from the causal conditions to the outcome.

The outcome explored is the credit assessment of 28 Greek firms for three consecutive years, 2017 – 2019. The analysis is based on eleven financial ratios, i.e., *Equity/Total liabilities*, *(Total liabilities- Equity)/Total assets*, *Cash and Cash Equivalents /Total liabilities*, *(Inventories + Cash + Receivables + Long-term receivables) / Total assets*, *Cash and Cash Equivalents / Total Revenue*, *EBITDA / Total Revenue*, *Undistributed earnings / Total assets*, *Operating results / Total Revenue*, *EBITDA / Financial expenditure*, *Promissory notes payable / Total Revenue*, and *Receivables / Total liabilities*. In this context, the financial ratios (causal conditions) constitute the input variables, while the presence of firm's credibility status is the desired outcome.

The results provide a more detailed and valid analysis of credibility. The study shows the value of a set-theoretic comparative analysis technique, to supplement other techniques, such as regression analysis and multi-criteria analysis.

Keywords

fsQCA method, Rule-based methods, credit assessment

VI.2.1. MULTI-CRITERIA DECISION ANALYSIS TO SUPPORT MASTERPLAN SCHEDULING: AN APPLICATION OF ELECTRE TRI-B FOR SORTING REGENERATION ACTIVITIES FOR AN INDUSTRIAL AREA IN NORTHERN ITALY

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Abstract

Urban regeneration projects are a collection of complex activities that use human, material, and economic resources and are carried out at various times. The organization of resources is critical for correlating and finalizing activities to achieve predefined goals. The Multi-Criteria Decision Analysis appears to be a useful tool in this context, as it allows for the connection of the contents of a complex system in which multiple urban areas are regenerated and different, and frequently contradictory, points of view emerge. The multi-step methodological framework presented attempts to optimize urban regeneration and assists decision makers (DM) in scheduling complex urban regeneration masterplans during planning phase and in monitoring of the intervention's progress by assigning start and end dates to each elementary activity to ensure that the entire project. Following the evaluation frame, the masterplan was firstly deconstructing in simple actions. Then, the ELECTRE TRI-B-based model (Roy and Bouyssou, 1993; Almeida-Dias et al., 2010) divides the portfolio of basic activities into priority classes based on a set of criteria. The actions are then distributed in a Gantt chart based on the scheduling priority of resources and activities. The proposed model was put to the test in a case study of the rehabilitation of an industrial region in Turin (Northern Italy). The evaluation methodology enabled the master plan activities to be organized over time while taking into account the opinions of an expert panel comprised of municipal technical offices, experts, and members of society (Mallia and Morgese, 2019). The findings demonstrated how this multidimensional and interactive performance evaluation system enabled the management of a large amount of data while optimizing financial, economic, environmental, and social resources while taking logical restrictions and urban policy requirements into account.

Keywords

Electre Tri-B, masterplan scheduling, urban regeneration

VI.2.2. MULTICRITERIA EVALUATION OF NEW AGRICULTURAL PRACTICES SCENARIOS IN FIELD CROPS TO REDUCE PESTICIDE USE AND ASSOCIATED RISKS

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Abstract

To meet the food requirements of population growth, agricultural productivity has evolved over nearly half a century in industrialized countries through the massive and often excessive use of synthetic chemical inputs (plant protection products, fertilizers). The aim was to combat diseases, plant pests and manage weed competition in an intensive agricultural production process. These easy-to-use and highly effective pesticides have been systematically applied in these decades according to recommendations, without generally taking into account agronomic or ecological considerations. The excessive use of these pesticides has its consequences in the contamination of ecosystems, particularly hydrosystems and soils.

The various European and national public policies implemented aim to evolve from a global productivist system towards a more sustainable one. This requires profound changes in plant protection practices, but more generally, in production systems and methods.

In a watershed area for field crops in the south-west of France, we first assessed the risks of transferring plant protection products from each agricultural parcel to surface waters, using a multicriteria analysis method for decision support (Electre Tri-C), coupled with a geographic information system. Then we built scenarios by optimizing the applied phytosanitary pressure and good environmental practices. The multicriteria assessment of these scenarios shows that the risks of contamination can be reduced on parcels but that overall at the watershed scale, they are still high.

