Service Operations Research Seminar HWS 2024 (OPM 781)

"Current Topics in Service Operations Management Research"

General Information:

1. The goal of this seminar is to introduce participants to conducting applied scientific research in the field of (service) operations management. Also, the seminar aims at practicing presentation skills, such as speaking with clarity, confidence and connection.

2. The master thesis prepares students for writing their M.Sc./Diploma Thesis primarily at the Chair of Service Operations Management, but OPM781 also qualifies you formally for writing a master thesis at any other chair in the Operations Area.

3. The offered topics are presented below and designed to be explored by a single student based on the fundamental literature. Each participant will present 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).

4. 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 (OPM 791) and topics **labeled with "S"** refer to the **Chair of Service Operations Management (OPM 781)**. The **assignment of topics** to students will be preference-based through ILIAS. 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]

5. The **application period** starts on **April 26th** and ends on **May 10th, 2024**.

6. **Admission** to the seminar is **binding** and will be confirmed by E-mail by **May 17th, 2024** at latest.

[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. A **kick-off meeting** for all participants will be held on Wednesday, **May 29th at 12:00 in SO322**. During this meeting, general guidelines for conducting scientific work will be discussed.

8. The latest **submission** date for the written report incl. appendices is **Nov. 20th (2024),** For submission, please …

    a. **Upload your report** (Word- / Latex-document and PDF) via Task "Upload of final Thesis & Calculations/Software Output" in the OPM781 ILIAS group. If you have multiple files (e.g. a pdf and some Excel analysis), please upload all in a single zip file.

    b. **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. The **final presentations** of the seminar participants will be held by default in the **regular presentation session on November 27th (2024),** in room SO 318. A **fast-track presentation track** may be offered to students who desire to start with their master thesis early in HWS24 based on their request. Attendance is mandatory for all presentations on your own presentation date.

10. In addition, we will offer an **optional mock-up presentation** session two weeks before the regular final presentations, i.e., on **Nov. 13th**. Here, participants can practice their final presentation and get tips on structure, content and presentation style risk-free without being graded – if they want to. In the kick-off on May 29th, we will provide guidance on how to train your presentation skills upfront, such as speaking with clarity, confidence and connection.

11. Please **upload your final 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.

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. Every thesis will contain some literature review, and more recommendations maybe helpful for this. Also, your supervisor may have more recommendations for you, in particular, if the initial list of recommended references for a topic is short.

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Topic S01: Revenue Management – Recent Advances and Selected Models

Revenue management (RM) has become a vital strategy for firms across various industries, aiming to predict consumer behavior and optimize product availability and prices to maximize revenue or profit. With the advent of data-driven decision-making and the emergence of new industries such as internet advertising, cloud computing, and e-commerce, there has been a growing demand for innovative RM models, frameworks, algorithms, and policies. In response to this demand, researchers have been focusing on advancing RM methodologies, particularly in accommodating RM to emerging industries and leveraging data-driven approaches. This includes the development of advanced personalized pricing and assortment models, exploration of RM strategies in industries with reusable resources, and the proposal of network RM and end-to-end decision-making techniques, etc.

The objectives of this thesis are to:

- review and classify existing approaches in RM and specify the recent advances published in leading academic journals, such as INFORMS journals, European Journal of Operational Research, Production and Operations Management, Journal of Operations Management, Journal of Revenue and Pricing Management;
- delve into one specific approach within RM with the focus on its model, advantages, limitations, and applications;
- elaborate one extension of the specific approach in detail, in terms of the motivation, model, advantages, and challenges;
- assess any gaps between the specific approach in the academic literature and the practical needs for this approach in industries.

Selected Literature Recommendations:

Chen, N., & Hu, M. (2023). Frontiers in Service Science: Data-Driven Revenue Management: The Interplay of Data, Model, and Decisions. Service Science, 15(2), 79-91.

Klein, R., Koch, S., Steinhardt, C., & Strauss, A. K. (2020). A review of revenue management: Recent generalizations and advances in industry applications. European journal of operational research, 284(2), 397-412.

Lobel, I. (2021). Revenue management and the rise of the algorithmic economy. Management Science, 67(9), 5389-5398.

Topic S02: Choice-based Price Optimization under Consideration of the Risk-Return Tradeoff

Pricing and revenue management under discrete choice demand models have attracted attention in recent years due to their flexibility for accommodating demand interactions among multiple products and the ease of empirical parameterizations. The multinomial logit (MNL) choice models, based on random utility maximization, are particularly attractive due to their analytical tractability. In these models, customers associate a utility with each product based on product characteristics, price, and a random term that accounts for all unobservable/neglected factors. Assuming that each customer chooses the product with maximum utility, one can derive a closed-form purchase probability for each product. Therefore, from the firm's perspective, the demand follows a multinomial distribution. The current literature of pricing problems under discrete choices models focuses on maximizing the firm's expected revenue or profit, assuming a risk-neutral decision maker. Researchers have derived or applied the optimal pricing solution or equilibrium under the MNL model. Recently, Li & Webster (2023) extended the analysis to a firm's multi-product pricing decision with the goal to optimally balance the expected return on product investment with the profit risk associated with uncertain customer choices. In particular, the authors examine a pricing problem under the MNL choice model and the mean-variance objective function.

