Service Operations Research Seminar HWS 2022 (OPM 781)

"Current Topics in Service Operations Management Research"

General Information:

1. The goal of this seminar is to introduce participants to conducting scientific research. It thereby prepares students for writing their M.Sc./Diploma Thesis. The seminar is geared towards students intending to write their Thesis at the Chair of Service Operations Management.

2. The **application procedure** for this seminar is combined with those for the seminars of the Chair of Production Management (OPM 761), the Chair of Logistics (OPM 701) and the Chair of Procurement (OPM 791). Students can apply for topics from all chairs by joining the ILIAS application group and completing the online form provided there. Topics labeled with "L" refer to the Chair of Logistics (OPM 701), topics labeled with "P" refer to the Chair of Production Management (OPM 761), topics labeled with "B" refer to the Chair of Procurement and topics **labeled with "S"** refer to the **Chair of Service Operations Management (OPM 781)**. To better match topic and student background, applicants for OPM 781 may in addition send a CV and official grades overview by post to the chair or by e-mail to soma@mail.uni-mannheim.de with subject "OPM 781 Seminar Application".[1]

3. The **application period** starts on **April 29th** and ends on **May 13th**, 2022.

4. **Admission** to the seminar is **binding** and will be confirmed by E-mail by **May 20th, 2022.**

5. Each participant admitted to OPM 781 will explore one of the research topics listed below – based on the fundamental literature provided. Each participant presents his/her findings in a written report (about 20 pages) as well as in an in-class presentation (20 min), followed by a discussion (10 min).

6. A **kick-off meeting** for all participants will be held on **Tuesday**, **May 24th, 2022 at 10:15am** in **SO318**. During this meeting, general guidelines for conducting scientific work will be discussed.

[1] Data protection: Please note that a breach of confidentiality and the unauthorized access by third parties cannot be excluded when transmitting an unencrypted email. Note on data protection: The submitted documents will be returned only if an envelope with sufficient postage is included. Otherwise they will be destroyed after the application process according to the requirements of the data protection law. Electronic applications will be deleted accordingly.

7. Each student has **eight weeks** to complete the Seminar Thesis. This timeframe can individually be set **between the kick-off day and November 11th, 2022** (Note: November 11th is the latest submission date).

8. To start the eight weeks completion time, please follow these **four steps**:
    a. Go to the **ILIAS Group** "OPM 781 Research Seminar"
    b. Select the **Test** "Seminar Thesis_[YOUR NAME]",
    c. Follow the **instructions of the Test**,
    d. The eight weeks completion time **will start automatically after finishing the test**.

9. On your individual submission date, you have to…
    a. **Upload your report** (Word- / Latex-document and PDF) via Task "Upload of final Thesis & Calculations/Software Output" in the ILIAS group.
    b. *If applicable:* ***Upload your software-output*** *(in a single zip file*) via Task " Upload of final Thesis & Calculations/Software Output" in the ILIAS group.
    c. **Submit a hard copy** at our secretary's office (Mon-Thu before noon) or at your Thesis supervisor. Please make an appointment for submitting the hard copy.

10. Student **presentations** will be held by default in the **regular presentation** session on **November 30st (2022), starting at 10:15 in room SO 318**.
    A **fast-track presentation** session on **October 5th (2022)**, may be offered to students who desire to start with their master thesis early in FSS23 (with seminar thesis submission deadline on **September 16th,** 2022). Attendance is mandatory for all presentations on your own presentation date.

    Please **upload your presentation slides** (ppt and PDF) on **Task "Upload of Final Presentation"** in the ILIAS group one day before the presentation, latest by 18:00 pm – no changes allowed afterwards. The chair's laptop will be used to show the presentations during class.

11. The report and the presentations can be delivered either in English or in German.

12. The final grade for the seminar is composed of the following components: Written report (60%), presentation (30%), contribution to discussion of your own topic and of potentially other topics presented on the same date (10%).

13. For questions concerning the seminar contact us by email at soma@mail.uni-mannheim.de.

Seminar topics

Please note:
The amount of recommended literature does not indicate more or less workload. Your supervisor may have more recommendations for you.

Topic overview

Topic S01: Collection, use, and analysis of data as success factor in service operations

With the continuous digitalization in the service industry, the amount and availability of data in service organizations is strongly increasing from year to year offering companies better opportunities to analyze and understand consumer behavior and market developments. Based on that service organizations can improve both their efficiency and service quality and come up with innovations differentiating from competitors and creating new value to their customers. Due to its large impact, data use and analysis has been identified as one of eight key themes in service operations management by Field et al. (2018).