We then modelled production system scenarios with different driving modes: conventional, conventional optimized, organic farming, at the virtual farm level. The economic and environmental performances of these systems were assessed using the Electre III multicriteria analysis method.

The results obtained with organic farming systems are the most effective, thanks to high-paying secondary crops (e.g., lentils, peas). Unfortunately, it would not be possible to extend them to the whole of a territory, because they require contracts, the areas of which are limited. On the other hand, optimized production systems that incorporate various good practices (longer

rotations, less pressure, increased biodiversity) can reduce pesticides. This study opens up many avenues for discussion with stakeholders in the agricultural world to develop methods of production that save on inputs and thus reduce the risks of contamination of ecosystems by pesticides.

Keywords

Field crops, Pesticides, Risks, Best practices, Multicriteria Decision Aiding

Acknowledgements

This work was carried out as part of the PESTIPOND project with the financial support of ANR-18-CE32-0007.

VI.2.D.1. A MULTI-CRITERIA METHODOLOGY FOR MARKET SEGMENTATION BASED ON THE CRITERIA ANALYSIS

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Abstract

Correct market segmentation is a key problem in marketing with a significant impact on the success of introducing new products or services to the market. Multi-criteria decision analysis contributes to solving the problem of market segmentation by analyzing the criteria based on which the consumer/customer (decision maker) expresses his/her preferences when purchasing a product or service. The MARKEX methodology dealt with the problem of segmentation of the market based on the analysis of the criteria. The aim of this work is the development of a methodology that will improve the proposed by the Multi Criteria Decision Support System MARKEX methodology, by expanding the criteria analysis, adding a second layer of examination that will allow the further extraction of information from the same data and the deeper understanding of the competition between the products/services and their weak and strong points in reference to the criteria. The more in-depth analysis of the criteria obtained by the addition of a clustering algorithm and the NAI algorithm. Through this expansion of the analysis, the criteria that constitute the basis for the market segmentation will be determined with more precision and lead to a more detailed and accurate market segmentation.

Keywords

Multi-criteria decision analysis, Decision Support Systems, Criteria Analysis, Clustering, Market Segmentation, Marketing

VI.2.D.2. REPUTATION MULTI CRITERIA RATING SYSTEM FOR USERS OF EV CHARGE POINT APPLICATIONS

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Abstract

A key issue in most marketplace apps is evaluating the punctuality and quality of service between counterparties. For example, in ride hailing app such as Uber, utilizing transparent mechanisms to evaluate the punctuality of drivers or passengers to their appointments is key to maintaining a fair user reputation system. Such fair rating system establishes trust in the marketplace and encourages prudent behavior among marketplace counterparties. As electric vehicles (EVs) are growing in popularity, a new category of marketplace platforms is emerging. These are EV charge spot management platforms where electric vehicle drivers identify public charger spots on the map, navigate to them and initiate charge sessions via a mobile app. Trust and punctuality of counterparties is especially important for EV charge spot apps that enable reservations charge spots. In these cases, users can reserve a public charge spot, before arriving at the location and effectively prevent other drivers from using the charger for a set time after their reservation start time. If users with reservations fail to show up or arrive and depart with a delay, the utilization of public charge spots decreases significantly. Trust in the marketplace also decreases, which may lead to charge spot managers migrating to other less sophisticated management platforms without reservation functionality. However, given the rapid growth of EVs and the relatively long recharge time required, reservation functionality is key for the operation of public charge spots. The objective of this paper is to present the design for a multi-criteria reputation management system (named ENARXIS) for e-mobility applications based on Quorum Blockchain. The novel user reputation system is designed to be transparent to all marketplace participants and interoperable across different mobile applications in the same vertical. To achieve this, ENARXIS relies on smart contracts that receive as input reservation start and end time from the charge point app and actual start and actual end time from charge point (via Open Charge Point Protocol

(OCP)) and automatically adjust user reputation score. This paper utilizes data provided by EV Loader charging application developed by Parity Platform P.C and EV Chain Research project led by National Technical University of Athens, Public Power Corporation of Greece and Egnatia Highway S.A.

