

SPECIAL ISSUE ON APPLICATIONS OF OPERATIONS RESEARCH IN THE PUBLIC SECTOR: FOREWORD

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Operations research dates back to World War II as a means of analyzing defense challenges, with the first contributions to anti-aircraft fire control and radar systems, antisubmarine warfare methods, convoy sizing and routing, and other military problems (Hitch, 1955; Horvath, 1948; Kimball, 1957; Robbins, 1956). In the following decades, operations research has extended from military applications to the public and for-profit sectors.

Operations research has long been recognized for its value and importance in the public sector (Sinuany-Stern & Sherman, 2014). Fox (2002) states, “Regardless of where we live, the management of the public sector impacts our lives. Hence, we all have an interest, one way or another, in the achievement of efficiency and productivity improvements in the activities of the public sector.” This relevance can be confirmed through books (Fox, 2002; Pollock et al., 1994) that emphasize this subject and recent articles. For instance, a search in the SCOPUS database¹ for articles published between 2020 and 2024 indicated several application fields: sustainable development (Arbolino et al., 2020), energy efficiency (Mazur et al., 2022), waste management (Herzberg et al., 2023), budgeting and public investment (Thesari et al., 2021), urban transportation (Heidary Dahooie et al., 2023), public security (Nepomuceno et al., 2021), greenhouse gases (Chen et al., 2022), health care (Kadoić et al., 2021), public-private partnership (Almarri, 2023), humanitarian operations (Rodríguez-Espíndola et al., 2023), among others.

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¹This search considered the expressions in their titles, abstracts and keywords, which were “public sector” or “public administration” and “operations research” or “multicriteria” or “optimization”. The survey returned 223 articles in English, Portuguese and Spanish.

The variety of techniques available in OR is significant, ranging from the most complex mathematical programming algorithms to simple additive weighting in multicriteria decision models. In a Fountzoula & Aravossis (2022) review article, the authors identified the preponderance of some techniques used to support decision making in the public sector between 2010 and 2020. They found that 271 studies utilized a single method, whereas 180 studies used integrated methods. Data Envelopment Analysis (DEA) was the most common method used by 97 studies, but the Analytic Hierarchy Process (AHP) was used by 178 studies when counting both simple and integrated methods. In terms of sector, the author found that most studies were concerned with transportation, health, education, and economics/finance in descending order, whereas the least regarded sectors were construction, politics, telecommunications, and tourism.

This special issue on the topic of operations research in the public sector gathers a selection of 13 peer-reviewed papers. Out of the total number of 13 papers, 6 were submitted by participants of the Brazilian Symposium on Operations Research (54th SBPO), held in November 2022, who were invited to submit developments of their communications. Many scholars and students attended the symposium and contributed new insights on the latest advancements in public sector applications.

The first paper, entitled “A multimethodological approach to organ donation logistics: systemic analysis of Brazilian Federal Units through qualitative system dynamics and efficiency assessment using Data Envelopment Analysis”, is authored by Níssia Carvalho Rosa Bergiante, Lidia Angulo Meza, Isabela Chaves Alves and João Victor Canelas de Accioly. This study combined qualitative system dynamics and data envelopment analysis to investigate, map, and analyze the efficiency of organ transplant logistics across different Brazilian federative units. Organ transplantation plays a significant role in the healthcare sector, offering hope to patients with chronic diseases and organ failure. However, the logistical aspects of organ transplants present significant hurdles, with inefficiencies leading to organ loss during transportation and fatalities while on the waiting list. The results highlighted efficient/inefficient units and offered benchmarks and targets for improvement.

Gabriel de Oliveira Castro, Danielle Costa Morais, and Thomas Edson Espíndola Gonçalves, in their paper entitled “Model for sorting municipalities based on the criticality of assistance for combating drought”, bring a multicriteria model based on the FlowSort for sorting municipalities into highly, moderately, and slightly critical levels to cope with drought. The model sorted 14 municipalities affected by drought in the Apodi-Mossoró river basin in Rio Grande do Norte, Brazil. Regions vulnerable to drought require resource allocation to develop projects that combat the negative impacts of low rainfall.

The application of project management is discussed by Giovana Nobrega Costa, Wellington Aparecido de Oliveira, Mischel Carmen Neyra Belderrain, Solange Garcia, and Mauri Aparecido de Oliveira in their paper titled “Applying problem structuring methods for the management of infrastructure projects in universities.” The authors propose a multimethodology based on Strategic Options Development and Analysis (SODA) and Soft Systems Methodology (SSM)

to structure a project management problem in a Brazilian public university. They explored data collected in a previous analysis to explore the perspectives of key stakeholders.

In the paper “Evaluating supply chain management performance in public health care: an MCDA approach”, the authors Newton Marube, André Andrade Longaray, Leonardo Ensslin, Sandra Rolim Ensslin, and Ademar Dutra developed a performance evaluation framework for the supply chain management of a public teaching hospital using the constructivist multicriteria decision aid methodology (MCDA-C). Through structured interviews with the hospital’s administrative manager, 160 criteria across eleven domains were identified to assess supply chain management performance. They proposed enhancements to boost global performance from 51.55% to 76.25%.

