CEJOR (2018) 26:259–263
https://doi.org/10.1007/s10100-018-0541-z

EDITORIAL

Emerging and innovative OR applications: a special issue in honor of Walter J. Gutjahr

Immanuel Bomze[1] · Karl F. Dörner[2] · Richard F. Hartl[3] · Ulrike Leopold-Wildburger[4] · Georg Pflug[1] · Marion Rauner[5] · Christian Stummer[6] · Gernot Tragler[7] · Tina Wakolbinger[8]

Published online: 21 April 2018

The special issue that you hold in your hands is dedicated to Prof. Dr. Walter J. Gutjahr on the occasion of his 65th birthday and retirement from the University of Vienna, Austria. The volume aims at demonstrating Prof. Dr. Gutjahr's impact

✉ Marion Rauner
marion.rauner@univie.ac.at

1 Department of Statistics and Operations Research and Vienna Center for Operations Research, School of Business, Economics, and Statistics, University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria

2 Department of Production and Logistics and Vienna Center for Operations Research, School of Business, Economics, and Statistics, University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria

3 Department of Production and Operations Management with International Focus and Vienna Center for Operations Research, School of Business, Economics, and Statistics, University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria

4 Department of Statistics and Operations Research, University of Graz, Universitätsstraße 15/E3, 8010 Graz, Austria

5 Department of Innovation and Technology Management and Vienna Center for Operations Research, School of Business, Economics, and Statistics, University of Vienna, Oskar-Morgenstern-Platz 1, 1090 Vienna, Austria

6 Department of Business Administration and Economics, Bielefeld University, Universitätsstraße 25, 33615 Bielefeld, Germany

7 Institute of Statistics and Mathematical Methods in Economics, Research Unit "Operations Research and Control Systems", Vienna University of Technology, Wiedner Hauptstraße 8/E105-4, 1040 Vienna, Austria

8 Institute for Transport and Logistics Management, WU (Vienna University of Economics and Business), Welthandelsplatz 1, 1020 Vienna, Austria

on operations research (OR) in Austria with a special focus on his contributions use of meta-and matheuristics, exact optimization methods, simulation–optimization techniques applied problems in production and logistics, innovation and technology management, disaster management and humanitarian aid, and health care management and search based software engineering. In the problem formulations very often multiple objectives, rich and real-world constraints, stochastics, and dynamics were considered. He mainly developed solution techniques and decision support systems for important and relevant problems of public and economic interest. Further related examples of special issues and volumes on emerging and innovative OR applications include: Dawid et al. (2010, 2016), Dlouhý et al. (2009), Doerner et al. (2011), Fleiß and Palan (2015), Reisach et al. (2016), and Weber et al. (2014).

Walter Gutjahr has contributed to our community in myriad ways: He was a board member of the Austrian OR Society, OEGOR (http://www.oegor.at/), for many years and actively involved himself in some of OEGOR's working groups. Walter also served as an editorial member for several international OR journals, and over the years he has provided more than a fair share of reviews, helping generations of young scholars to improve their work. In fact, several of the authors found herein are former students and mentees. As a researcher, Prof. Dr. Gutjahr has authored several seminal scientific papers, and he has always been willing to present his research at international OR conferences and discuss them with the community. Moreover, he is an excellent and patient teacher and mentor. Last, but not least, his appreciative, open, and gentle character makes him a special and unique person.

Prof. Dr. Gutjahr's particular and unique vision extended beyond his own research. He has fostered fundamental research, collaborated with theorists and practioners to develop innovative and applicable methods, facilitated the dissemination of research, and untiringly supported young researchers in their career.

The eleven contributions selected for this special issue reflect Prof. Dr. Walter J. Gutjahr's research interests. We hope that Walter will remain active in the scientific community in the next years. His special wisdom will always be alive in all the people who have been touched by him and who have collaborated with him.