Keywords

Electric vehicles, EV, Charging, user reputation, marketplace, trust, blockchain

Acknowledgements

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VI.2.D.3. APPLICATION OF MULTI CRITERIA OPTIMAL STOPPING THEORY TO PANDEMIC POLICIES

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Abstract

Due to the current COVID-19 pandemic, governments are facing a major challenge in identifying an optimal duration of the lockdown policy imposed. In many countries such as Lebanon and France, the response of the local governments to the COVID-19 crisis has been criticized heavily. In their decision-making process, many aspects should be taken into consideration such as the economic cost, the social welfare, the health-related consequences and others. On one hand, the lockdown policy helps in reducing the number of COVID-19 cases. However, on the other hand, it can have a negative economic effect. Consequently, to solve the optimal lockdown duration problem, a robust mathematical tool should be adopted in order to find a trade-off between all aspects involved.

In the literature, various mathematical tools (cost-benefit analysis, optimization, simulation techniques and others) are used to address the problem. Based on the review of the literature, the optimal stopping theory seems to be an appropriate method to address the problem. In an optimal stopping problem, the decision maker aims at picking the optimal time to take a certain action at which an expected reward or cost is maximized or minimized respectively.

The origins of the optimal stopping time problem are in the "Secretary Problem", one of the most important problems in this area, and it consists in finding a strategy to maximize the probability of picking the best applicant among various candidates to fill a single secretarial position. The optimal stopping problem can be formulated according to a single criterion (e.g., Secretary Problem) or to multiple criteria. In a multi-criteria optimal stopping problem, the decision maker ranks arriving offers according to many criteria. And then, the decision maker will pick the best offer according to his own objective (e.g., best offer according to at least one criterion, to a social choice function, to a Pareto Solution). Also, depending on the nature of the problem, the criteria can be either independent or dependent. Moreover, the multi-criteria optimal stopping problem has a variety of real-life applications. For instance, it is used in a portfolio management problem

to derive the optimal trading strategy according to many factors including stock price, liquidity and risk.

In addition to that, the optimal stopping theory can be applied to a Markov Chain process and the problem becomes a typical Markov Decision Process (MDP). MDPs are sequential decision-making models under an uncertain environment in which the goal of the decision maker is to maximize or minimize an expected reward or cost respectively. In particular, in a multi-objective MDP, the decision maker aims at simultaneously optimizing many objectives.

The aim of this paper is to use the multi-criteria optimal stopping theory applied to a MDP to tackle the optimal lockdown duration problem. A discrete-time MDP model is already built by applying the optimal stopping theory to a Discrete Time Markov Chain SIS (susceptible-infected-susceptible) epidemic model, in an attempt to derive simple optimal lockdown strategies. In this model, we assume that a lockdown is not imposed yet and that the objective of the decision maker is to choose the optimal time to impose the lockdown, such as the total expected cost (health related cost and economic cost) incurred by the lockdown is minimized. The model assumes the reproduction number R to be constant with time. The main contributions of this model are: (i) the derivation of a threshold number of infections over which the lockdown policy is always imposed and (ii) the proposal of a simple heuristics solution to the Markov Decision Process that leads to simple decision strategies.

We are currently extending our Markov Decision Process model to fulfil our objective and build a multi-criteria Markov Decision Process in which the costs incurred are tackled separately, instead of being aggregated in one objective function. We will use this model to find trade-off solutions between health-related and economic aspects of the optimal lockdown duration problem.

