Service Operations Research Seminar HWS 2021 (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 **May 3rd** and ends on **May 16th**, 2021.

4. **Admission** to the seminar is **binding** and will be confirmed by E-mail by **May 21st, 2021.**

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 25th, 2021 at 10:15am** via **ZOOM** (please access the link here: https://portal2.uni-mannheim.de:443/portal2/pages/startFlow.xhtml?_flowId=detailView-flow&unitId=22048&periodId=928&navigationPosition=studiesOffered,searchCourse

[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.

s). During this meeting, general guidelines for conducting scientific work will be discussed.

7. Each student has **eight weeks** to complete the Seminar Thesis. This timeframe can individually be set **between the kick-off day and September 17th, 2021** (Note: September 17th 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 **Wednesday, October 6th starting at 10:15 in SO 318** (only if on-campus operations have been resumed at the University). 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.

Topics on Digitalization and Digital Transformation:

Topic S01: Digitalization and Digital Transformation in the Service Industry

Digitalization and digital transformation are trending topic in recent years. Both terms are often used interchangeably, although they can also be defined individually and differentiated them from each other. 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. Both forms have a fundamental impact for the respective company changing the way it operates in the market. Thus, both the academic and the business world have strong interests in advancing this topic across all industry sectors, from primary sector, to manufacturing, to services.

The objectives of this thesis are to:

- Introduce and differentiate the terms digitalization and digital transformation;
- identify, cluster and analyze related research topics and questions in the context of services;
- present potential topics for future research;

Basic Literature:

Agostino, D., Arnaboldi, M., & Lema, M. D. (2021). New development: COVID-19 as an accelerator of digital transformation in public service delivery. Public Money & Management, 41(1), 69-72.

Breidbach, C. F., Keating, B. W., & Lim, C. (2019). Fintech: research directions to explore the digital transformation of financial service systems. Journal of Service Theory and Practice, 30 (1), 79-102.

Gebauer, H., Paiola, M., Saccani, N., & Rapaccini, M. (2020). Digital servitization: Crossing the perspectives of digitization and servitization.

Leischnig, A., Ivens, B., Wölfl, S., & Hein, D. (2017). Service digitization–review of the literature and research agenda. Dienstleistungen 4.0, 43-59.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118-144.

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., Cannavale, C., Laurenza, E., & Metallo, C. (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., Holweg, M., Lawson, B., Pil, F. K., & Wagner, S. M. (2019). The digitalization of operations and supply chain management: Theoretical and methodological implications. [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., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. Journal of Business Research, 122, 889-901.

Topics on Process Mining:

Topic S03: From Process Mining to Process Simulation

Emerged as a new approach to process management and analysis, process mining combines process science and data science and provides many new forms of analysis in the area of business process management. For example, process discovery algorithms allow to derive process maps from the data collected during process execution, thereby creating a representation of the process as it is actually performed. For managers, these insights allow e.g. a comparison of the executed process model with the normative process model. Given the discovered process, further analyses can take place, such as the evaluation of process improvement possibilities. Using the output of the process mining's discovery algorithm, a simulation model can be built in order to test different process variants and configurations. Generally, a simulation is a frequently used method to compare different alternatives and parameter settings to identify the best performing process.

This thesis focuses on the existing literature which combines process mining and simulation analysis. A literature review should show the different approaches authors chose to fulfill the individual aims of their study. A comparison of the approaches, purposes, and findings will shed some light on valuable insights and recommendations for researchers performing similar studies in the future.

The objectives of this thesis are to:

- conduct a literature review on the existing studies combining process mining and simulation for process analysis and improvement,
- compare the approaches chosen for the respective research goals as well as the reported findings, and
- give a recommendation for future research at the interface of process mining and simulation based on different purposes;

Basic Literature:

Mesabbah, M., Abo-Hamad, W., & McKeever, S. (2019): A hybrid process mining framework for automated simulation modelling for healthcare. In: 2019 Winter Simulation Conference (WSC) (pp. 1094-1102). IEEE.

