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## Article

# Editorial for the special issue: "Novel Solutions and Novel Approaches in Operational Research"

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## Editorial for the Special Issue: "Novel Solutions and Novel Approaches in Operational Research"

co-published with the *Slovenian Society INFORMATIKA – Section for Operational Research (SSI-SOR)*

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### Abstract

This special issue of Business Systems Research (SI of the BSR) is being co-published by the Slovenian Society INFORMATIKA – Section for Operational Research (SSI -SOR). It focuses on recent advances in Operations Research and Management Science (OR / MS), with a particular emphasis on linking OR / MS with other areas of quantitative and qualitative methods in the context of a multidisciplinary framework. The ten papers that were chosen for this Special Issue of the BSR present advancements and new techniques (methodology) in the field of Operations Research (OR), as well as their application in a variety of fields, including risk management, mathematical programming, game theory, gravity, spatial analysis, logistics, circular economy, continuous improvement, sustainability, e-commerce, forecasting, Gaussian processes, linear regression, multi-layer perceptron, and machine learning.

**Keywords:** gravity model; multi-criteria decision-making; inconsistent pairwise comparisons; semiparametric spatial autoregression; cluster analysis; greenhouse gas emissions; maritime transport; internal migration; investor sentiment; age management.

**JEL classification:** C44, C61, C63, D81

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## Editorial process

Operations research (OR), sometimes referred to as management science (MS), is a systematic methodology for decision-making that seeks to determine the most efficient means of constructing or managing a system, particularly in contexts necessitating resource allocation (Winston, 2003; Boucherie et al., 2021). Operations Research (OR) is a discipline dedicated to decision support, primarily aimed at creating tools and methodologies that assist decision-makers in problem-solving and judgement formation. Data analysis, simulation, modelling methodologies, and software applications are the decision-support topics of Operations Research (Mladenović et al., 2003; Rubio and Jiménez-Parra, 2014).

Operations Research (OR) is applicable in several domains, such as industrial engineering, management, business, manufacturing, government, healthcare, transportation, geographic information systems, scheduling, marketing, inventory, and other sectors (Cochran et al., 2011). The applications of Operations Research facilitate the clear and adaptable articulation of complex issues within a real-world setting, integrating both quantitative (e.g., financial ratios) and qualitative aspects into the evaluation process (Figueira et al., 2005).

The application of Operations Research has substantially enhanced organisational efficiency, resulting in increased productivity and social welfare. The International Federation of Operational Research Societies (IFORS) and the Association of European Operational Research Societies (EURO) serve as umbrella bodies for operational research societies globally. Collectively, these two associations encompass over 50 national societies, including the Slovenian Society INFORMATIKA - Section for Operational Research (SSI-SOR). SSI-SOR primarily concentrates on the organisation and coordination of international symposia.

The 17th International Symposium on Operations Research, often called SOR'23, was held in Bled, Slovenia, from September 20th to September 22nd, 2023. SOR'23 was a scientific event in the field of Operations Research. It was another in the usual series of international OR conferences held every two years and hosted by SSI-SOR in Slovenia. The main goal of SOR'23 was to promote the knowledge, interest and education of OR in Slovenia, Europe, and worldwide. In addition, it was agreed at SSI-SOR to collaborate with other disciplines to find a middle ground between the breadth of theoretical knowledge in OR and the understanding of theory, techniques, and problems in other disciplines, both within and outside OR. SOR'23 was attended by 198 individuals from different research institutes, universities, government agencies, private and public companies, and 19 countries worldwide, both in person and online. The conference included 96 papers or abstracts, with 198 authors and co-authors contributing to their production. After a blind peer review process conducted by two independent reviewers from the SOR'23 Programme Committee and reviewers nominated by SSI-SOR, the articles were finally approved for publication.

As a result of the decision taken at SOR'23 to publish the special issue (SI) of the BSR, the call for papers for this SI was already published at this conference in Bled in September 2023. The invitation was addressed to all those who had registered for SOR'23 and to other researchers from the field of OR. The submitted papers should present current breakthroughs and novel approaches in OR methodologies and models and their practical applications in economics, business, finance, organisation, management, social sciences, environment, agriculture, education and transport, among others.