Keywords

Optimal Stopping Theory, Markov Decision Process, Optimal Lockdown, SIS epidemic model, economic costs, health-related costs

VI.2.D.4. A DECISION SUPPORT SYSTEM (DSS) FOR THE DESIGN AND SELECTION OF ICS DEVICES USING FUZZY LOGIC

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Abstract

Flat plate thermosiphon (FPTU) systems and integrated collector storage (ICS) systems are used by many people around the world for water heating. A common problem faced by building users is the selection of the most suitable system and the number of systems among the numerous solar thermal systems available today, with different capacities and costs. The main difficulty lies in the lack of experience and specific knowledge of potential users about the use of a solar thermal system, especially an ICS device, which has led engineers in the industry to make considerable efforts to develop new models with better performance and lower cost to help decision makers (users) choose an ICS system (ICS-SP). This paper is about the development of a decision support system (DSS) to solve the above problems (i.e., design and ICS-SP), using fuzzy logic and multi-objective optimization techniques to access both industry design specifications and occupant requirements to propose a set of alternative solutions. The use of fuzzy logic is dictated by the fact that the technical requirements in the manufacturing phase and the economic preferences of the buyer may not be explicitly stated. It is therefore more efficient to adapt the decision model to human reasoning by using fuzzy logic techniques. Another objective is to evaluate the thermal energy generated by the designed ICS devices in operating mode and the environmental footprint at this stage. All the development is implemented in an interactive software tool using Visual Basic and Fortran programming languages. The module uses the MATLAB fuzzy logic toolbox to exchange results/information with the main program. This computerized system for ICS design and selection can be used both by engineers who are exclusively involved in the manufacture of ICS units and by building users who wish to purchase these thermosiphonic units for their own use.

Keywords

Develop new models with better performance and lower cost, Choose an ICS system (ICS-SP), Decision Support System (DSS), Fuzzy logic and multi-objective optimization, Thermal energy and environmental footprint.

VII.2.1. HOW TERTIARY EDUCATION CAN EXPLAIN THE DIFFERENCES IN GDP PER CAPITA AMONG EU NUTS2? PORTUGAL AS A CASE STUDY

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Abstract

Education's influence on regional development is a subject that is already very much studied and explored in scientific literature and political debates. On the one hand, in underdeveloped countries, we observe that access to satisfactory basic education is still insufficient. In regions belonging to developed countries, namely UE regions, it is more interesting to measure their differences in development by the gross domestic product (GDP) per capita and understand if education can explain that. The percentage of residents with tertiary education may help to explain why some regions, traditionally in the central and northern EU, have better sustainable development and provide a better quality of life for their citizens. Are there regions with lower levels of tertiary education efficient in terms of GDP per capita values? Is the tertiary education of their citizens relevant for explaining the values of GDP per capita? Are there related effects among neighboring regions?

As an initial step in responding to these questions, a data envelopment analysis (DEA) optimization (input-oriented) was developed to study the (benchmark) regions for a given level of GDP per capita (output), having an optimized (minimized) percentage of the population with tertiary education (input).

Secondly, in addition, to answer the previous questions, a couple of spatial econometric models for all EU regions NUTS 2 were built to explain the distribution of GDP per capita values. The instruments considered for estimating this independent variable are spatial functions of the percentage of people with tertiary education. Additionally, a spatial exploratory analysis was developed emphasizing and confirming the differences among regions in terms of GDP per capita

and whether the contribution of the percentage of people with tertiary education is effective in explaining it.

Furthermore, some clusters were built considering various classes of positive and negative standard deviations of spatial regression residuals. These clusters can at a certain point be compared with the results observed with the LISA (Local Indicators of Spatial Association) clusters. The case of Portugal as a particular set of (seven) regions NUTS 2 included in the EU is detailed and analyzed in-depth.

