



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

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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: interdisciplinary research, operations research, 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, machine learning.

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Editorial process

Operations research (OR), often known as management science (MS), is a scientific approach to decision-making that aims to figure out how to build or operate a system most effectively, typically in situations that require the allocation of resources (Winston, 2003, Boucherie et al., 2021). OR is a field that focuses on decision support, and as such, its main purpose is to develop tools and methods that can help decision-makers solve problems and form judgments. Data analysis, simulation, modelling approaches and software tools are all part of the decision-support themes of OR (Mladenović et al., 2003; Rubio and Jiménez-Parra, 2014).

The use of OR in real-world problems can be found in various contexts, including industrial engineering, management, business, manufacturing, government, health care, transportation, geographic information systems, scheduling, marketing, inventory, and other fields (Cochran et al., 2011). The applications of OR enable complicated issues to be articulated clearly and flexibly in the context of a real-world environment, incorporating quantitative (e.g., financial ratios) and qualitative factors into the review process (Figueira et al., 2005).

The use of OR has had a significant impact on increasing organisational efficiency, leading to an increase in both production and social welfare. Both the International Federation of Operational Research Societies (IFORS) and the Association of European Operational Research Societies (EURO) are umbrella organisations for OR societies worldwide. Together these two organisations represent more than 50 national societies, including the Slovenian Society INFORMATIKA - Section for Operational Research (SSI-SOR). The main focus of SSI-SOR is the planning and coordination of international symposia. The 16th International Symposium on Operations Research, often called SOR'21, was held in Bled, Slovenia, from September 22nd to September 24th, 2021. SOR'21 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'21 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'21 was attended by 125 individuals from different research institutes, universities, government agencies, private and public companies, and 19 countries worldwide, both in person and online. 118 articles were presented, with 240 authors and co-authors contributing to their production. After a blind peer review process conducted by two independent reviewers from the SOR'21 Programme Committee and reviewers nominated by SSI-SOR, the articles were finally approved for publication.

As a result of the decision taken at SOR'21 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 2021. The invitation was addressed to all those who had registered for SOR'21 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, and transport, among others.

Fifteen contributions were received. Some are extended versions of short articles presented at SOR'21 and published in the Proceedings of SOR'21 (Drobne et al., 2021). The submissions to the BSR's SI were first blindly evaluated by the guest editors and then by two experts. This special issue of the BSR contains ten different contributions from different authors. They have consistently focused on model formation and modelling, contributing to their practical orientation. Moreover, they are more than just a presentation of algorithms; they amplify them to the latest advances in optimisation, simulation, and decision analysis.

The selected contributions deal with developments and techniques in OR and their practical application in business, economics, spatial science and location, environment, and social sciences. The topics covered in the selected papers represent interdisciplinary research. From a methodological point of view, they include risk management, mathematical programming, game theory, gravity, spatial analysis, logistics, circular economy, continuous improvement, sustainability, e-commerce, forecasting, Gaussian

processes, linear regression, multi-layer perception, and machine learning. The case studies are from four countries: Portugal, Croatia, Slovenia, and Spain.

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 that are published in BSR, following the objectives and editorial policy of BSR, is to present original theoretical and empirical advances in the field of business and economic systems using a wide range of methodological approaches, mainly from the fields of operations research/analytics, management science, and statistics. This is done to fulfil BSR's mission and to 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 Risk and Return of Traditional and Alternative Investments Under the Impact of COVID-19", *Aljinović, Marasović, and Miličević* provide risk and returns analyses and compare various traditional and alternative investments with special reference to the crisis COVID-19. The assets included in the analysis are stocks, bonds, commodities, real estate, foreign exchange, cryptocurrencies, renewable energy sources, gold, and oil. The risk measures of standard deviation, Value at Risk (VaR), Conditional Value at Risk (CVaR), and Sharpe ratio are used to compare the representatives of each asset class. This research shows that stocks won against all other assets, including gold and cryptocurrencies, during the COVID-19 crisis. The good features of a new alternative investment – renewable energy sources – with excellent earning potential are shown.

