Proceedings of the 2023 Winter Simulation Conference
C. G. Corlu, S. R. Hunter, H. Lam, B. S. Onggo, J. Shortle, and B. Biller, eds.

HYPERHEURISTIC OPTIMIZATION AS DECISION SUPORT FOR THE OPERATIVE SERVICE DELIVERY PLANNING IN THE CONTEXT OF PRODUCT-SERVICE SYSTEMS

Enes Alp

Chair of Production Systems (LPS)
Ruhr-Universität Bochum
Industriestraße 38c
Bochum, 44894, GERMANY

ABSTRACT

In the pursuit of differentiation and revenue increment, numerous manufacturing enterprises are innovating their business models through the introduction of Product-Service Systems (PSS). In these business models, the efficacy of service delivery assumes paramount significance, leading to challenges in the planning. The objective of this PhD project is the conceptualization and development of a decision support system for operative service delivery planning within the context of PSS.

1 PROBLEM DESCRIPTION

In recent decades, a notable shift within the manufacturing industry has become evident. Companies that once focused primarily on the sale of machinery are now redirecting their business models toward a more customer-centric approach. As a result, not the machine itself but its usability or availability are offered to the customers e.g. within subscription models. This is realized by combining assets with appropriate services into so-called Product-Service Systems (PSS). While providing companies can profit from increased revenues and enhanced differentiation from competitors, customers gain the advantage of outsourcing tasks like maintenance, allowing them to focus on their core competencies (Li et al. 2020).

Hence, in PSS business models, value creation does not end with the production of assets but extends into the use phase at the customer site. Consequently, the effectiveness of service delivery has a crucial impact on the profitability of the business model. Delayed service delivery could not only cause penalties but also result in the loss of trust of the customer (Reim et al. 2018). The effectiveness and efficiency of service delivery are mainly determined by the operative planning, usually conducted by a dispatcher. His task is to generate a delivery plan by allocating the right resources to each service delivery process (Alp et al. 2022). Even though this is a highly complex task, in reality, many dispatchers still conduct this task manually, leaving optimization potentials created through advances in information and communication technologies unexploited (Sala et al. 2021).

2 RESEARCH OBJECTIVES

The primary objective of this PhD project is to develop a simulation-based decision-support system (DSS) tailored for enhancing operative service delivery planning within the context of PSS. The project aims to integrate an optimization framework composed of hyperheuristic algorithms into an adaptive simulation model. This system will enable dispatchers to input data related to their company and customers to generate a proper simulation model depicting the business constellation. With the additional input of data regarding available resources and order requests and starting the optimization, the hyperheuristic algorithm will allocate the appropriate resources to the orders, ultimately generating an optimized schedule for the forthcoming week.

Research Questions:

RQ 1: How can an adaptive simulation model be modeled and implemented to evaluate and analyze various service delivery plans within the context of PSS?

RQ 2: How can a hyperheuristic algorithm be conceptualized and implemented tailored to the service delivery context, and what specific low-level heuristics should be integrated to facilitate effective optimization?

RQ 3: How can the simulation model be coupled with the optimization framework in a way that optimized plans can be generated under the consideration of uncertainties and unexpected events?

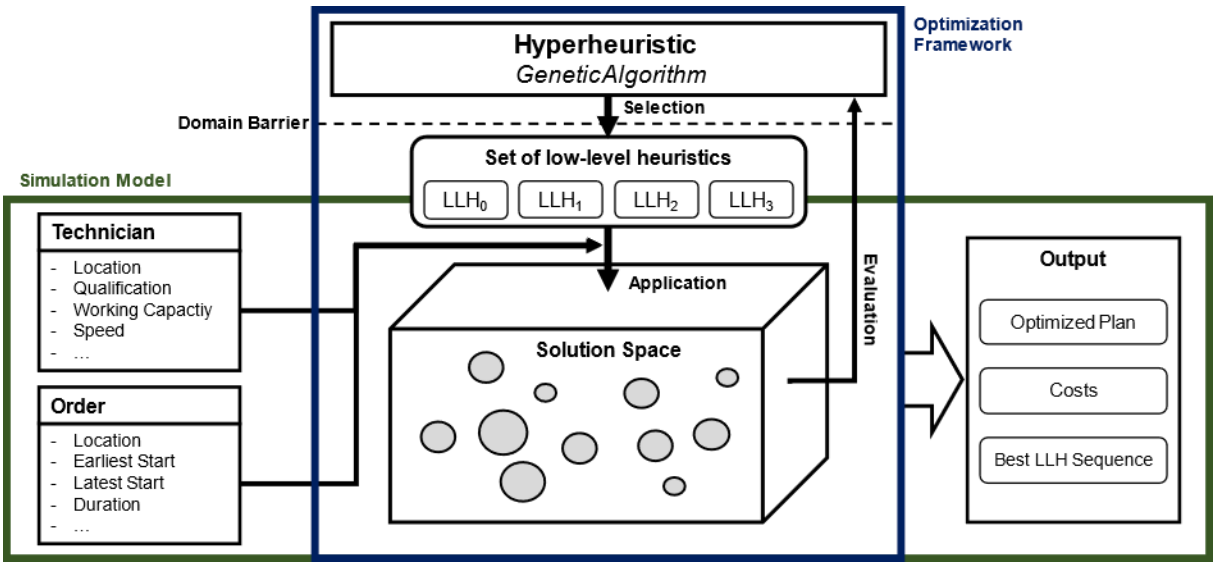

Figure 1: Concept of the Solution.

ACKNOWLEDGEMENTS

I extend my gratitude to Dr.-Ing. Stefan Leineweber for the inception of this research endeavor, and to Prof. Dr.-Ing. Bernd Kuhlenkötter for invaluable guidance throughout the study. We express our sincere thanks that this research was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – 424733996

REFERENCES

Alp, E., M. Herzog, and B. Kuhlenkötter. 2022. "A Hyperheuristic Approach for Operative Service Planning in Product-Service Systems: Ein hyperheuristischer Ansatz für die operative Serviceplanung in Product-Service Systems (German)". *Zeitschrift für wirtschaftlichen Fabrikbetrieb* 117(12):830–834.

Li, A. Q., M. Kumar, B. Claes, and P. Found. 2020. "The State-of-the-art of the Theory on Product-Service Systems". *International Journal of Production Economics* 222:107491.

Reim, W., V. Parida, and D. R. Sjödin. 2018. "Managing Risks for Product-Service Systems Provision: Introducing a Practical Decision Tool for Risk Management". In *Practices and Tools for Servitization*: *Managing Service Transition*, edited by M. Kohtamäki, T. Baines, R. Rabetino, and A. Z. Bigdeli, 249–266. Cham: Palgrave Macmillan.

Sala, R., M. Bertoni, F. Pirola, and G. Pezzotta. 2021. "Data-based Decision-Making in Maintenance Service Delivery: The D3M Framework". *Journal of Manufacturing Technology Management* 32(9):122–141.