



# Recent theoretical and practical contributions to the OR environment and CEJOR from the perspective of SSI-SOR

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## Abstract

The article summarizes the research topics published in this special issue. The papers in this issue are based on the selected and peer-reviewed papers from the 17th International Symposium on Operations Research in Slovenia – SOR'23, which took place in Bled, Slovenia (<https://arhiv.fov.um.si/sor23/>), September 20–22, 2023. In addition, we examined the 27 research papers in the last two SSI-SOR CEJOR special issues, 16 in the Cent Eur J Oper Res 31, issue 3, 2023, and 11 in this CEJOR special issue, and grouped them into clusters using keywords according to the methodology published by Kastrin et al. (2021) Methodologies and applications for resilient global development from the aspect of SDI-SOR. The clusters show the main and niche topics presented and, on the one hand, illustrate the European and international state of the art in the field of OR over the last five years and, on the other hand, can serve as a stimulus for further work on upcoming strategic OR topics.

**Keywords** OR research · SOR conferences · Slovenia · Cluster analysis

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# 1 Introduction

The OR in Slovenia has developed into a vibrant community since the first OR foundations in the first 60 years, as explained in Povh et al. (2023). One of the most visible activities of the Slovenian Section for Operations Research within the Slovenian Society INFORMATIKA (SSI-SOR) is the biannual organization of a series of Symposia in Operations Research (SOR). The last one, the 17th International Symposium on Operations Research (SOR'23), took place from September 20–22, 2023, in Bled, Slovenia. The event attracted participants from many countries in Europe and beyond, including Slovenia, Croatia, Hungary, Serbia, the Slovak Republic, the Czech Republic, Poland, Spain, Turkey, the USA, Germany, France, Italy, Austria, Israel, Pakistan, the Republic of North Macedonia, the Netherlands and the United Kingdom. The topics of the 98 papers by 198 authors were covered in eight special sessions (Applications of OR in agricultural economics, Applications of OR in industry and mechanical engineering, Artificial intelligence in business, Discrete optimization methods and models, Game theory, Industry and society 5.0, Social innovations in aging studies and Business models applying OR and statistics) and six regular sections (Econometric models, Human resources, Finance and investments, Location and transport, Graphs, Mathematical programming and optimization and Multicriteria decision making). In addition, the conference was enriched by five outstanding plenary lectures. The diversity of research areas on the agenda at the SOR'23 conference is reflected in the variety of topics covered in the papers of the SSI-SOR special issue, *Proceedings of the 17th International Symposium* (2023).

In 1994, SSI-SOR joined forces with the Austrian, Czech, Croatian, Hungarian, and Slovakian Societies for Operations Research to found an international journal. Under the leadership of the Austrian colleagues, the Central European Journal for Operations Research and Economics (CEJORE) was launched. From 1999, the journal was published by Physica and later by Springer Verlag under the current name Central European Journal of Operations Research (CEJOR). Since 1997, the members of SSI-SOR have been co-editors of CEJOR. In 2011, the first special issue of CEJOR was published with guest editors from SSI-SOR. In 2013, 2015, 2017, 2019, 2021, and 2023, members of SSI-SOR published further special issues on the international symposia (SOR) organized by SSI-SOR. The current issue of CEJOR is again an SSI-SOR special issue. Although the call for papers for this special issue was open, it was only announced at the SOR'23 conference and therefore attracted mainly the authors among the participants. The selection of contributions in this special issue of CEJOR clearly shows the international and especially the Central European character of the SOR conferences. Of the twenty-three authors, eight are from Slovenia, five from Croatia, four from the Czech Republic, three from the Slovak Republic, two from the United Kingdom, and one from Poland. Two authors from Hungary currently reside in Slovenia and are therefore listed in the statistics under Slovenia.

## 2 Brief overview of the articles in this CEJOR issue

Following the review process, 11 contributions were selected for this SSI-SOR CEJOR special issue. The contributions present new or modified theories and the application of OR in practice. They deal with graph theory, mathematical programming, multi-criteria decision making, discrete optimization problems and models, finance and investment, location and transportation, artificial intelligence in economics, and human resources.

