Service Operations Research Seminar HWS 2020 (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] The application period starts on **April 27th** and ends on **May 10th**, 2020.

3. **Admission** to the seminar is **binding** and will be confirmed by E-mail by **May 22nd, 2020.**

4. 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 + 10 min discussion).

5. A **kick-off meeting** for all participants will be held on Tuesday, **May 26th, 2020 at 10:15 am** in **ZOOM** (link will be communicated via Email). 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.

6. Each student has **eight weeks** to complete the Seminar Thesis. This timeframe can individually be set **between the kick-off day and October 9th, 2020** (Note: October 9th is the latest submission date).

7. 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**.

8. On your individual submission date, you have to…
   a. **Upload your report** (Word- / Latex-document <u>and</u> 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.

9. Student **presentations** will be held on **October 14th starting at 10:15 in room SO 318** (only if on-campus operations have been resumed at the University). Attendance is mandatory. Please **upload your presentation slides** (ppt <u>and</u> 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.

10. Each participant acts as a discussant for one of the other presentations. The discussant is responsible for critically assessing the presented work and for opening the ensuing discussion.

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 (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 Customer Learning:

Topic S01: How do customers learn? – An (experimental) study

Positive consumer experience is a key lever to increase demand and to achieve consumer loyalty, which in turn is a key precondition for long-term success. Product decisions typically have an influence on customer experience.

Understanding customer experience and learning is, therefore, key to make the right decision. However, understanding customer learning is not a trivial tasks. For example, consumers can learn by experience, from other consumers (social learning) or indirectly from other sources. More specifically, customers (may) adapt their expectations by gaining new information. Understanding the process of customer expectation formation

The objectives of this thesis are to

- Differentiate the different types of learning in the existing literature and highlight the importance of customer learning for company success,
- Discuss how customer learnings affects profitability on the basis of an (profit) optimization model of own choice,
- Select an appropriate empirical method and conduct a small (experimental) study to determine how customers adapt their expectations by experience for a product of own choice,
- Summarize the insights and put them into context of existing academic literature.

Basic Literature:

Ching, A. T., Erdem, T., & Keane, M. P. (2017): Empirical models of learning dynamics: A survey of recent developments. In Handbook of marketing decision models (pp. 223-257). Springer, Cham.

Sterman, J. D. (1987): Expectation formulation in behavioral simulation models. Behav. Sci. 32(3) 190–211.

Liu, Q., & Van Ryzin, G. (2011): Strategic capacity rationing when customers learn. Manufacturing & Service Operations Management, 13(1), 89-107.

Topic S02: Customer experience and learning – How can customer learning be integrated in optimization models?

Positive consumer experience is a key lever to increase demand and to achieve consumer loyalty, which in turn is a key precondition for long-term success. On the other hand, negative consumer experience may turn out to be detrimental for company profitability. In particular, with increased consumer communication via social platforms, negative experience may spread very fast. There are different types of learning. For example, consumers can learn by experience or from other consumers (social learning). The main goal of learning models is to describe consumer preference formation, updating a consumer's utility (or satisfaction) based on learning inputs.

The decisions of a company typically have an influence on customer experience. However, Second, incorporating customer learning in decision-making is not a trivial task. From an operations perspective, incorporating customer learning implies modifying the employed demand models. This, however, may significantly increase the complexity of the optimization problem. Therefore, a trade-off needs to be made between obtaining a more realistic model on the one hand and model increasing model complexity on the other hand.

The objectives of this thesis are to

- Review the literature for consumer learning models and classify the different types of learning;
- Discuss the implications of incorporating customer learning in optimization problems, focusing on the trade-off between model realism vs. complexity;
- Highlight the 5 most relevant contributions to this field of research from your personal perspective. Point out the facts that lead you to the selection of these contributions;
- Select a optimization model of own choice and discuss potential extensions to the model;
- Optional: Select a model of own choice and implement it in AMPL.

Basic Literature:

Ching, A. T., Erdem, T., & Keane, M. P. (2017): Empirical models of learning dynamics: A survey of recent developments. In Handbook of marketing decision models (pp. 223-257). Springer, Cham.

Meyer, R. J., & Sathi, A. (1985): A multiattribute model of consumer choice during product learning. Marketing Science, 4(1), 41-61.

Ovchinnikov, A., & Milner, J. M. (2012). Revenue management with end-of-period discounts in the presence of customer learning. Production and operations management, 21(1), 69-84.

Topics on Customer Experience:

Topic S03: Identifying and Prioritizing Relevant Customer Journeys for Service Process Design

Optimizing the overall customer experience is crucial for any company since it drives customer satisfaction and in turn sales and word-of-mouth. To improve the respective service processes underlying each customer experience, a clear understanding is needed, which customer journeys to optimize and prioritize. Most companies have a variety of services, each with several different customer journeys depending on target segment, context, or stage in the customer lifecycle for example. Since companies cannot improve every service process at the same time, it is crucial to determine what matters most to the customer and which customer journeys have the strongest impact on the overall customer experience.