Keywords

GDP per capita, tertiary education, EU NUTS 2, DEA optimization, spatial econometrics

VII.2.2. A MANAGEMENT PROCEDURE TO TAKE ADVANTAGE OF MINORITIES

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Abstract

A group of companies is often formed and controlled by a single entity, namely the holding or parent company. The holding company can exercise administrative control to the whole group, i.e., drive all investment and management decisions. The control can be either direct, meaning the parent company holds the majority of the voting rights of another economic entity of the group, or indirect, through intermediaries which holding shares to a third company, and the parent can direct them to vote in its favor. The group shares the same strategic spirit and all decisions made, aiming its growth as a whole. Subject to the fact that the companies belonging to a group are being controlled and directed by another entity, a portion of their common stock is often owned by third parties outside of the group. In accounting and consolidation processes these parties are referred as the non controlling interest and their rights as minority voting rights. Usually, such rights exist when a company is open to public offering and independent investors or external companies acquire part of the equity common stock, or when a partial take over has taken place and the majority of target's capital is acquired by the group, in any combination. Minority rights in an economic entity cease at the percentage of the company's share capital attributable to them. For the group as a whole, minority interests refer to the proportion of the group that is held by third parties. From the holding company's point of view, the objective is to maximise the value of the group and, by extension, to maximise its shareholders value. Under holding company redistribution group's shares a multi-objective model explores the pareto frontier to search alternatives leading to decrease in holdings' integrated control at the same time increasing in its cash inflows.

Keywords

Group of Companies, Participations, Minority Interest, Cash Flow Management, Multi-objective optimization

VII.2.3. APPLYING MCDA DISAGGREGATION – AGGREGATION APPROACHES TO THE ASSESSMENT OF A GLOBAL PRODUCTS ENVIRONMENTAL FOOTPRINT INDEX: THE CASE STUDY OF REFRACTORY PRODUCTS

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Abstract

The assessment of the Products Environmental FootPrint (PEF) is achieved through discrete stages, which are progressed in a waterfall interactive manner, starting with the identification of the goals and scope of the PEF study, continuing with the creation of the resource use and emissions profile and the assessment of the environmental impacts estimation and finally to the integration and the reporting. The PEF cannot be bordered only to the climate change factors while a set of other factors are involved. Worldwide is proposed a set of impact factors to be taken into consideration for PEF assessment, 14 of which has been adopted by European Union, including Climate Change, Ozone Depletion, Ecotoxicity, Human Toxicity, Photochemical Ozone Formation, Acidification, Eutrophication, Resources Depletion and Land Transformation.

The Multicriteria features of the assessment of Products Environmental Footprint is analyzed in this reach work for the assessment of an integrated PEF index. According to the EU legislation (L124, ISSN 1977-0677) is proposed the estimation of the PEF to conclude to an overall PEF index through normalization and weighting processes at the stage of the environmental impacts assessment, integrating the separate environmental footprint of the relative impacts.

This research work is focused to identification and the experimentation of the disaggregation – aggregation multicriteria approaches for the estimation of a value system that will support the estimation of an integrated PEF index into the frame of the proposed methodology by the above-mentioned legislation of the EU. The proposed methodology will be adapted for the production of refractory bricks and masses for two separate production cases, a) the use or mining materials and the mix of mining materials with recycled refractory in order to emerge the sustainability of the adoption of recycling in heavy industry.



Keywords

Multicriteria Disaggregation – Aggregation Approach, Products Environmental Footprint

Acknowledgement

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VII.2.D.1. ACCELERATING POWER PURCHASE AGREEMENTS: A VALUABLE TOOL FOR MANAGING CORPORATE GREEN ENERGY NEEDS

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Abstract

To meet sustainability goals and to align with climate change mitigation initiatives a vast number of Corporates agree upon purchasing green energy to meet their needs. This is often accomplished through the execution of bilateral power purchase agreements (PPAs) with renewable energy assets. PPAs are a useful tool for managing Corporates' green energy requirements. A PPA can be structured in a variety of ways, but the essential premise is that a buyer (Corporate) agrees to purchase imminent energy output from a seller (renewable energy owner) at a predetermined set price (strike price). Such contracts are usually long-term oriented, i.e., 10-20 years, and can incur rather complex structures. These concerns necessitate thorough care and planning throughout the negotiating period. PPAs are financially appealing to sellers due to price stability, contrasting trading in power markets. As a result, different tactics have been utilized in PPAs to incentivize buyers to undertake such offers. The aim of this study is to propose a Multi-Criteria Decision Analysis-based method to assess the integration of the sustainability philosophy in Corporates via the application of PPAs that best fit their needs. By utilizing the proposed approach to compare different PPA structures, the researchers aim to reveal the appropriate scenario within different types of Corporates, to allow off-takers to make decisions towards sustainable practices. Furthermore, analysis of the formation procedure of a PPA, based on a real-life data provided by ABO Wind Hellas SA and proposal of a decision tree for a win-win PPA structure as the basis for a conceptual framework that will enhance reliability, is being suggested.