Brezovnik et al. (2025) deal with graph theory. They focus on the 2-rainbow domination number of Cartesian graph bundles of cycles over cycles, extending recent results for the Cartesian product of cycles and providing exact values for certain infinite families including lower and upper bounds for the general case.

The paper by Hladík (2025) extends sensitivity analysis in linear programming to measure the effects of variations in one coefficient on the optimal solution for all input data. It determines the maximum variations of the data using the matrix, spectral and maximum norms and focuses on maintaining the optimal basis. In addition, it also considers the variations of some submatrices, performs selected numerical experiments to analyze the computation time and accuracy, and investigates the computational complexity to find out for which norms the problem is efficiently computable and for which it is NP-hard.

A bilevel programming to solve the problem of optimal taxation of a competitive company is considered by Kojić (2025). The author emphasizes that in business theory the production function is crucial for selection of input quantities to maximize profits for a given tax. He describes the firm's taxation problem by the CES (constant elasticity of substitution) function and shows that this approach with the CES production function is a generalization of the study of Lukač (2023a) under the same conditions with the Cobb-Douglas production function. Moreover, instead of multi-variable calculus and a non-trivial optimality test to solve the long-run profit maximization problem of a perfectly competitive firm, the present study uses an elementary approach based on the weighted arithmetic mean and geometric mean (WAMGM) inequality and Hoelder's inverse inequality.

The multistage bipolar method, originally based on the ELECTRE method, is discussed by Trzaskalik (2025). The paper suggests replacing the ELECTRE method with the AHP method and incorporating the verbal comparisons used in the AHP method into the existing multilevel bipolar method. Moreover, the multilevel decisions are not directly compared with each other, but they are confronted with the level sets of the reference objects.

Horaček (2025) examines agent-based models of opinion formation dynamics in small groups. He introduces the Opinion Shift Map, a novel tool for visualizing and quantifying individual reactions to an advisor's opinion based on differences in opinion and trust and integrates it into an agent-based model. He also used computer simulations to investigate the influence of initial opinion and trust distribution on opinion development. In addition, he investigated the influence of perceived differences in opinion and trust. The results show key factors that influence group consensus. The strengths and limitations of the model are also assessed.

Szomolanyi et al. (2025) examine the business characteristics in the small EU countries during the COVID-19 pandemic. The results for the small EU countries differ from those for the large countries and from those presented in other studies. The authors confirm that the macroeconomic changes during the pandemic are due to changes in trade and labor supply. They also explain that the instability of investment is due to higher debt servicing costs.

Baldouski et al. (2025) address the problem of container port terminals, which serve as important hubs within global supply chain networks. They present a mathematical model that integrates the entire terminal network through a comprehensive set of constraints that enforce FIFO rules for all road segments, maximum capacity limits for all roads and facilities, turnaround time requirements at gates and docks, priority relationships between trucks along the entire route, coordination with vessel schedules, and dock assignments. The model is based on mixed-integer linear programming and allows us to find optimal truck routes and schedules. In addition, a rolling horizon heuristic is developed to solve cases where the model is otherwise intractable. The port of Koper is used as an application of the presented model and demonstrates its effectiveness and potential scalability.

Garajová and Rada (2025) present a mathematical model for transportation problems in which the values of supply, demand and transportation costs are subject to uncertainty and can be independently perturbed within the given lower and upper bounds. The model is based on linear interval programming and analyzes the complexity of finding the worst (finite) optimal value of an interval transportation problem. The authors also prove that the decision problem associated with computing the worst optimal value is NP-hard for all basic formulations of interval transportation problems. They show that a direct transformation of an equation-constrained interval transportation problem into an inequality-constrained or mixed formulation preserves the worst optimal value and highlight two special classes of interval transportation problems that are not covered by the NP-hardness proof and whose complexity is still a problem.

The study by Bach et al. (2025) uses a hybrid approach to identify the key determinants that influence the use of e-democracy and e-government tools. In order to capture different aspects of e-democracy and e-government, including the motivation to use the tools, a survey was conducted among a sample of Croatian citizens. A cluster analysis was conducted to identify groups of citizens based on their motivation level, while a multiple regression analysis was used to examine information literacy, intensity, constraints and barriers to the adoption of e-democracy and the use of e-government. The results show that demographic characteristics have a strong influence on the barriers, while motivation and information literacy play a greater role in the intensity of use. The study is a good support for policy makers and government institutions in improving the development and effective implementation of e-democracy and e-government tools.