Măruşter, L., & van Beest, N. R. (2009): Redesigning business processes: a methodology based on simulation and process mining techniques. Knowledge and Information Systems, 21(3), 267-297.

Abohamad, W., Ramy, A., & Arisha, A. (2017): A hybrid process-mining approach for simulation modeling. In: 2017 Winter Simulation Conference (WSC) (pp. 1527-1538). IEEE.

Topic S04: Challenges and Limitations of Process Mining

Process Mining has emerged as a promising new tool for business process management. Based on the usage of event logs extracted from the IT systems, this approach uses real-life data instead of observations or opinions as source for the analysis. Hence, this data-driven approach promised the advantage of a more precise analysis of multiple perspectives discovered from the data. Yet, some analyses require information that cannot be found only in the data. For example, when analyzing the resource utilization, the resource's available capacity must be known. Often, the event log only shows the actual time spend working by each resource without specifying any preparation times or the total time a resource is available.

This thesis focuses on the challenges and limitation of process mining. A literature review should be conducted in order to identify the different challenges encountered in existing studies and the approach chosen by the authors to overcome the respective challenge. Special attention should also be paid to any limitations of process mining, especially during the process discovery stage. Thus, the thesis provides valuable insights into the challenges and limitations that future research should further discuss and solve.

The objectives of this thesis are to:

- provide a literature overview of the challenges and limitations in existing process mining studies with focus on process discovery,
- critically discuss the approaches followed in the studies to overcome the different challenges, and
- give recommendations on still existing challenges, limitations, and open research topics, which future researchers should address;

Basic Literature:

Buijs, J. C., van Dongen, B. F., & van der Aalst, W. M. (2014): Quality dimensions in process discovery: The importance of fitness, precision, generalization and simplicity. International Journal of Cooperative Information Systems, 23(01), 1440001.

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

Van der Aalst, W. M., & Weijters, A. J. (2004). Process mining: a research agenda.

Topics on Discrete Choice and Heuristics:

Topic S05: Discrete Choice Models – A Review of State-of-the-Art Approaches

Understanding and predicting customer choice is a crucial task for any company. Customers can often decide between different alternatives but can choose only one offered. Researchers have developed different discrete choice models. The first choice model is one of the simplest method, which assumes that the customer always picks the option with the maximum utility. Popular models are probit model, latent class model, binary logit model, multinomial logit model, nested logit model and ordered logit model.

The objectives of this thesis are to:

- to review and systematically summarize the literature on key aspects like underlying assumptions, model formulations and estimation procedures for discrete-choice models,
- to compare and discuss the benefits and drawbacks of the different model categories (or individual models),
- to highlight the state-of-the-art approaches and point out their benefits as compared to the "older" models,
- to select two of the reviewed models and compare them in detail (e.g. MNL and LCM) and
- to implement a self-created experiment in Excel to explain how the models work (optional);

Basic Literature:

Denton, J. W. (1995). How good are neural networks for causal forecasting?. The Journal of Business Forecasting, 14(2), 17.

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

Shen, J. (2009). Latent class model or mixed logit model? A comparison by transport mode choice data. Applied Economics, 41(22), 2915–2924. https://doi.org/10.1080/00036840801964633

Topic S06: Heuristic methods to solve product line design problems

To maximize profit through customer satisfaction, a key strategic decision for a firm is the product offering. The manufacturer can not only customize and optimize a single product, but also design a product line which can capture the needs of different market segments. Product line design problems determine the products which should be offered and how to design them. The design decision takes different attributes (e.g. price, size, color) into account. The potential advantages for the vendor of an extensive product portfolio have to be weighed against the cost and possible substitution effects between products.

When the amount of data on customer preferences or possible product configurations is large and no analytical relations can be established, the problem of an optimal product line design becomes very difficult and there are no exact methods to solve it efficiently (Fruchter et al. 2006). Heuristics can be used to find near optimal solutions.