Fourteen submissions were received. Several articles are expanded versions of concise papers delivered at SOR'23 and subsequently published in the Proceedings of SOR'23 (Drobne et al., 2023). The submissions to the BSR's Special Issue were initially assessed anonymously by the guest editors and subsequently by two experts. This special issue of

the BSR has 10 distinct essays from various writers. They have continually emphasised model development and modelling, enhancing their practical orientation. Furthermore, they exceed mere algorithm presentation by enhancing them with the newest advancements in optimisation, simulation, and decision analysis.

The selected contributions span various developments and techniques in operations research (OR), economics, spatial science, and business, with practical applications across different sectors. Methodologically, the papers cover topics such as gravity models, multi-criteria decision-making, semiparametric spatial autoregression, cluster analysis, behavioural finance, and mathematical programming. These approaches are applied to pressing issues like environmental sustainability, labour market dynamics, age management, agricultural policies, and market asymmetries. Case studies include a wide geographic range, with contributions focusing on the European Union, Slovenia, Croatia, Central and Eastern Europe, and beyond. Together, these papers provide interdisciplinary insights into economic, social, and environmental challenges, offering policy recommendations and strategic frameworks for improving sustainability and efficiency across various domains.

The achievements of the BSR's SI are due to the collective work that has been done. The guest editors would like to thank the authors for their thoughtful and well-written contributions and the reviewers for their careful consideration of the contributions and their insightful and helpful comments. Last but not least, the guest editors would like to express their sincere gratitude and appreciation to the Editor-in-Chief, Professor Mirjana Pejić Bach, PhD, for asking us to serve as guest editors of the BSR's SI.

## Contributions

The purpose of the papers published in BSR, following BSR's objectives and editorial policy, is to present original theoretical and empirical advances in business and economic systems using a wide range of methodological approaches, mainly from operations research/analytics, management science, and statistics. This is done to fulfil BSR's mission and comply with BSR's editorial policy. These objectives have been achieved with ten papers BSR has accepted for this SI.

In the first paper, entitled "The Impact of a New Container Port on the Greenhouse Gas Pollution", Bogataj, Campuzano-Bolarin, and Moreno Nicolás examine how the construction of a new container terminal affects greenhouse gas emissions, including CO<sub>2</sub>. Using a gravity model within a global supply chain, the study evaluates the environmental impact of maritime transport and the added emissions from poor railway connections. Results indicate that while the new terminal can reduce emissions by cutting time spent on routes and in ports, insufficient rail infrastructure undermines these gains. The authors show how the optimal capacity of a new port can be calculated using a multi-level gravity model, predicting its effect on pollution both at the port and along transportation routes to consumers.

In the article "Selection Procedure of the Approximation Methods for Deriving Priorities: A Case of Inconsistent Pairwise Comparisons", Vesna Čančer presents a method to evaluate the accuracy of approximation methods used in multi-criteria decision-making. The study compares the results of different approximation methods to the eigenvalue method, particularly in cases where pairwise comparisons exhibit inconsistency. Using mean absolute deviation (MAD) and mean absolute percentage deviation (MAPD), the research shows that the geometric mean method is the most accurate for deriving priorities. This paper contributes to decision-making literature by guiding users on choosing appropriate methods when deriving priorities from inconsistent comparisons.

In the third article "Design of Social Infrastructure and Services Taking into Account Internal Migration by Age Cohort", Samo Drobne and Marija Bogataj explore the impact

of demographic changes on urban and regional planning, focusing on migration patterns by age cohort. Using the gravity model applied at Slovenian NUTS 2 and NUTS 3 spatial levels, the study investigates how factors such as distance, wages, and the capacity of care homes influence internal migration. Key findings reveal that distance is less significant for those aged 65-74, while wages mainly affect younger cohorts. The study emphasizes the need for adapted social infrastructure and services, particularly for older adults, to support the growing silver economy.

In the fourth article "Beyond Parametric Bounds: Exploring Regional Unemployment Patterns Using Semiparametric Spatial Autoregression", Andrea Furková and Peter Knížat address the limitations of traditional econometric models in capturing nonlinear relationships between economic variables. The authors propose a semiparametric spatial autoregressive model to account for both spatial effects and nonlinearities. Using penalised basis splines, they demonstrate how this approach provides greater flexibility in modelling local variations. The empirical study, focusing on regional unemployment across the European Union, reveals significant spatial dependence between regions. The authors conclude that semiparametric models offer improved accuracy over parametric models, providing a better understanding of regional unemployment dynamics.