The role of jury and public votes in the Eurovision Song Contest (ESC) at national and ESC level to ensure objectivity is analyzed by Kadoić et al. (2025). It was hypothesized that the audience is not able to make an objective evaluation and that the correlation between the national jury and the ESC jury and national juries is high, while the correlation between the national audience and the ESC audience is low.

The analysis shows mixed results and concludes that the influence of the juries on the final result is overwhelming. The authors make two suggestions for the future: the voting system needs to be improved, and two prizes (Jury Award and Public Award) should be introduced.

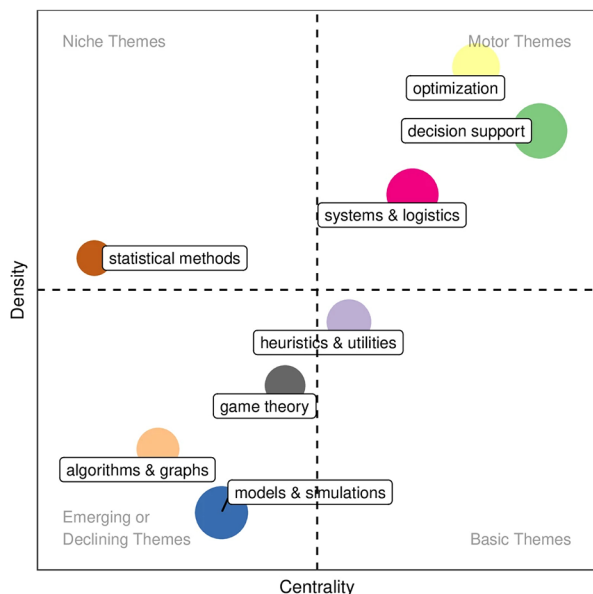
Mihelač and Povh (2025) investigate the similarities and differences between twenty-two European countries by using the Information Dynamics of Music (IDyOM) computer model to analyze various musical elements in folk songs, children's folk songs and children's songs. Their results show significant differences between countries highlighting the way the musical elements are integrated into the musical structure.

### 3 Bibliometric analysis of the latest CEJOR SI of the SSI-SOR

The bibliometric analysis of the articles published in the first six SSI-SOR special issues of CEJOR is presented in Kastrin et al. (2021). The authors also analyze and visualize the annual dynamics of the number of published articles, highlight the most prolific authors and countries, present the articles with the highest impact in terms of number of citations, and examine the network of keyword sharing, which was divided into eight keyword clusters based on the Louvain community detection algorithm. The clusters were named as follows: “decision support”, “optimization”, “algorithms and graphs”, “models and simulations”, “systems and logistics”, “heuristics and utilities”, “game theory”, and “statistical methods” (in order of decreasing centrality).

Based on centrality and density, the clusters were divided into four quadrants, see Fig. 1, which appears as Figure 3 in Kastrin et al. (2021). Quadrant I contains three engine clusters called “optimization”, “decision support”, and “systems & logistics”.

**Fig. 1** The diagram with the eight clusters based on centrality value and density value. (source Kastrin et al. (2021))



These clusters relate to scientific topics that are already well developed and are driving progress in the field of OR. The cluster in Quadrant II (“statistical methods”) could indicate the topic(s) that will be the driving themes in the future. In Quadrant III, there are three clusters, namely “models & simulations”, “algorithms & graphs”, and “game theory” that have both low centrality and low density, implying that these topics are well developed but on the periphery of the community’s interest. The only cluster in Quadrant IV is “heuristics and utilities”, which has a high centrality but a low density.

The names of the eight clusters are based firstly on the top keywords, i.e., about 50 of the 266 keywords, which account for about 50% of the total number of keywords, and secondly on an attempt to capture the spirit of the less frequent keywords that were added to the cluster by the clustering method used. Here we consider the 27 research papers in the last two SSI-SOR CEJOR special issues, 16 in *Cent Eur J Oper Res* 31, issue 3, 2023, and 11 in this volume. We assign them to clusters based on the keywords used. In many cases, an article may be naturally associated with more than one cluster, so we often assign such articles to two clusters. In rare cases, the keywords appear to be somewhat removed from the top keywords of the clusters, so we also consider the content to decide which cluster the paper best fits into. Of course, the ad hoc method we used has its limitations, but on the other hand, we should also be aware that the small number of papers considered does not always allow us to draw clear conclusions, even if a more sophisticated method were applied.

However, it is interesting to note that the rough assignment of the papers discussed here (27) to the clusters confirms to some extent the positions of the clusters in the quadrant. Two of the clusters, “decision support” and “optimization”, from Quadrant I are clearly the most popular. This is consistent with the Kastrin et al. (2021) observation that these are the driving themes of OR. The “optimization” cluster is obviously the most popular, and the keyword “optimization” is explicitly found in eleven contributions (see Table 1). The situation is similar with six contributions that are assigned to the »decision support« cluster, and in which decision-making processes or decision-making are explicitly mentioned as keywords (see Table 2). It is worth mentioning that two papers in this issue that are assigned to the “optimization” cluster, namely Garajová and Rada (2025) and Baldouski et al. (2025), also fit into the »systems & logistics« cluster, as they explicitly deal with the problem of transportation.

As expected, the clusters in the other quadrants are less popular. An exception is the »models & simulations« cluster with seven entries, not only because the words “model” and “simulation” appear as keywords, but also because of our content assessment (see Table 3). Two papers, namely Gabrovšek et al. (2023) and Brezovnik et al. (2025), are assigned to the other two clusters in Quadrant III, i.e. »algorithms & graphs”. Only one paper is assigned to the “game theory” cluster, namely Lukač (2023b), which can also be assigned to the “optimization” cluster and which we have shown in Table 1.

The only cluster in Quadrant II is the »statistical methods« cluster, to which we assign the paper Horaček (2025), which also appears in the “algorithms and graphs” cluster, as well as the paper Pejić Bach et al. (2025). Both papers are listed in Table 3.

**Table 1** Keywords used in the contributions assigned to cluster »optimization« (they generally contain the four most important keywords: optimization, demand, planning and uncertainty)

Article (author)	Keywords
Baldouski et al. (2025)	scheduling, port logistics, container flow optimization, simulation, mixed-integer linear programming
Nagy and Varga (2023)	mathematical programming, linear optimization, interior point algorithms, algebraic equivalent transformation technique
Gaspars-Wieloch (2023)	one-criterion and multi-criteria optimization, decision making under certainty and uncertainty, interactive programming with aspiration levels, scenario planning, analogies, Portfolio optimization
Garajová and Rada (2023)	transportation problem, interval programming, optimal value
Garajová and Rada (2025)	transportation problem, interval data, uncertainty, optimal value
Hladík (2023)	Multi-objective linear programming, interval analysis, robust optimization, weighted scalarization
Hladík (2025)	linear programming, sensitivity analysis, robustness, tolerance analysis, matrix norm, NP-hardness
Kojić (2025)	optimal tax revenue, profit maximizing perfectly competitive firm, CES production function, many inputs, bilevel programming, elementary inequalities, mathematical induction
Lukač (2023b)	Stackelberg game, multiple followers, export costs, optimal tax policy, optimal production, competing companies
Lukač (2023a)	optimal tax revenue, profit maximizing perfectly competitive firm, Cobb–Douglas production function, bilevel programming
Perić et al. (2023)	multi-objective programming, linear fractional programming, iterative method, sensitivity, efficient solution

**Table 2** Keywords used in the contributions assigned to the cluster »decision support« (these papers usually contain four main keywords: decision, process, decision-making, and methodology)

Article (authors)	Keywords
Gaspars-Wieloch (2023)	one-criterion and multi-criteria optimization, decision making under certainty and uncertainty, interactive programming with aspiration levels, scenario planning, analogies, Portfolio optimization
Kašparová (2023)	business intelligence, technologic innovation, UTAUT (2), decision-making
Milavec Kapun et al. (2023)	multi-criteria decision-making, DEX methodology, healthcare, self-care, home environment, patient empowerment
Perić et al. (2023)	multi-objective programming, linear fractional programming, iterative method, sensitivity, efficient solution
Trzaskalik (2023)	multistage decision process, multiple criteria decision analysis (MCDA), multistage bipolar method, vectors of indicators, Pointer function, dynamic programming
Trzaskalik (2025)	multistage decision process, multiple criteria decision making (MCDM), multistage bipolar method (MBM), Saaty's scale (SS), analytical hierarchy process (AHP)

Many other papers implicitly use statistical methods, but this keyword does not appear in the lists of keywords or in the summaries.