The paper entitled “Decision spatial model to evaluate human development in the state of Rio Grande do Norte”, authored by Leon Antônio Costa Neto, Ciro José Jardim de Figueiredo, and Thyago Celso Cavalcante Nepomuceno, applied a decision spatial model to evaluate human development in the state of Rio Grande do Norte. This study considered the social, economic, health, education, and territorial aspects of municipalities. The model uses decision rules and the identification of spatial clusters to analyze the grouping of cities with better and worse performances. Three analyses were performed to obtain approximate results, verifying the robustness of the model employed. In addition, the results were compared with the Human Development Index of the municipalities.

The authors Leonardo Neves and Marcos Negreiros, in the paper entitled “Dengue Outbreak Early Identification by Rain and Human Cases Evolution in Fortaleza/CE” deal with an analytical evaluation of the behavior of dengue in the city of Fortaleza/CE, throughout all the epidemiological weeks of years 2007 to 2021, considering only the influence of rainfall on the increase of dengue in the municipality. They used Ljung–Box and Shapiro–Wilk statistical tests between rain and dengue SARIMA curves and found that rain explained dengue human cases up to four weeks before they occurred, applying SARIMA models to both events.

The contribution of authors Guilherme Armando de A. Pereira, Kiara de Deus Demura, Iago Nunes, Katia Cesconeto de Paula, and Pablo Silva Lira is entitled “An early warning system for school dropout in the state of Espírito Santo: a machine learning approach with variable selection methods”. The authors explored a logistic regression-based tool for predicting dropout rates in the public schools of Espírito Santo, Brazil. They used students’ information, such as grades, school attendance, and socioeconomic data, provided by Espírito Santo State Education Secretariat and the National Institute of Educational Studies and Research Anísio Teixeira.

The authors Amanda N. Ribeiro, Solange Garcia, Tereza C. M. B. Carvalho, Mischel Carmen Neyra Belderrain, and Wilson C. Sousa Junior, in the paper titled “Definition of objectives and sustainable alternatives for a standing forest economy in the Amazon region using problem structuring methods”, explored the value-focused thinking and brainstorming to structure objectives and sustainable-development alternatives for the Amazon Forest, based on the Amazônia 4.0 project. This project promotes the standing forest’s values, through four fundamental objectives:

adding value to products, creating means for industrialization, developing local economy, and empowering communities.

Another application on sustainable development is presented in the paper “A decision support framework for planning and prioritizing urban sustainable development strategies under uncertainty conditions: a case study”, by Adolfo René Santa Cruz Rodriguez, Adalberto José Tavares Vieira, Marcio Ricardo Herpich, Juliano José de Tondas Pereira, and Marco Aurélio dos Santos. The authors addressed decision-making under uncertainty regarding the development of public policies and sustainable development strategies in an urban region in Brazil. A set of urban sustainable development strategies were prioritized to help local authorities improve their decisions using the fuzzy VIKOR method.

Marco Aurelio Faveri, Caroline Maria de Miranda Mota, and Francisco de Sousa Ramos presented the paper “Distribution of investigations in the Brazilian Federal Police using Agency Theory, Shapley's value and MCDA model”, proposing a decision model for the distribution of common and special investigations by the Brazilian Federal Police, which usually generate difficulties for the manager when identifying adequate personnel for each task. Rational abstractions from game theory, especially the principal-agent theory and Shapley's value, were used to build a model that associates both techniques, combined with a multicriteria model to measure the policemen's operational satisfaction.

In the paper “A statistical approach to aircraft cargo launching to support humanitarian aid operations”, the authors Mauro Guilherme Gazola, Fausto Luiz Jorge Pádua, and Denise Beatriz Teixeira Pinto do Areal Ferrari presented a mathematical ballistic launch model to improve the accuracy of launchings in humanitarian operations. They studied the random variables that influence the trajectory of the load using Monte Carlo simulations to minimize deviations from a desired impact point on the ground.

Eliane Gonçalves Gomes, Bruno dos Santos Alves Figueiredo Brasil, and Mirian Oliveira de Souza, in “Tender vacancies allocation to the member units of a public research company: a Data Envelopment Analysis approach”, the authors dealt with the employment vacancy problem in the Brazilian Agricultural Research Corporation due to retirement or promotion layoffs in 43 research centers. They explored a zero sum gain DEA (ZSG-DEA) model based on production and performance perspectives to propose an allocation solution in which all research centers were 100% efficient.

Finally, in the paper entitled “Ranking of instructors in a Brazilian Air Force school using the AHP and TOPSIS methods”, the authors Carlos Eduardo José da Silva, Luiz Leduino de Salles-Neto, and Marcos dos Santos addressed the selection process for instructors at the Brazilian Air Force Officers School (EAOAR). They used an AHP-TOPSIS hybrid approach to rank candidates and expedite the process using the Three Decision Methods (3DM) software web (v.1) for efficient calculations.

All the above-mentioned papers present significant contributions and insightful analyses on the applications of operations research in the public sector. The editors of this special issue would

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