Keywords

PPAs, Sustainability, MCDA, Green energy, Corporates

VII.2.D.2. MAXIMIZING BENEFIT OF DOUBT THROUGH THE LENS OF MCDA

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Abstract

This innovative approach is focused not only to suggest optimal decisions among alternate linearly formulated decisions not even to unify the better but at the same time to gain the maximum benefit of doubt in other words trust or the confidence of decision maker(s). This is achieved with its well-formulated and integrated interactive e-model to resolve the ranking problem with aggregation of known ordering techniques weighted/ non weighted sum, multi criteria analysis TOPSIS index and DEA matrix of superior indexes. Therefore, the novelty is that the solution satisfies all ranking methods by extracting the relative supreme relationships to adjust the suggested weights to his preferences. The power of interactivity enables the running of what-if scenarios, to simulate strategies or to proof related theorems. It utilizes several LP models linear and non-linear and was used in several operational cases. Variables values may be expressed as crisp or fuzzy numbers and initial weights from one or a group of experts may be assigned. Different data normalization (min-max, linear, vector, z score) are utilized.

This work resolves the mentioned contradictions by extracting the endogenous composite indicators which furthermore may be adjusted and personalized according to experts supreme preferences.

The non-linear method to unify TOPSIS and DEA ranking is presented, and some theorems are proved. Finally, the case of decision making for vessels' emission monitoring implemented in EMERGE EU project is presented.

Keywords

DEA, TOPSIS, MADM, LP, DP, normalization

VII.2.D.3. PUBLIC HEALTH INTERVENTIONS IN THE FACE OF PANDEMICS: NETWORK STRUCTURE, SOCIAL DISTANCING, AND HETEROGENEITY

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Abstract

Complexity, resulting from interactions among many components, is a characterizing feature of healthcare systems and related decisions. It scales up in the face of pandemics that give rise to multiple sources of uncertainty and where various contextual factors interact with each other and with policy parameters that combine to yield outcome distributions. This paper proposes a unified agent-based modeling framework to derive qualitative insights that assist and inform policy decisions related to pandemics. The general framework comprises a contagion model that explicates exogenous policy-relevant variables, as well as their links with features of the environment in which the policy decisions will be implemented. Furthermore, the framework identifies sources of uncertainty at different system layers. The characterization of the macro level, for example, as manifested in the network structure, encompasses two constitutive factors. These two factors, in turn, capture much of the stochasticity that results from the network's inherent randomness. By synthesizing the model components further into a broader agent-based model, the current framework also accounts for heterogeneous micro-level attributes that collectively yield macro-level outcomes. Several stylized examples help establish insights into the overall tendency of complex systems to produce multidimensional outputs. A comprehensive, controlled, computational experiment offers further evidence across a range of scenarios and various policy conditions.

Keywords

Decision support systems, Agent-based models, Random networks

VII.2.D.4. MODELING THE ECONOMIC IMPACT OF COVID-19

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Abstract

We suggest a novel theoretical model to investigate the role of pandemic risk factors in financial markets. To this end, we adopt an incomplete market framework under the assumption that the parameters of the model depend on a stochastic external economic/risk factor, which is assumed to follow a geometric Brownian motion with exponential growth. Based on the theoretical model proposed, we provide an original empirical application to assess the impact of COVID-19 disease on the US stock market using data for the period spanning from January 21, 2020, to December 09, 2020. The results document a negative association between COVID-19 growth rates and US stock market returns.

Keywords

COVID-19; Economic impact; Modeling; Stock market

We thank you for your participation