We did not find any work that we felt would fit into the “heuristics & utilities» cluster, the only cluster in Quadrant IV.

On the other hand, there are two articles in this issue that deal with other questions about music. These are the articles Kadoić et al. (2025) and Mihelač and Povh

**Table 3** Keywords used in the articles assigned to the »models & simulations« cluster

Article (author)	Keywords
Čegovnik et al. (2023)	electricity demand, load forecasting, neural network, random forest, accuracy, parallelization
Horaček (2025)	opinion formation, opinion shift, confidence shift, agent-based modeling, computer simulation
Krpan (2023)	monopsony in the labor market, duality, non-wage determinant of the labor supply, short-run normalized profit function, Hotelling's lemma
Pejić Bach et al. (2023)	data mining, SMEs, TOE framework, structural equation modeling, artificial neural networks, hybrid
Ősz et al. (2023)	Scheduling, waste wood processing, discrete-time model, prece-dence-based model, reverse wood value chain
Szomolanyi et al. (2025)	COVID-19 pandemic, European Union, small economies, business cycle, MXN model
Varga and Madari (2023)	Hungarian insurance market, market structure, Panzar–Rosse model, dynamic panel model

(2025). The keywords used in these two articles do not explicitly match the clusters discussed.

## 4 Conclusions

From this brief overview of the articles published in the last two SDI-SOR CEJOR special issues, it is clear that the “motor” topics mentioned in Kastrin et al. (2021) are still the most frequently investigated topics. It might be interesting to extend the analysis to a larger group of studies, e.g. all articles recently published in the journal CEJOR.

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## References

- Bach MP, Žmuk B, Stjepić AM et al (2025) Citizen-centric insights into e-democracy and e-government: hybrid approach using cluster and multiple regression analysis. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-025-00963-2>
- Baldouski D, Krész M, Dávid B (2025) Scheduling truck arrivals for efficient container flow management in Port logistics. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-025-00976-x>
- Brezovnik S, Rupnik Poklukar D, Žerovnik J (2025) The 2-rainbow domination number of cartesian bundles over cycles. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-024-00949-6>