In the second paper, entitled "Possible Impact of Risk Management Strategies with Farm Model on a Mixed Farm Type", *Brečko and Žgajnar* present a mathematical model whose main objective is to evaluate the effectiveness of production and various possible agricultural holdings strategies by reducing risks. The applied model is based on linear programming and was extended with QRP for risk analysis. The approach was tested on a medium-sized mixed agricultural holding, which often faces challenges in light of the structural changes taking place in Slovenia. The results suggest that such a farm could improve its financial results through a more efficient risk management strategy. The authors conclude that diversification has a positive potential for a mixed farm that could achieve better financial results. With flexibility in management, the farmer could also achieve higher efficiency in risk management and better farm results.

In the third paper, "Conflict and Corporate Social Responsibility in Duopoly", *Vrankić* analyses the duopoly model in which firms decide on optimal social investment and production in two phases. The basic research question is how the significance of the conflict affects social investments, market shares, production quantities, profits, and social welfare. Game theory, optimisation, and comparative statics are used in the analysis. The conditions for the existence of equilibrium and its characteristics are described. The conflict harms the inefficient firm's profits while it has a positive effect on social welfare. The impact of conflicts on the profit of an efficient firm depends on the marginal cost difference. The author concludes that it is cheaper for firms not to invest in socially responsible activities if there is no significant cost difference, which affects social welfare. When the difference in marginal costs is significant, corporate social responsibility increases an efficient firm's profit and positively impacts social welfare.

In the fourth paper, "Migration Flows through the Lens of Human Resource Ageing", the

authors *Drobne and Bogataj* are motivated by the fact that the ageing and shrinking of the European population influences the shrinking of central places and the surrounding areas of cities in a spatial structure. The authors use data on internal migration between Slovenian municipalities in 2018 and 2019 to develop a cohort-based spatial interaction model to estimate future inter-municipal migration. In a spatial interaction model, we analysed differences in the attractiveness and stickiness of municipalities for different cohorts, focusing on those over 65 who may wish to prolong their working status. The authors also tried to answer the question of how to mitigate shrinkage processes in spatial units by investigating the potential to contribute to the social value of communities. The study results show that the over-65s do not have the same preferences regarding attractiveness and stickiness factors as younger migrants.

In the fifth paper, entitled "Boosting Regional Socioeconomic Development through Logistics Activities: A Conceptual Model", authors *Vieira, Ângela, Jorge Esparteiro and Wellington* are motivated by the trend that regional development allows countries to level out regional disparities by providing economic and social benefits to communities. Their research highlights the importance of logistics activities for regional social development, and a framework for assessing these linkages is proposed. Their paper aims to explore how regional socio-economic development can be promoted through logistics. The contributions of logistics to socio-economic development are analysed based on the previous research, and the case of the Alto Minho (AM) region in Portugal was used to illustrate the connection between logistics and regional development. Results showed that logistics had created jobs, increased company turnover and exports, and increased GDP growth in several regions. For the AM region, the results suggest that many companies are active in this sector and help to support municipalities in reducing regional imbalances. A framework for assessing regional logistics performance is proposed along with several logistics performance indicators. This approach is essential for future developments that incorporate logistics into socio-economic development.

In the sixth paper, entitled "Circular Economy and Consumer's Engagement: An Exploratory Study on Higher Education", authors *Alves, Silva, and Rodrigues* emphasise that the circular economy (CE) is considered one of the most important principles of modern society. Concerns about rising resource consumption have led governments and businesses to consider circular models as a hedge against resource scarcity and a driver of innovation and growth. This paper aims to bring together the CE and the consumer's perspectives to perceive the impact of their choices on CE initiatives. The authors surveyed consumer engagement with circular economy concepts. The results show consumer awareness and readiness to transition from the linear to the circular production model, which offers added value to consumers in reducing environmental impacts. The authors conclude that consumer behaviour can lead to creating a best practice guide for companies, designers, and consumers to consider when implementing circular economy initiatives.

The seventh paper, entitled "Internal Logistics Process Improvement using PDCA: A Case Study in the Automotive Sector", is based on the plan-do-check-act (PDCA) cycle methodology for implementing a continuous improvement project. Authors *Amaral, Ferreira and Ramos* aim to quantify the gains from waste reduction resulting from the application of the PDCA cycle as a tool in the implementation and optimisation of a milk run in an assembly line of a company in the automotive sector by determining the optimal cycle time of supply and the standardisation of the logistical supply process and material flow. The study was conducted through on-site observation and data collection and included two main phases: planning and implementation. According to the phases of the PDCA cycle, the process was analysed, and tools such as the SIPOC matrix, process stratification, 5S, and visual management were introduced. It was possible to reduce

waste by establishing concise flows and defining a supply pattern, which reduced movements. Transport waste was reduced by defining the position of more than half of the materials in the logistic trailers. The Excel simulator developed provided the optimal cycle time for the logistic train. The authors conclude that the assembly line supplied by milk-run was fundamental in demonstrating several improvements in the process of internal supply, such as better integration of stock management systems, greater application of quality or the introduction of better communication systems between the different areas and staff.

In the eighth paper, entitled "Dashboard for the Management and Acceptance of Customer Orders", authors *Nascimento, Frazão, Teixeira, and Ribeiro* focus on the activities related to customer orders management within an auto components plant in the Automotive Industry. The main challenge was highlighted: customers do not always adhere to the flexibility rules agreed with the company. Therefore, the planners must decide whether deviations in the order quantity can be accepted in the forecast period or whether an adjustment is necessary. The aim was not only to streamline the decision-making process in the planning team but also to provide important tools for carrying out their daily tasks – a visual and interactive dashboard to assess whether deviations in customer orders are within limits agreed with the company. Following lean information management and business intelligence principles, a thorough process analysis was conducted, centralised and standardised reports were created to serve as databases, and the dashboard was developed. The proposed tool reduced time from 3.5 hours per week, spent mainly on collecting data, calculating variations, and selecting and adjusting flexibility limits, to 0.2 hours a day per planner. In addition to streamlining the daily activities of planners, the main contributions are the promotion of digital transformation, data-driven decision-making, and an automated record of customer order variations that can be easily adapted to suppliers.

In the ninth paper, entitled "Using EPP Boxes in a Dark Store: A New Approach to Simplify Food Retail E-Commerce Deliveries", authors *Pintado, Coelho de Oliveira and Esparteiro Garcia* emphasise that e-commerce has emerged as a good response to the COVID-19 pandemic. However, the cost of providing a service that includes a driver and a vehicle is very high in a regular vehicle that can transport goods that require positive cold (0°C to 5°C). This paper investigates how a large Portuguese retail company can reduce its dependence on refrigerated vehicles by simplifying operations and reducing the cost of positively and negatively refrigerated food. This research was conducted in a Portuguese food retailer company, specifically in a Dark Store dedicated to the online channel. The study was developed based on the AS-IS/TO-BE process analysis method, which starts with analysing the current situation and produces the so-called AS-IS model. The results show that reducing costs associated with transporting positive refrigerated goods was possible. The result is that the cost of transporting orders could be reduced by 30%. The cost of transporting positive and negative refrigerated food was reduced, and the need for refrigerated vehicles was reduced by substituting room temperature transport vehicles.

In the tenth paper, entitled "A Machine Learning Approach to Forecast International Trade: The Case of Croatia", authors *Jošić and Žmuk* present a machine learning approach to forecasting Croatia's international bilateral trade. This paper aims to evaluate the performance of machine learning algorithms in forecasting international bilateral trade flows related to imports and exports in the case of Croatia. The dataset on Croatia's bilateral trade with over 180 countries worldwide from 2001 to 2019 was compiled using the main variables from the gravity trade model. Machine learning algorithms (Gaussian processes, linear regression and multi-layer perceptrons) were used to predict the values of Croatian bilateral exports and imports for one year (the year

2020). Each forecasting algorithm was evaluated by calculating the mean absolute percentage errors (MAPE). The authors found that the machine learning algorithms have the very good predictive ability in forecasting Croatia's bilateral trade, with the multi-layer perceptron of the neural network having the best performance among the other machine learning algorithms.

It can be concluded that the high quality and timely topics of the SI of BSR Papers are of interest to both the scientific and professional audiences, as there is a possibility that they will influence both theory and applications.

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