The objectives of this thesis are to:

- Introduce the field of service operations management and highlight the importance of data in this field;
- identify, summarize, and cluster research of the last decade on the collection, analysis, and use of data to benefit service operations;
- present potential topics for future research in this field.

Basic Literature:

Cohen, M. C. (2018). Big data and service operations. *Production and Operations Management, 27(9), 1709-1723.*

Feng, Q., & Shanthikumar, J. G. (2018). How research in production and operations management may evolve in the era of big data. *Production and Operations Management, 27(9), 1670-1684.*

Field, J. M. et al. (2018). Service operations: what's next? *Journal of Service Management, 29 (1), 55-97.*

Topic S02: On the mutual benefits of digitalization, digital transformation and operations research

In both the academic world and the business world there is a growing interest in digital transformation and digitalization in recent years. While digitalization is often described as digitally enabled improvements along the value chain, digital transformation refers to strategic business (model) changes taking advantage of digital progress. These changes have a fundamental impact for the respective company changing the way it operates in the market. Due to this complexity, a variety of research disciplines works on topics of digital transformation and digitalization – each contributing in a different way. While marketing might focus on identifying new customer needs in a more and more digital world, operations research can enable these new services with digital processes. In reverse, digitalization also helps to advance operations research through new technologies, new techniques, and new perspectives.

The objectives of this thesis are to:

- review academic literature to introduce and define both digital transformation and digitalization;
- briefly discuss how different research areas like operations, marketing, information systems, and others contribute to digital transformation and digitalization – provide a deep-dive in the field of operations research;
- analyze and explain how operations research in turn can benefit from digitalization.

Basic Literature:

Agrifoglio, R. et al. (2017). How emerging digital technologies affect operations management through co-creation. Empirical evidence from the maritime industry. *Production Planning & Control, 28(16), 1281-1283.*

Holmström, J. et al. (2019). The digitalization of operations and supply chain management: Theoretical and methodological implications. *Journal of Operations Management, 65(8), 728-734. [Editorial: See other articles in this issue]*

Schiavone, F., & Sprenger, S. (2017). Operations management and digital technologies. *Production Planning & Control, 28(16), 1298-1306. [Editorial: See other articles in this issue]*

Verhoef, P. C. et al. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research, 122, 889-901*

Topic S03: Scheduling models for eVTOL air taxi services

Electrical vertical takeoff and landing aircraft (eVTOL) are expected to enter service in this decade. Their operators will offer air taxi services powered by "green" electricity in order to provide a faster mode of transport in and between metropolitan areas as well as on the connected countryside. Similar to ride sharing services such as Uber, the service will work by order on demand. Differences to their ground-based counterparts are fixed landings stations called vertiports, limited charging & loading capabilities, as well as regulatory and operational rules. These specific requirements demand for new models for strategic decisions as well as new scheduling algorithms in daily operations.

The objectives of this thesis are to:

- introduce the eVTOL industry and discuss its sustainability critiqually;
- summarize the literature of scheduling models of the industry;
- discuss and / or improve one model in detail (optional);
- provide open research gaps and future trends.

Basic Literature:

Fagerholt, K., Foss, B. A., & Horgen, O. J. (2009). A decision support model for establishing an air taxi service: a case study. *Journal of The Operational Research Society, 60(9), 1173-1182.*

Rajendran, S., & Srinivas, S. (2020). Air taxi service for urban mobility: A critical review of recent developments, future challenges, and opportunities. *Transportation research part E: logistics and transportation review, 143, 102090.*

Rajendran, S., & Zack, J. (2019). Insights on strategic air taxi network infrastructure locations using an iterative constrained clustering approach. *Transportation Research Part E: Logistics and Transportation Review, 128, 470-505.*

Shao, Q., Shao, M., & Lu, Y. (2021). Terminal area control rules and eVTOL adaptive scheduling model for multi-vertiport system in urban air Mobility. *Transportation Research Part C: Emerging Technologies, 132, 103385.*

Topic S04: Discrete choice models for the accommodation market

The choice between different accommodation options, e.g., renting a flat or buying a house, can be characterized as a discrete choice situation with multiple levels, e.g., first a decision for the type of accommodation and renting/ownership and afterwards for a specific accommodation. While these decisions can be modelled with discrete choice models such as the “nested logit choice model (NL)”, only limited amount of research has been conducted in this area. It is especially surprising, as the spending for accommodation represents a large share of people’s budget and the choice of the specific housing determines a large part of their daily life.