- Čegovnik T, Dobrovoljc A, Povh J et al (2023) Electricity consumption prediction using artificial intelligence. *Cent Eur J Oper Res* 31:833–851. <https://doi.org/10.1007/s10100-023-00844-6>
- E.-Nagy M, Varga A (2023) A new long-step interior point algorithm for linear programming based on the algebraic equivalent transformation. *Cent Eur J Oper Res* 31:691–711. <https://doi.org/10.1007/s10100-022-00812-6>
- Gabrovšek B, Peperko A, Žerovnik J (2023) On the 2-rainbow independent domination numbers of some graphs. *Cent Eur J Oper Res* 31:817–831. <https://doi.org/10.1007/s10100-023-00840-w>
- Garajová E, Rada M (2023) Interval transportation problem: feasibility, optimality and the worst optimal value. *Cent Eur J Oper Res* 31:769–790. <https://doi.org/10.1007/s10100-023-00841-9>
- Garajová E, Rada M (2025) Complexity of computing the worst optimal value of interval transportation problems. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-024-00947-8>
- Gaspars-Wieloch H (2023) Possible new applications of the interactive programming based on aspiration levels—case of pure and mixed strategies. *Cent Eur J Oper Res* 31:733–749. <https://doi.org/10.1007/s10100-022-00836-y>
- Hladík M (2023) Various approaches to multiobjective linear programming problems with interval costs and interval weights. *Cent Eur J Oper Res* 31:713–731. <https://doi.org/10.1007/s10100-022-00804-6>
- Hladík M (2025) Global sensitivity analysis and robustness in linear programming using different norms. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-025-00960-5>
- Horaček J (2025) Modeling dynamics of opinion formation in small groups: A framework capturing individual opinion adjustments. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-025-00982-z>
- Kadoić N, Žajdela Hrustek N, Gligora Marković M (2025) Eurovision song contest: can juries assess the quality of songs objectively? *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-025-00971-2>
- Kašparová P (2023) Intention to use business intelligence tools in decision making processes: applying a UTAUT 2 model. *Cent Eur J Oper Res* 31:991–1008. <https://doi.org/10.1007/s10100-022-00827-z>
- Kastrin A, Povh J, Stirn Z (2021) Methodologies and applications for resilient global development from the aspect of SDI-SOR. *Cent Eur J Oper Res* 29:773–790. <https://doi.org/10.1007/s10100-021-00752-7>
- Kojić V (2025) An elementary approach to solving the optimal taxation of a perfectly competitive firm with CES production function as a bilevel programming problem. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-024-00931-2>
- Krpan M (2023) Duality in the analysis of monopsony in the labor market. *Cent Eur J Oper Res* 31:975–990. <https://doi.org/10.1007/s10100-022-00828-y>
- Lukač Z (2023a) Optimal taxation of a perfectly competitive firm with Cobb–Douglas production function as a bilevel programming problem. *Cent Eur J Oper Res* 31:891–909. <https://doi.org/10.1007/s10100-022-00832-2>
- Lukač Z (2023b) Optimal tax policy for single homogeneous commodity on  $n$  markets with export costs as a Stackelberg game. *Cent Eur J Oper Res* 31:873–890. <https://doi.org/10.1007/s10100-022-00822-4>
- Mihelač L, Povh J (2025) Computational analysis of musical elements across twenty-two European countries. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-024-00952-x>
- Milavec Kapun M, Drnovšek R, Rajković V et al (2023) A multi-criteria decision model for assessing health and self-care ability. *Cent Eur J Oper Res* 31:911–926. <https://doi.org/10.1007/s10100-022-00823-3>
- Ősz O, Dávid B, Hegyháti M (2023) Comparison of discrete- and continuous-time models for scheduling waste wood processing facilities. *Cent Eur J Oper Res* 31:853–871. <https://doi.org/10.1007/s10100-023-00852-6>
- Pejić Bach M, Topalović A, Turulja L (2023) Data mining usage in Italian smes: an integrated SEM-ANN approach. *Cent Eur J Oper Res* 31:941–973. <https://doi.org/10.1007/s10100-022-00829-x>
- Perić T, Matejaš J, Babić Z (2023) Advantages, sensitivity and application efficiency of the new iterative method to solve multi-objective linear fractional programming problem. *Cent Eur J Oper Res* 31:751–767. <https://doi.org/10.1007/s10100-023-00848-2>
- Povh J, Zadnik Stirn L, Žerovnik J (2023) 60 years of OR in slovenia: development from a first conference to a vibrant community. *Cent Eur J Oper Res* 31:681–690. <https://doi.org/10.1007/s10100-023-00859-z>
- Proceedings of the 17th International Symposium on Operational Research SOR'23 (2023) Bled, September 20–22, 2023, Drobne, S, Zadnik Stirn L, Kljajić Borštnar, M, Povh J, Žerovnik J (eds). SSI-SOR, Ljubljana, 532 pp. <https://www.drustvo-informatika.si/sekcije-drustva?stran=publikacije-sor>, <https://arhiv.fov.um.si/sor23/>
- Szomolanyi K, Lukacik M, Lukacikova A (2025) Macroeconomic performance of European union's small open economies during the COVID-19 pandemic. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-024-00948-7>

- Trzaskalik T (2023) Vectors of indicators and pointer function in the multistage bipolar method. *Cent Eur J Oper Res* 31:791–816. <https://doi.org/10.1007/s10100-022-00833-1>
- Trzaskalik T (2025) Saaty's scale application to multistage bipolar method. *Cent Eur J Oper Res*. <https://doi.org/10.1007/s10100-024-00953-w>
- Varga V, Madari Z (2023) The Hungarian insurance market structure: an empirical analysis. *Cent Eur J Oper Res* 31:927–940. <https://doi.org/10.1007/s10100-023-00842-8>

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