The paper by Behrens et al. (2018) explores the relationship of local air quality and the number of residents within an urban context. The paper seeks to provide insight into the complexity that the handling of an urban pollution problem poses to a planner in the longer run. The predator–prey model presented here not only allows to develop a better understanding of the intertemporal development of local air quality and residential dynamics. It also shows how to capture and understand the number (and the intertemporal evolution) of premature deaths caused by poor air quality in a small urban center like the city of Graz in Austria. Moreover, the model enables a planner to develop a refined understanding of the relative effectiveness of environmental measures. In terms of policy intervention, the effectiveness of pollution control depends on how green the lifestyle of the urban residents is relative to how ambitiously air quality measures have been brought into effect by policy makers. By the paper by Behrens the interdisciplinary aspects of the journal with specialization in environmental topics is going to be continued as it can be found already in earlier contributions by Dawid et al. (2017), Leopold (2016), and Weber et al. (2009).

Bomze (2018) proposes a new factorization method for completely positive matrices which uses a bordering approach, building upon an already known factorization of a principal submatrix. This can be used recursively to find the global solution to mixed-binary (non-convex) quadratic optimization problems, thereby solving the rounding problem usually occurring when applying conic approaches to hard optimization problems.

Burkart et al. (2018) develop an analytical model and investigate decisions of humanitarian organizations with respect to the allocation of received donations to overhead and program spending. This proves to be a challenge, as conflicting objectives of donors and humanitarian organizations often result in administrative cost ratios that are not optimal from beneficiaries' perspective. This challenge is well recognized as the "Non-profit starvation cycle." As the authors show, increased information transparency might worsen the situation.

Doerner and Maniezzo (2018) provide a summary of the research contributions made by Walter J. Gutjahr in his career so far. For this purpose, they classify his works in several areas of research and discuss findings from some of his most significant publications as well as linkages between them. Overall, it is shown that the oeuvre of Walter J. Gutjahr comprises a substantial number of both theoretical and application-oriented contributions.

Gansterer et al. (2018) deal with a multi-depot traveling salesman problem with pickups and deliveries, in which customer requests are to be redistributed and total cost is minimized, and they extend this setting by introducing minimum workload constraints. In a comparison of the performance of three exact solution approaches, Benders decomposition works best for the original setting. For the extended problem, however, it is clearly dominated by the proposed column generation approach.

Haurand and Stummer (2018) investigate the emergence of technological standards (i.e., dominant designs). To this end, they apply an agent-based simulation approach to a fictitious vampire economy. Results not only show that small events such as word-of-mouth or normative social influence indeed may initiate self-enhancing effects, but also demonstrate the effectiveness of some measures to further market success of a particular technology (e.g., in the context of smart products as discussed by Dawid et al. 2017).

Kovacevic (2018) investigates two versions of a simple type of contagion models, namely so-called SIS models, formulated by stochastic differential equations. In particular, the related Fokker–Planck equations are used in order to derive explicit expressions for stationary, respectively quasistationary densities and to analyze the limiting behavior of the processes. Finally, the asymptotic properties are used for choosing the cost-optimal level of treatment intensity.

Fikar et al. (2018) developed an agent-based simulation optimization framework to investigate dynamic disaster relief operations subject to transport disruptions and demand uncertainty. Word of mouth effects and various vehicle types are modelled for a sample setting based on the April 2015 earthquake in Nepal. Results of computational experiments highlight the importance of considering such factors in related planning procedures.

Parragh and Doerner (2018) consider pairwise route synchronization constraints in the context of a service technician routing and scheduling problem and the well-

known vehicle routing problem with time windows. Different approaches to handle such requirements within in a large neighborhood search framework are proposed and evaluated. Using the best combination, several new best results for available benchmark instances are obtained.

Pflug and Pichler (2018) introduce risk measures to quantify dependent risk. Systemic risk is a quality of risk, which is not observable when considering risk individually; systemic risk appears only in combination with similar, comparable random outcomes. Some copulas allow evaluating the risk explicitly based on the law of large numbers for dependent random variables. The risk measures are further characterized by stochastic, multivariate order relations.

Rauner et al. (2018) developed a decision support systems (DSS) in the European Union (EU) project named S-HELP (Securing Health.Emergency.Learning.Planning) to enhance interoperability of policy makers for disaster preparedness, response, and recovery. They establish a skills taxonomy for the S-HELP DSS Toolset "Decision Making Module" to interlink key emergency interventions/tasks with main national emergency responders supported by international emergency responders with a special focus on the EU. Furthermore, they provide an overview of which key emergency interventions/tasks can be covered by EU Civil Protection Modules.