An underlying assumption of the discrete choice models is the possible decomposition of the product or service into attributes with different levels, where each attribute level is connected to a particular partial utility. Datasets for choice estimation are created by choice tasks in which the preferred alternative has to be identified. Traditionally, these alternatives are represented by a specification of chosen attribute levels in text format.

The objectives of this thesis are to:

- briefly introduce the MNL and similar discrete choice models;
- summarize the literature of conjoint studies in the field of accommodation with a focus on the previously used attributes;
- discuss the use of study results for accommodation design and other applications;
- provide open research gaps and future trends.

Basic Literature:

Garrow, L. (2010). Discrete choice modelling and air travel demand: Theory and applications. *Farnham, Surrey; Burlington, Vt.: Ashgate.*

Gluszak, M., & Marona, B. (2017). Discrete choice model of residential location in Krakow. *Journal of European Real Estate Research, 10(1), 4-16.*

Train, K. E. (2009). Discrete choice methods with simulation. *Cambridge university press.*

Yates, J., & Mackay, D. F. (2006). Discrete choice modelling of urban housing markets: A critical review and an application. *Urban studies, 43(3), 559-581.*

Topic S05: Customer response measurement on the trade-off of responsiveness and customization

In today's fast-moving world, responsiveness in form of process speed constantly gains importance and many service providers aim at improving their process speeds to reduce customer waiting time. Yet, there is an operational trade-off, as responsiveness often reduces flexibility of the process. As such, customers can either ask for a very fast or a very customized service. Increased customization clearly prolongs the service process as the service provider needs to address the specific customer needs. In case of a rather unspecific customer demand, the service can be provided much quicker. Process speed is thereby directly linked to the flexibility level of the operations. Service providers must hence handle this so-called customization-responsiveness squeeze appropriately. For example, regression or Conjoint Analysis are suitable methods to determine the customer response or satisfaction on the trade-off of responsiveness or waiting time and customization.

This seminar thesis focuses on the existing works on this matter. A literature review should be conducted to review and compare the literature regarding the methodological approaches and reported results, clearly stating the used keywords and databases. Special attention should be paid to conjoint analysis and the banking industry. In the end, the thesis should summarize the findings and provide guidance for practitioners to evaluate the importance of this trade-off in the respective area.

The objectives of this thesis are to:

- conduct a literature review of existing works about customer response measurement on the trade-off of responsiveness and customization;
- provide an overview of the methodological approaches and the results of the identified studies;
- give recommendations on the trade-off of customization and process speed for different service operations.

Basic Literature:

McCutcheon, D. M., Raturi, A. S., & Meredith, J. R. (1994). The customization-responsiveness squeeze. *Sloan Management Review, 35(2), 89-99.*

Wang, G., Wang, J., Ma, X., & Qiu, R. G. (2010). The effect of standardization and customization on service satisfaction. *Journal of Service Science, 2(1), 1-23.*

Kalantari, H.D. and Johnson, L. (2018). Australian customer willingness to pay and wait for mass-customised products. *Asia Pacific Journal of Marketing and Logistics, 30(1), 106-120.*

Topic S06: A critical review of the Simod approach for automated discovery of simulation models

Process Mining (PM) is a structured approach to discover process models from process execution data, so-called event logs. Based on these event logs, the process model can be created, compared to the normative process model for conformance checking, and used for extending the current process model. Besides, PM can be used to support other methodologies, like simulation. Combining PM and business process simulation (BPS) offers many potentials, as PM provides an unbiased data source as compared to the traditionally used interviews to collect data and input parameters. Existing research has hence proposed different approaches to combine PM and BPS algorithmically. One of these approaches for automated discovery of simulation models is Simod proposed by Camargo, Dumas, and González-Rojas (2020).

A combination of PM and BPS offers many advantages, as e.g. time-intensive interviews become unnecessary. However, the input required for BPS is not always easily extractable from the event logs or PM analysis. Various challenges in this area have been identified. The aim of this thesis is to explain and critically review the Simod Approach to identify which challenges at the interface of PM and BPS it can or cannot address.

The objectives of this thesis are to:

- explain the Simod approach for automated discovery of BPS models;
- critically review which challenges at the interface of PM and BPS Simod can or cannot address;
- provide an overview of open challenges when combining PM and BPS.