The objectives of this thesis are to:

- to review and systematically summarize the literature on product line design and their heuristic solution methods,
- to compare and discuss the benefits and drawbacks of the different algorithms,
- to highlight one state-of-the-art heuristic model,
- to implement a heuristic method in Excel or with a programming language and use it to solve a product line design problem instance (optional);

Basic Literature:

Belloni, A., Freund, R., Selove, M., & Simester, D. (2008). Optimizing Product Line Designs: Efficient Methods and Comparisons. Management Science, 54(9), 1544–1552. https://doi.org/10.1287/mnsc.1080.0864

Dobson, G., & Kalish, S. (1993). Heuristics for Pricing and Positioning a Product-Line Using Conjoint and Cost Data. Management Science, 39(2), 160–175. https://doi.org/10.1287/mnsc.39.2.160

Fruchter, G. E., Fligler, A., & Winer, R. S. (2006). Optimal Product Line Design: Genetic Algorithm Approach to Mitigate Cannibalization. Journal of Optimization Theory and Applications, 131(2), 227–244. https://doi.org/10.1007/s10957-006-9135-3

Topics on Sustainable Product Design:

Topic S07: Sustainable product design and conjoint analysis

In light of several recent developments, companies are forced to rethink their product design approaches. One of the most pressing developments is the increase of environmental challenges. This development has an impact on individuals and their preferences, which translates to changes in customer demand for products. Hence, companies are forced to review their product design strategies in order to not fall behind.

During product design, many decisions have to be made that affect both, the economic as well as the environmental performance of the respective product. These decisions include (but are not limited to) (1) choice of material, (2) choice of supply sources and suppliers, (3) choice of attributes and respective attribute levels, and others.

The challenge of designing products that fit to (changing) customer preferences is not new in the business world. Companies have faced similar challenges for decades. Several approaches have been developed to facilitate and support product design.

The objectives of this thesis are to:

- introduce the topic of product design, with focus on current developments (environmental challenges) driving the need to rethink product design strategies;
- review the state-of-the-art approaches that have been developed to facilitate and support product design;
- introduce the Conjoint Analysis (CA) approach and discuss its relevance for product design in today's research and practice;
- discuss pros and cons of Choice-based Conjoint (CBC) as the best CA method;
- provide a recommendation for a product design approach of an electronic product;

Basic literature:

Green, Paul E.; Srinivasan, Venkat (1990). Conjoint analysis in marketing: new developments with implications for research and practice. Journal of Marketing 54 (4), pp. 3–19.

Bradley, J. R., & Guerrero, H. H. (2008). Product design for life-cycle mismatch. Production and Operations Management, 17(5), 497-512.

Orme, B. (2010). Getting started with conjoint analysis: strategies for product design and pricing research second edition. Madison: Research Publishers LLC. Partly available online here.

Topic S10: Product durability and planned obsolescence – Empirical evidence

Planned obsolescence is a policy of designing a product with an artificially limited useful life, so it will become obsolete, i.e. no longer functional after a certain period of time. The rationale behind the strategy is to generate long-term sales volume by reducing the time between repeat purchases. Such a policy goes hand-in-hand with several side effects, in particular high impact on the environment in terms of resource use as well as waste disposal.

Overall, three general types of planned obsolescence strategies can be identified. Physical obsolescence (originally "Obsolescence of quality") arises when a product breaks or wears out with time beyond repair in an unnatural manner. In this case, the product is deliberately built to break sooner than naturally. Technological obsolescence (originally "Obsolescence of function") arises when a new (technologically or functionally) superior product is introduced to the market. Psychological obsolescence (originally "Obsolescence of desirability") arises when the product becomes outdated in the eyes of consumers due to changes in fashion, style or similar.

The objectives of this thesis are to:

- highlight the pros and cons of planned obsolescence, differentiated by type if necessary;
- review the literature for planned obsolescence, focusing on empirical academic studies and potential case examples;
- develop an appropriate classification scheme for the reviewed literature;
- classify the different academic contributions and highlight the relevance of each class in terms of past and current research focus;
- discuss potential gaps in academic literature and recommend future research directions.

Basic literature:

Echegaray, F. (2016). Consumers' reactions to product obsolescence in emerging markets: the case of Brazil. Journal of Cleaner Production 134, 191-203.