The objectives of this thesis are

- to introduce the concepts of customer experience management and service process design;
- to analyze the link between these two areas of research;
- to show how individual customer journeys impact the overall customer experience;
- to provide managerial implications on how companies can prioritize their effort for optimizing individual service processes.

Basic Literature:

Fließ, Sabine und Kleinaltenkamp, Michael (2004). Blueprinting the service company: Managing service processes efficiently. Journal of Business Research 57 (4), 392-404.

Lemon, K. N., & Verhoef, P. C. (2016). Understanding customer experience throughout the customer journey. *Journal of marketing*, 80(6), 69-96.

Topic S04: Customer Experience Management – Integrating the Marketing and Operations Perspective

Customer experience management (CEM) is a research domain that strongly gained popularity during the last decade. Introduced as a new marketing perspective, it followed the service-dominant logic and focusses on the customers' experience with a company, a product or a service. While whole industries created a trend by actively engaging in customer experience management, extensive research in this field is sparse – despite of extensive research on customer experience itself. Started as a marketing construct, CEM is also of interest for other research disciplines. In operations management for example a similar stream called service experience management exists, which combines marketing and operations considerations in a single construct. The question, which areas elaborate on customer experience management to which extent, is important to evaluate the multi-disciplinary nature of the construct.

The objectives of this thesis are

- to introduce the terms customer experience and customer experience management including an overview of its historical development;
- to provide a research map covering research on customer experience management with a focus on (but not restricted to research areas like) marketing and operations management over the last decade;
- to highlight the role of operations management and present areas of future research on CEM in this context.

Basic Literature:

Homburg, C., Jozić, D., & Kuehnl, C. (2017). Customer experience management: toward implementing an evolving marketing concept. *Journal of the Academy of Marketing Science*, 45(3), 377-401.

Kwortnik Jr, R. J., & Thompson, G. M. (2009). Unifying service marketing and operations with service experience management. *Journal of service research*, 11(4), 389-406.

Topics on Service Design and Business Modelling:

Topic S05: When do customers prefer to wait? – Satisfaction effects of waiting time at different service stages

The quality of a service includes many factors. ServQual (Parasuraman et al, 1988), a popular approach to evaluate service quality, proposes five principal components of service quality: reliability, responsiveness, assurance, tangibles, and empathy. Responsiveness is therein defined as the ability and willingness to help customers and provide prompt service. A pragmatic operationalization is waiting time. As studies have shown, the rule of thumb holds true: lower waiting times are associated with higher customer satisfaction. Yet, research showed that waiting time effect on satisfaction are more complex than that. For example, the stage of the service process matters as customers differentiate the waiting time at the different phases of the service encounter.

For service providers aiming at achieving high customer satisfaction, insights in this area are very valuable. Knowing when customers prefer to wait, service providers can shape the service encounter accordingly and allocate resources more effectively. How can service providers design their processes in order to increase customer satisfaction with regards to waiting time and responsiveness?

The aim of this seminar thesis should be to:

- Conduct a literature review to identify the different studies on waiting time and satisfaction effects,
- Review the literature in order to identify the customer preferences concerning waiting time at different service stages, and
- Give recommendations on the design of a process and its allocated waiting times.

Basic literature:

Parasuraman, A Parsu & Zeithaml, Valarie & Berry, Leonard (1988): SERVQUAL: A multiple- Item Scale for measuring consumer perceptions of service quality. *Journal of retailing*, 64(1), 12-40.

Davis, M. M., & Maggard, M. J. (1990): An analysis of customer satisfaction with waiting times in a two-stage service process. *Journal of Operations Management*, 9(3), 324-334.

Soremekun, O. A., Takayesu, J. K., & Bohan, S. J. (2011): Framework for analyzing wait times and other factors that impact patient satisfaction in the emergency department. *The Journal of emergency medicine*, 41(6), 686-692.

Topic S06: How responsive is a service? – Measuring Responsiveness in Service Operations

Service quality is an important factor of customer satisfaction. ServQual (Parasuraman et al, 1988), a popular approach to evaluate service quality, proposes five principal components of service quality: reliability, responsiveness, assurance, tangibles, and empathy. Two of these are the prevailing impact factors of service quality and ultimately customer satisfaction. These are reliability and responsiveness. Responsiveness can be defined as the ability and willingness to help customers and provide prompt service.

For service providers aiming at achieving high customer satisfaction, insights in this area are very valuable as responsiveness can greatly impact the service quality. The first step is to measure responsiveness in order to evaluate and improve the performance in this field. A pragmatic and often used measure is waiting time. However, is waiting time the main factor determining responsiveness and thus the best measure for responsiveness?

The aim of this seminar thesis should be to:

- Conduct a literature review to identify the measurement approaches for responsiveness,
- Evaluate the use of waiting time as appropriate measure for responsiveness, and
- Give a recommendation on how to measure responsiveness in service operations.