The objectives of this thesis are to:

- explain the problem addressed in the paper of Li & Webster (2023) and motivate its relevance;
- position the paper in the corresponding stream of scientific literature, and provide a literature review for it;
- explain pricing model and solution methodology (for the MNL choice only) and optionally apply it to an academic example;
- discuss managerial implications, critically assess the paper's contribution to theory and practice, discuss its limitations, and provide a future outlook.

Selected Literature Recommendations:

Gönsch, J. (2017). A survey on risk-averse and robust revenue management. European Journal of Operational Research, 263(2), 337-348.

Hanson, W., & Martin, K. (1996). Optimizing multinomial logit profit functions. Management Science, 42(7), 992-1003.

Li, H., & Webster, S. (2023). Optimizing risk-balancing return under discrete choice models. Operations Research, 71(6), 2232-2244.

Topic S03: Nonlinear Pricing: Theory and Applications to Alibaba Price Optimization and Product Recommendations

A nonlinear optimization problem is one where some of the constraints or the objective function are nonlinear. Nonlinear optimization is widely applied in multi-product multi-resource pricing, assortment planning, stochastic resource allocation, etc. Deng et al. (2023) provide an example: Alibaba, one of the world's largest e-commerce platforms, applied an evolutionary algorithm (Črepinšek et al. 2013) to its multiproduct pricing problem which is a nonlinear problem and whose objective is to determine the promotional prices for a set of products to maximize the total revenue while maintaining a target profit margin. Furthermore, Alibaba integrated this price optimization into its product recommendations.

The objectives of this thesis are to:

- provide a brief introduction of nonlinear optimization, including the standard model, typical applications, difficulties with nonlinearities, and optimality conditions;
- describe the pricing problem that Alibaba faced in Deng et al. (2023);
- elaborate how this pricing problem is solved by Alibaba and how the price optimization is integrated into product recommendations, including the optimization problem, technique, and results;
- critically assess the contribution of Alibaba to the practice and discuss other possible ways to solve the pricing problem that Alibaba faced.

Selected Literature Recommendations:

Deng, Y., Zhang, X., Wang, T., Wang, L., Zhang, Y., Wang, X., ... & Peng, X. (2023). Alibaba realizes millions in cost savings through integrated demand forecasting, inventory management, price optimization, and product recommendations. INFORMS Journal on Applied Analytics, 53(1), 32-46.

Črepinšek, M., Liu, S. H., & Mernik, M. (2013). Exploration and exploitation in evolutionary algorithms: A survey. ACM Computing Surveys, 45(3), 1-33.

Topic S04: Customer Choice Behavior for Vehicle Content Optimization at General Motors

The Franz Edelman Award recognizes and celebrates outstanding achievements in the practice of operations research and analytics. It is often considered the highest honor in the field. It is awarded annually by INFORMS (the Institute for Operations Research and the Management Sciences), which is a professional society dedicated to the advancement of operations research and analytics. In 2022 General Motors' (GM) was one of the finalists for the use of Vehicle Content Optimization (VCO), a strategy that involves optimizing the packaging and pricing of over 100 customer-facing features in GM vehicles. These decisions significantly impact the customer experience and GM's business outcomes. The features are categorized as standard, optional, or unavailable on various trim levels, resulting in a vast solution space with numerous combinations.

Customer demand for the VCO is modelled with the help of discrete choice models. There are several popular methods to estimate and apply discrete choice models. In Wu-Smith et al. (2023), the authors highlight the unique challenges they face and how to overcome them. For example, the authors notices that customers behave noncompensatory, meaning that customers only consider products with specific acceptable criteria. In addition, they managed the independence of irrelevant alternatives problem which is a common property if a multinominal logit model is used.

The objectives of this thesis are to:

- provide an introduction into discrete choice models and their estimation methods;
- give an overview which demand models are used in recent years in the automotive industry;
- describe the problem that Wu-Smith et al. (2023) face;
- elaborate how this problem is solved by Wu-Smith et al. (2023), focus on the discrete choice models, there extensions and estimation methods;
- explain the Bayesian Markov-Chain Monte Carlo estimation procedure in detail and explain what other methods could have been used;
- critically assess the contribution of Wu-Smith et al. (2023) to theory and practice and discuss any gaps.

Selected Literature Recommendations:

Wu-Smith, Peiling; Keenan, Philip T.; Owen, Jonathan H.; Norton, Andrew; Kamm, Kelly; Schumacher, Kathryn M. et al. (2023): General Motors Optimizes Vehicle Content for Customer Value and Profitability. INFORMS Journal on Applied Analytics 53 (1), pp. 59–69. DOI: 10.1287/inte.2022.1144.