Guiltinan, J. (2009). Creative destruction and destructive creations: environmental ethics and planned obsolescence. Journal of business ethics 89(1), 19-28.

Slade, G. (2009): Made to break: Technology and obsolescence in America. Harvard University Press.

Topics on Airtravel:

Topic S11: Customer Utility Functions in Airtravel

The choice between different transport modes for a trip can be characterized as a discrete choice situation, as the best travel option is selected by customers. These decisions can be modelled with discrete choice models; their most prominent functional specification is the multinomial choice model (MNL). An underlying assumption of the models is the possible decomposition of the product or service in attributes with different levels, where each attribute level is connected to a particular partial utility. As example, Coldren et al. (2003) identified itinerary service characteristics for flights connecting east & west coast of the United States as attributes and estimate the part worth utilities of the respective attribute levels. The emergence of online booking engines and data availability create a new possibility to analyze real-life data for parameter-estimation.

The objectives of this thesis are

- to introduce and compare the MNL and similar discrete choice models;
- to provide an overview of empirical studies measuring the utility choice behavior of air travel and competing transport modes including attributes, their levels, and chosen segments;
- to identify and discuss the state-of-the-art approach in choice model estimation for air travel; and
- to provide open research gaps and future trends.

Basic Literature:

Adler, T., Falzarano, C. S., & Spitz, G. (2005): Modeling service trade-offs in air itinerary choices. *Transportation Research Record*, 1915(1), 20-26.

Coldren, G. M., Koppelman, F. S., Kasturirangan, K., & Mukherjee, A. (2003): Modeling aggregate air-travel itinerary shares: logit model development at a major US airline. Journal of Air Transport Management, 9(6), 361-369.

Train, K., & Ebrary, Inc. (2009): *Discrete choice methods with simulation* (Second ed.). Cambridge New York Melbourne Madrid Cape Town Singapore São Paulo Delhi Mexico City

Topic S12: Integrated Airline Crew Scheduling

To organize daily operations, airlines have 4 planning stages to distribute the available resources such as aircraft and crews to activities such as flights and maintenance events. The last step is usually the Airline Crew Scheduling Problem, in which crew members are assigned to specific flights in a planning period with the objective to have the cost minimizing solution. This problem has received much attention due to the high savings potential of crew cost; generally, it is solved in two sequential steps called crew pairing and crew assignment to better manage complexity and following the process of first minimizing the schedule costs and then satisfying crew members. Similar processes can be found for railways and other transport industries.

Integrated crew scheduling is the idea of combining both crew scheduling problems again to achieve a lower overall cost and to consider employee preferences earlier. These models are challenged by the large problem size due to the combinatorial nature of the problem; multiple solution techniques have been identified such as improvements of column generation, colony ant optimization or genetic algorithms to name a few.

Aim of the seminar thesis should be to,

- introduce the crew scheduling problem and the disadvantage of the sequential approach,
- summarize integrated crew scheduling models,
- to discuss a specific integrated crew scheduling in detail,
- to provide open research gaps and future trends.

Basic Literature:

Barnhart, C., Cohn, A. M., Johnson, E. L., Klabjan, D., Nemhauser, G. L., & Vance, P. H. (2003): Airline crew scheduling. In *Handbook of transportation science* (pp. 517-560). Springer, Boston, MA.

Kasirzadeh, A., Saddoune, M., & Soumis, F. (2017): Airline crew scheduling: models, algorithms, and data sets. *EURO Journal on Transportation and Logistics*, 6(2), 111-137.

Lin, D. Y., & Tsai, M. R. (2019): Integrated crew scheduling and roster problem for trainmasters of passenger railway transportation. *IEEE Access*, *7*, 27362-27375.

Zeighami, V., & Soumis, F. (2019): Combining Benders' Decomposition and Column Generation for Integrated Crew Pairing and Personalized Crew Assignment Problems. *Transportation Science*, *53*(5), 1479-1499.

Topics on Simulation Modeling: