

Intelligent Decision Support for Logistics and Supply Chain Management – An Ongoing Story

Stefan Voß
University of Hamburg
Germany
stefan.voss@uni-hamburg.de

Hans-Jürgen Sebastian
RWTH Aachen University
Germany
sebastian@or.rwth-aachen.de

Julia Pahl
University of Southern
Denmark, Odense
Denmark
julp@iti.sdu.dk

Abstract

Information systems, theoretical developments and real-world applications related to intelligent problem solving in logistics and supply chain management are here to stay. Now that we see buzzwords like Digital Transformation, Industrie 4.0, Internet-of-Things and alike taking the stairs of real-world applications and stages of maturity, we ever more need to take care about a methodological underpinning to make these concepts possible. Related methods include various kinds of optimization, heuristics, metaheuristics and matheuristics, simulation, agent technologies, and descriptive methods. Recent advances incorporate big data and cloud computing as well as other issues from the realm of information and communication technology (ICT) research. We feature theoretical developments, real-world applications and information systems related to solving decision problems in logistics and supply chain management. In a sense, we were and are – still – representing the future of logistics over the years.

The march of digitalization is changing logistics and supply chain management. Though, just digitizing, adopting modern technologies and advanced methods, is not enough. What comes on top to make it happen is the proper adaptation of processes and organizational structures. The alignment of strategies and the meaningful cooperation among stakeholders play a crucial role in transforming logistics operations. This refers to intra-, inter-, and meta-organizational perspectives to analyze options as well as resulting costs and benefits of digital transformations. [1]

This year the *Intelligent Decision Support for Logistics and Supply Chain Management* minitrack consists of five papers. They are covering a small subset of the above topics.

In their paper *RFID-Enabled Management of Highly-Perishable Inventory: A Markov Decision Process Approach for Grocery Retailers* Chokdee Siawsolit, Gary Gaukler, and Sarun Seepun address the challenge of managing perishables inventory through the scope of a Markov decision process. More than two thirds of improvements in profit margin are possible, e.g., through delaying the process of order placements.

Martin Waitz, Andreas Mild, and Christian Fikar investigate *A Decision Support System for Efficient Last-Mile Distribution of Fresh Fruits and Vegetables as Part of E-Grocery Operations*. This serves as a means to support the digital transformation of fresh food delivery. While 2017 has seen some rise and fall of related services from major providers, research in this area is more than ever necessary to better understand how to make them successful, if applied at all.

Unit load devices are containers and pallets used in the air cargo industry to bundle freight for efficient loading and transportation. As with all means of transportation, repositioning of empty resources is a major issue as it can be found, e.g., for containers in maritime shipping, bicycles, scooters, and cars in vehicle sharing systems, or push back vehicles and the mentioned unit load devices at airports. In *An Intelligent Decision Support System for the Empty Unit Load Device Repositioning Problem in the Air Cargo Industry* Daniel A. Döppner, Patrick Derckx, and Detlef Schoder propose a decision support system to handle the imbalance of the latter devices and show its impact on real-world data. Most importantly, they recognize the impact of related pooling in multi-carrier networks.

In *Deep Multi-Agent Reinforcement Learning Using DNN-Weight Evolution to Optimize Supply Chain Performance* Taiki Fuji, Kiyoto Ito, Kohsei Matsumoto, and Kazuo Yano report on the development of a multi-agent reinforcement learning technique and its

application in supply chain management. This is combined with a deep-neural-network (DNN)-weight evolution approach and successfully utilized in the context of classical beer game situations.

More on the methodological side is Daniel Soper with his contribution *On the Need for Random Baseline Comparisons in Metaheuristic Search*. At the dawn of metaheuristics many approaches failed to compare favorably once benchmarked against random search strategies. While recent years has seen the advent of more and more approaches hiding behind fancy acronyms without adding much towards the understanding of the basic ingredients of those methods [2], we still see the same type of issue. Under the initial question whether randomness can actually be good for organizational decision-making, the author goes back to that old metaheuristics discussion and adds insights.

To conclude, the technology is there and even the data is there (at least in many cases); we just need to learn using it. And we need to be able to put our algorithms and methodological developments into running systems. If we succeed in that, we may have an impact. [3]

References

- [1] L. Heilig, E. Lalla-Ruiz and S. Voß: Digital transformation in maritime ports: analysis and a game theoretic framework. *Netnomics* 18 (2017), DOI 10.1007/s11066-017-9122-x.
- [2] K. Sörensen: Metaheuristics - the metaphor exposed. *International Transactions in Operational Research* 22 (2013), DOI 10.1111/itor.12001.
- [3] S. Voß, H.-J. Sebastian and J. Pahl: Intelligent decision support and big data for logistics and supply chain management – A biased view. In: R.H. Sprague and T. Bui (eds.) *Proceedings of the 50th Annual Hawaii International Conference on System Sciences*, IEEE, Piscataway (2017), DOI 10.24251/HICSS.2017.159