In the fifth article "Sentiment and Stock Characteristics: Comprehensive Study of Individual Investor Influence on Returns, Volatility, and Trading Volumes", Aleš Kresta, Jialei Xiong, and Bahate Maidiya explore the relationship between individual investor sentiment and stock market variables. Using data from the American Association of Individual Investors (AAII) sentiment index, the study examines 480 components of the Standard & Poor's 500 index. The findings show a positive correlation between investor sentiment and stock returns, while a negative relationship is observed with volatility and trading volume. The research highlights the significant influence of individual investor sentiment on market behaviour, contributing to the field of behavioural finance.

In the sixth article "Age Management Practices and Benefits in Organisation: An Evaluation of the Effect of Economic Sector, Organisation Size, and Family Business Status", Terezie Krestová, Aleš Kresta, and Lucie Bestová examine the factors influencing age management practices within organisations. The study explores whether the economic sector, organisation size, and family business status affect the selection of age management strategies and their observed benefits. Based on a questionnaire survey and chi-square tests, the authors find that the economic sector impacts the choice of age management practices, while the organisation's size affects the benefits gained. The findings offer practical guidance for organisations in selecting appropriate age management strategies to maximize potential outcomes.

In the seventh article, "School-to-Work Transition in the Youth Labor Market in Central and Eastern Europe: A Cluster Analysis Approach", Tomislav Korotaj, James Ming Chen, and Nataša Kurnoga explore youth labour market dynamics in eleven central and Eastern European countries from 2008 to 2021. Using hierarchical clustering and multidimensional scaling, the study evaluates wage ratios, early departure from education or training, and the share of youth not in employment, education, or training. The results reveal distinct clusters, including the Visegrád countries, the Baltics, and the Balkans, each facing unique challenges. The findings emphasize the role of historical and geographical ties in shaping youth labour market outcomes, with Poland, Estonia, and Bulgaria emerging as outliers in their respective regions.

In the eighth article, "Strategic Categorization of Dairy Cow Farms in Croatia using Cluster Analysis", Maja Petrač, Krunoslav Zmaić, and Jaka Žgajnar examine the challenges faced by the milk processing sector in Croatia, characterized by a bipolar structure with large-scale producers and struggling small to medium-sized farms. The study aims to categorize typical dairy farms using cluster analysis to provide insights for

policy formulation. Employing both hierarchical and non-hierarchical clustering techniques on data from the Croatian Agency for Agriculture and Food, the researchers identified 16 clusters of relatively homogeneous farms. These clusters offer a detailed understanding of Croatia's dairy sector and provide a foundation for targeted investments aimed at improving farm efficiency, economic viability, and sustainability.

In the ninth article "Estimating Asymmetric Fuel Price Responses in Croatia", Karol Szomolányi, Martin Lukáčik, and Adriana Lukáčiková examine the asymmetry in the transmission of oil prices to retail fuel prices in Croatia. The study employs various econometric models, including the Linex approach, which uses a non-linear adjustment cost function and the generalised method of moments. Results from standard methods are mixed, while the Linex approach reveals clear price asymmetries, particularly in how fuel prices rise faster than they fall. The study concludes that the Linex approach is effective in detecting price asymmetries, even in large datasets with frequent price changes, aligning with findings from similar studies worldwide.

In the tenth article "Decision-Making Model to Support Agricultural Policies in Realizing Economic and Social Sustainability", Jaka Žgajnar and Lidija Zadnik Stirn present a mathematical programming model to aid in the development of the Common Agricultural Policy (CAP) Strategic Plan for 2023-2027, focusing on the beef sector. The linear programming model enables ex-ante analysis by simulating farm-level production plans and aggregating outcomes at the sector level. The study highlights the challenges faced by the beef sector, including high costs, low efficiency, and structural limitations. Results show that production-related payments are crucial to mitigate negative trends, particularly for larger farms, underscoring the model's effectiveness in supporting policy design for enhanced economic and social sustainability.

It can be concluded that the high-quality and timely topics of the SI of BSR papers are of interest to both scientific and professional audiences, as they may influence both theory and applications.

Ljubljana, Zagreb, September 2024

*Guest Editors of SI BSR*

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