Basic Literature:

Camargo, M., Dumas, M., & González-Rojas, O. (2020). Automated discovery of business process simulation models from event logs. *Decision Support Systems, 134, 113284.*

Jadrić, M., Pašalić, I. N., & Ćukušić, M. (2020). Process Mining Contributions to Discrete-event Simulation Modelling. *Business Systems Research: International journal of the Society for Advancing Innovation and Research in Economy, 11(2), 51-72.*

Rozinat, A., Mans, R. S., Song, M., & van der Aalst, W. M. (2009). Discovering simulation models. *Information systems, 34(3), 305-327.*

Topic S07: Business process simulation – with application to the Baria planning Solutions case

Simulation is a powerful and commonly used method to analyze business processes by experimenting with the computer rather than the real system. By simulating the flow of units through the sequence of activities, important performance measures like the utilization of resources or the thoughput time can be evaluated. In this regard, scenarios of alternative process designs can be evaluated and compared against each other before being implemented, as the implementation can be both costly and time-intensive. Yet, before any analysis can be done, a valid simulation model has to be built.

This thesis should cover this first step of a simulation project, namely the construction of a valid simulation model. As application example, the Baria Planning Solutions case (Wheelwright & Schmidt, 2011) is chosen. Baria Planning Solutions is consulting firm whose sales support process lacks efficiency. For this purpose, the simulation tool Arena should be used to build a simulation model. Having constructed the model, a brief analysis of the process can be added. From this implementation work, an overview of current issues or bottlenecks in this specific process shall be provided.

The objectives of this thesis are to:

- provide a brief introduction into the methodology of simulation;
- build a valid simulation model for the Baria Planning Solutions case and optionally analyze the process to give improvement recommendations (based on the simulation);
- provide an overview of the current problems faced by the organization.

Basic Literature:

Law, A. M. (2019). How to build valid and credible simulation models. *In 2019 Winter Simulation Conference (WSC) (pp. 1402-1414). IEEE.*

Watson, E. F., Chawda, P. P., McCarthy, B., Drevna, M. J., & Sadowski, R. P. (1998). A Simulation Metamodel for Response-Time Planning. *Decision Sciences, 29(1), 217-241.*

Aaby, K., Herrmann, J. W., Jordan, C. S., Treadwell, M., & Wood, K. (2006). Montgomery county's public health service uses operations research to plan emergency mass dispensing and vaccination clinics*. Interfaces, 36(6), 569-579.*

Case Study:

Wheelwright, S. C., & Schmidt, W. (2011). Baria Planning Solutions, Inc.: Fixing the Sales Process, HBS Brief Cases.

Topic S08: Why does a customer choose a service? – Conjoint studies in service design

Why does a customer choose a service? The answer can be versatile. In most cases it is not because of a single factor but a combination of different attributes. If a customer travels from A to B the choice of the mode of transportation can be dependent on the price, the duration, the connection, the level of comfort, or even if there is something good to eat nearby. Companies are interested to understand the decision-making process of their customers to improve their products and services.

Former scholars developed a method called conjoint study to estimate part-worth utility of product attributes. One main method is the choice-based conjoint analysis (CBC). CBC is a decomposition method, which was developed in the 19th century and has become a widely used method in both worlds, commercial as well as scientific. By conducting a choice experiment, customers are asked to select their most preferred product among a selected product offering. Operations management can improve their products with the help of discrete choice models to estimate purchase behavior.

The objectives of this thesis are to:

- review literature on conjoint studies;
- explain how to estimate part worth utility and to discuss advantages and disadvantages;
- give an overview over literature in service design who uses conjoint studies and explain one paper in detail;
- provide open research gaps and future trends.

Basic Literature:

Baier, Daniel; Brusch, Michael (2009). Conjointanalyse: Methoden-Anwendungen-Praxisbeispiele: Springer-Verlag.

Eggers, F., Sattler, H., Teichert, T., & Völckner, F. (2018). Choice-Based Conjoint Analysis. *Handbook of Market Research, Springer, Cham, 1-39.*

Han-fen Hu, William Moore, & and Paul J. Hu (2012). Incorporating User Perceptions and Product Attributes in Software Product Design and Evaluation.

Topic S09: Sequence effects in the design of experiential services

Past researchers have found empirical evidence that customers consider the sequence of event utility when evaluating past and future service experiences. Dixon and Verma (2013) provide a thorough review of the psychology and behavioral economics literature concerned with sequence effects and cite four main effects that emerge as relevant to sequencing service encounters: (i) the impact of the highest point, most intense, or highest utility part of an experience (Peak Effect); (ii) the impact of the last point of an experience (End Effect); (iii) the impact of the timing of the peak (Spread Effect); (iv) and the overall trend of the experience over time (Trend Effect).

Based on the empirical results Dixon & Thomson (2016) formulate an optimization problem with a focus on optimizing schedule sequence characteristics in order to maximize customer experiences.