References

Behrens DA, Koland O, Leopold-Wildburger U (2018) Why local air pollution is more than daily peaks: modelling policies in a city in order to avoid premature deaths. CEJOR 26(2):1–22. https://doi.org/10.1007/s10100-018-0534-y

Bomze IM (2018) Building a completely positive factorization. CEJOR 26(2):1–19. https://doi.org/10.1007/s10100-017-0499-2

Burkart C, Wakolbinger T, Toyasaki F (2018) Funds allocation in NPOs: the role of administrative cost ratios. CEJOR 26(2):1–24. https://doi.org/10.1007/s10100-017-0512-9

Dawid H, Dockner E, Hartl RF, Haunschmied J, Leopold-Wildburger U, Luptacik M, Mehlmann A, Prskawetz A, Rauner M, Sorger G, Tragler G, Veliov VM (2010) Gustav Feichtinger celebrates his 70th birthday. CEJOR 18(4):437–451

Dawid H, Doerner KF, Feichtinger G, Kort P, Seidl A (2016) Dynamic perspectives on managerial decision making. Springer, Berlin

Dawid H, Decker R, Hermann T, Jahnke H, Klat W, König R, Stummer C (2017) Management science in the era of smart consumer products: challenges and research perspectives. CEJOR 25(1):203–230

Dlouhý M, Pickl S, Rauner M, Leopold-Wildburger U (2009) Special issue on "innovative approaches for decision analysis in energy, health, and life sciences". CEJOR 17(3):229–231

Doerner KF, Maniezzo V (2018) Metaheuristic search techniques for multi-objective and stochastic problems: a history of the inventions of Walter J. Gutjahr in the past 22 years. CEJOR 26(2):1–26. https://doi.org/10.1007/s10100-018-0522-2

Doerner KF, Gutjahr WJ, Van Wassenhove L (2011) Special issue on optimization in disaster relief. OR Spect 33(3):445–449

Fikar C, Hirsch P, Nolz PC (2018) Agent-based simulation optimization for dynamic disaster relief distribution. CEJOR 26(2):1–20. https://doi.org/10.1007/s10100-017-0518-3

Fleiß J, Palan S (2015) Collaborative decision systems in economics and in complex societal and environmental applications. CEJOR 23(2):279–282

Gansterer M, Hartl RF, Salzmann PE (2018) Exact solutions for the collaborative pickup and delivery problem. CEJOR 26(2):1–15. https://doi.org/10.1007/s10100-017-0503-x

Haurand MD, Stummer C (2018) Stakes or garlic? Studying the emergence of dominant designs through an agent-based model of a vampire economy. CEJOR 26(2):1–22. https://doi.org/10.1007/s10100-017-0492-9

Kovacevic RM (2018) Stochastic contagion models without immunity: their long term behaviour and the optimal level of treatment. CEJOR 26(2):1–27. https://doi.org/10.1007/s10100-018-0526-y
Leopold A (2016) Energy related system dynamic models: a literature review. CEJOR 24(1):231–261
Parragh SN, Doerner KF (2018) Solving routing problems with pairwise synchronization constraints. CEJOR 26(2):1–22. https://doi.org/10.1007/s10100-018-0520-4
Pflug GC, Pichler A (2018) Systemic risk and copula models. CEJOR 26(2):1–19. https://doi.org/10.1007/s10100-018-0525-z
Rauner MS, Niessner H, Odd S, Pope A, Neville K, O'Riordan S, Sasse L, Tomic K (2018) An advanced decision support system for European disaster management: the feature of the skills taxonomy. CEJOR 26(2):1–46. https://doi.org/10.1007/s10100-018-0528-9
Reisach U, DeTombe D, Weber GW (2016) Editorial, Special issue on international aspects of OR. CEJOR 24(4):797–799
Weber GW, Kropat E, Akteke-Öztürk B, Görgülü ZK (2009) A survey on OR and mathematical methods applied on gene-environment networks. CEJOR 17(3):315–341
Weber GW, Blazewicz J, Rauner M, Türkay M (2014) Recent advances in computational biology, bioinformatics, medicine, and healthcare by modern OR. CEJOR 22(3):427–430