Basic Literature:

Soremekun, O. A., Takayesu, J. K., & Bohan, S. J. (2011): Framework for analyzing wait times and other factors that impact patient satisfaction in the emergency department. *The Journal of emergency medicine*, *41*(6), 686-692.

Davis, M. M., & Heineke, J. (1998): How disconfirmation, perception and actual waiting times impact customer satisfaction. *International Journal of Service industry Management*, 9(1), 64-73.

Santos Bernardes, E., & Hanna, M. D. (2009): A theoretical review of flexibility, agility and responsiveness in the operations management literature. *International Journal of Operations & Production Management,* 29(1), 30-53.

Topics on Service Design and Transportation:

<u>Topic S07: Customer Utility Functions in Airtravel</u>

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;
- 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;
- Identify and discuss the state-of-the-art approach in choice model estimation for air travel; and
- 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 S08: Integrated 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.

The objectives of this thesis are to:

- Introduce the crew scheduling problem and the disadvantage of the sequential approach,
- Summarize integrated crew scheduling models
- Discuss a specific integrated crew scheduling in detail, and
- Provide open research gaps and future trends.

Recommended basic literature:

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.

Saddoune, M., Desaulniers, G., Elhallaoui, I., & Soumis, F. (2012): Integrated airline crew pairing and crew assignment by dynamic constraint aggregation. *Transportation Science*, 46(1), 39-55.

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:

Topic S09: Simulation Metamodeling – a Powerful Approach with Applications to the Management of Service Operations?

Computer simulation is the imitation of the operation of a real-world process or system. Simulation has become an invaluable tool for managerial decision making that can be considered an experimental laboratory in which to study a model of a real system. Based on what-if scenarios, simulation allows analyzing how the system's performance (output) might respond to inputs such as changes in policies, resource levels, or customer demand. The simulation data can then be used to draw inferences concerning the operating characteristics of the real system that is represented.

However, simulation may be computationally slow or expensive: i.e., it may take much computer time to obtain the response for a given combination of the simulation inputs. While the simulation model is often treated as a black box, simulation metamodels are explicit and relatively simple approximations of the input/output (I/O) function implicitly defined by the underlying simulation model. Metamodels lend support to simulation models by trying to generalize the simulation output and predicting the output for a new input combination of the expensive simulation model.

The objectives of this thesis are to

- Introduce the simulation metamodeling approach with a focus on regression metamodels;
- Discuss advantages and limitations;
- Provide an overview of applications in service operations management;
- Optionally provide an academic example application to a simple service process like an M/M/1 queue.

Basic Literature:

Kleijnen, J. P., Sanchez, S. M., Lucas, T. W., & Cioppa, T. M. (2005). State-of-the-art review: a user's guide to the brave new world of designing simulation experiments. INFORMS Journal on Computing, 17(3), 263-289.

Kleijnen, J. P. (2017). Design and analysis of simulation experiments: Tutorial. A. Tolk et al. (eds.), Advances in Modeling and Simulation (Chapter 8, pp. 135-158). Springer.

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.

Topic S10: Simulation Metamodeling with Neural Networks – a Powerful Approach with Applications to Process Design?

Computer simulation is the imitation of the operation of a real-world process or system. Simulation has become an invaluable tool for managerial decision making that can be considered an experimental laboratory in which to study a model of a real system. Based on what-if scenarios, simulation allows analyzing how the system's performance (output) might respond to inputs such as changes in policies, resource levels, or customer demand. The simulation data can then be used to draw inferences concerning the operating characteristics of the real system that is represented.

However, simulation may be computationally slow or expensive: i.e., it may take much computer time to obtain the response for a given combination of the simulation inputs. While the simulation model is often treated as a black box, simulation metamodels are explicit and relatively simple approximations of the input/output (I/O) function implicitly defined by the underlying simulation model. Metamodels lend support to simulation models by trying to generalize the simulation output and predicting the output for a new input combination of the expensive simulation model. Chambers and Mount-Campbell (2002) use a neural network to optimize a production process.

The objectives of this thesis are to

- Introduce the simulation metamodeling approach with a focus on neural network metamodels;
- Review the approach of Chambers and Mount-Campbell (2002) in detail;
- Discuss advantages and limitations of the simulation metamodeling approach by Chambers and Mount-Campbell (2002) for manufacturing process optimization and discuss applicability for service processes.

Basic Literature:

Chambers, M., & Mount-Campbell, C. A. (2002). Process optimization via neural network metamodeling. International Journal of Production Economics, 79(2), 93-100.

Kleijnen, J. P., Sanchez, S. M., Lucas, T. W., & Cioppa, T. M. (2005). State-of-the-art review: a user's guide to the brave new world of designing simulation experiments. INFORMS Journal on Computing, 17(3), 263-289.

Kleijnen, J. P. (2017). Design and analysis of simulation experiments: Tutorial. A. Tolk et al. (eds.), Advances in Modeling and Simulation (Chapter 8, pp. 135-158). Springer.