Other researchers (e.g., Das Gupta et al. 2016, Roels 2019) have developed mathematical models to optimize the service experience by incorporating selected psychological constructs like memory decay or acclimation and thereby mapping the underlying mental processes in the consumer's brain.

The objectives of this thesis are to:

- review and systematically classify current empirical knowledge on sequence effects as well as state-of-the-art optimization models incorporating sequence effects;
- compare different optimization approaches and discuss their advantages and limitations;
- discuss one optimization model in detail or compare two approaches;
- provide open research gaps and future trends;
- implement a subsection of the model in Dixon & Thomson (2016) in Excel (optional).

Basic Literature:

Bellos, I., & Kavadias, S. (2020). Service design for a holistic customer experience: A process framework. *Management Science. Published Online: 21 Aug 2020 https://doi.org/10.1287/mnsc.2020.3609*

Das Gupta, A., Karmarkar, U. S., & Roels, G. (2016). The design of experiential services with acclimation and memory decay: Optimal sequence and duration. *Management Science, 62(5), 1278-1296.*

Dixon, M. J., & Thompson, G. M. (2016). Bundling and scheduling service packages with customer behavior: Model and heuristic. *Production and Operations Management, 25(1), 36-55.*

Topic S10: Product line design/selection problem

Optimization problems from various fields (e.g., assortment optimization, product line selection, location planning) often incorporate probabilistic choice behavior in dependence of the availability of given choice alternatives. Attraction choice models are widely used in marketing and economics to model choices and the multinomial logit model and in the case of multiple customer segments, the discrete finite mixture MNL (MMNL) are special cases of these models. However, integrating such choice models into optimization problems often results in non-linear formulations. Bechler et.al (2021) made a review of several exact linearization approaches that have been proposed in recent years. In the case of product line selection, for instance, there are various models with different structures depending on the choice model used. Chen and Hausman (2000) analyzed the problem under a single-segment aggregated MNL model and showed that the non-linear problem can be solved efficiently. Schön (2010) extended the previous model for multiple segments by using the discrete finite mixture MNL (MMNL) and also linearized that under the assumption that each segment can be priced independently of the others.

The objectives of this thesis are to:

- make a brief review of product line design/selection problem;
- show how problem formulations differ regarding the assumed customer choice behavior;
- make a review of linearization techniques in Bechler et.al (2021) and discuss in detail the linearization method used by Schön (2010);
- implement an example instance of the two alternative optimization problem formulations under the MMNL choice model for the original non-linear problem and the linearized version of that and compare the results. (optional).

Basic Literature:

Chen, K. D., & Hausman, W. H. (2000). Mathematical properties of the optimal product line selection problem using choice-based conjoint analysis. *Management Science, 46(2), 327-332.*

Schön, C. (2010). On the optimal product line selection problem with price discrimination. *Management Science, 56(5), 896-902.*

Bechler, G., Steinhardt, C., & Mackert, J. (2021). On the linear integration of attraction choice models in business optimization problems. *In Operations Research Forum (Vol. 2, No. 1, pp. 1-13). Springer International Publishing.*

Topic S11: Product line design from an operational perspective

A critical decision facing firms across industries is the selection of a mix of products to offer in the marketplace. The product line design problem is the interface of marketing and operations management and has been considered from both perspectives. From a marketing perspective, the focus has been on alternative sets of products that interact and compete in the marketplace, consumer choice, and using attraction models to model consumer behavior. In operational implications of product line decisions, the importance and complexity of interactions among products in the manufacturing environment increase with broadening product lines. Further-more, consideration of manufacturing synergies among products in product line design is increasingly beneficial given efforts in many industries to improve coordination of manufacturing activities across products. The objectives of this thesis are to:

- make a brief review of product line design/selection problem with focusing on operational perspective;
- make a classification of the different types of cost functions in the optimization models and their effect on the structure of the model;
- provide open research gaps and future trends;
- implement an example instance of one optimization problem (optional).

Basic Literature:

Morgan, L. O., Daniels, R. L., & Kouvelis, P. (2001). Marketing/manufacturing trade-offs in product line management. *Iie Transactions, 33(11), 949-962*

Schön, C. (2010). On the optimal product line selection problem with price discrimination. *Management Science, 56(5), 896-902.*

Andrade, X., Guimarães, L., & Figueira, G. (2021). Product line selection of fast-moving consumer goods. *Omega, 102, 102389.*

Aydin, R., Kwong, C. K., & Ji, P. (2016). Coordination of the closed-loop supply chain for product line design with consideration of remanufactured products. *Journal of Cleaner Production, 114, 286-298.*