Topic S05: Discrete Choice vs. Machine Learning Demand Models in Revenue Management and Assortment Optimization

Developing a practical approach for many operations problems typically involves two key steps. First, managers choose a demand model based on historical sales data. Then, this model informs an optimization problem guiding crucial decisions like inventory, pricing, and assortments. Traditionally, the operations and revenue management fields favor simple demand models with explicit relationships between product features (e.g., price) and demand, for example discrete choice models like the multinomial logit (MNL) model. These models allow for easy estimation and formulation of optimization problems. However, the recent rise of machine learning (ML) offers an alternative approach. Algorithms like gradient-boosted decision trees and neural networks excel at predicting demand patterns, potentially outperforming simpler models in accuracy and capturing customer behavior nuances. Furthermore, considering the wide availability of user-friendly open-source machine learning software packages, it's not surprising that many recommendation systems in industry rely on advanced machine learning models. Given this context, a natural question arises: If cutting-edge machine learning models can indeed outperform choice models in accurately predicting customer purchasing patterns, why would managers still opt for the latter? Some findings e.g. by Feldman et al. (2022) suggest that while accurate predictions are crucial, they alone do not ensure profitable operational decisions based on these estimates. Equally important is the sophistication of the subsequent optimization problem in capturing key operational trade-offs.

The objectives of this thesis are to:

- provide an introduction into discrete choice and ML models and their estimation methods;
- review and classify studies that compare the performance of classical choice models (such as MNL) vs. ML models with regard to suitable performance criteria;
- discuss the study by Feldman et al. (2022) in detail with respect to data, models, methodology, results, managerial implications, and limitations.

Selected Literature Recommendations:

Feldman, J., Zhang, D. J., Liu, X., & Zhang, N. (2022). Customer choice models vs. machine learning: Finding optimal product displays on Alibaba. Operations Research, 70(1), 309-328.

Van Cranenburgh, S., Wang, S., Vij, A., Pereira, F., & Walker, J. (2022). Choice modelling in the age of machine learning-discussion paper. Journal of choice modelling, 42, 100340.

Wang, S., Mo, B., Hess, S., & Zhao, J. (2021). Comparing hundreds of machine learning classifiers and discrete choice models in predicting travel behavior: an empirical benchmark. arXiv preprint arXiv:2102.01130.

Topic S06: Consumer Preferences for Sustainability: the Case of Remanufactured Products

Product line design decisions are important decisions at the interface of marketing and operations that are very costly to implement and change, and are determinant for market success. In order to systematically support decision-making in this area, a number of predictive consumer behavior models (in particular based on conjoint and discrete choice analysis, see e.g. Sawtooth Software 2023) and prescriptive mathematical programming models for optimal product (line) design based on customer preference data have been developed in the last decades. In these models, a product is considered to be a bundle of buyer-relevant attributes and their levels, respectively.

In recent years sustainability has become more important and consumers have been increasingly interested in purchasing remanufactured products due to their lower prices and concerns in environmental issues. Remanufactured products are normally developed by collecting and recovering previously sold new products. Then, they are usually labelled as remanufactured and/or refurbished products and sold at lower prices with reduced environmental and social impacts.

Conjoint analysis is used to determine part-worth utilities of sustainability attributes; and typical product attributes for remanufactured products include the product's CO2 footprint reduction, quality, warranty, price and so on compared to new products.

The objectives of this thesis are to:

- introduce conjoint analysis as a tool for measuring consumer preferences for certain attribute levels;
- review the empirical literature which examine consumer preferences on remanufactured products considering economic, environmental and social attributes;
- provide open research gaps and future trends.

Selected Literature Recommendations:

Aydin, R., & Mansour, M. (2023). Investigating sustainable consumer preferences for remanufactured electronic products. Journal of Engineering Research, 11(1), 100008.

Ovchinnikov, A. (2011). Revenue and cost management for remanufactured products. Production and Operations Management, 20(6), 824-840.

Sawtooth Software (2023): Choice-Based Conjoint (CBC) Analysis, https://sawtoothsoftware.com/conjoint-analysis/cbc, last accessed on Sept. 4th, 2023.

Topic S07: Implications of Take-back Regulations on the Remanufacturing Industry

Take back regulations like Extended Producer Responsibility (EPR) are policies that require manufacturers to take responsibility for the environmental impacts of their products throughout the entire product life cycle, including after the product has reached the end of its useful life. They encourage the design of products that are more sustainable, durable, and easily recyclable and remanufacturable, leading to a more circular economy and reduced environmental impact.

Remanufacturing is the production of like-new products using components retrieved from previously used products in addition to new components. There are different aspects in the literature on remanufacturing that influence the efficiency and the environmental benefits of that. For example, remanufacturing activity comes from independent remanufacturers (IR), the original equipment manufacturers (OEM) that put the product on the market in the first place, or both. Several interesting research questions arise: How do individual and collective producer responsibility schemes compare? Does regulation always reduce environmental impact? Are regulations slowing down the introduction of new products? And so on.

The objectives of this thesis are to:

- review the literature of EPR and its influence on the remanufacturing industry;
- investigate the challenges of implementing regulations and its effect on OEM profit and sustainability;
- provide open research gaps and future trends.

Selected Literature Recommendations:

Atasu, A., & Boyaci, T. (2010). Take-back legislation and its impact on closed-loop supply chains. Wiley Encyclopedia of Operations Research and Management Science. DOI, 10, 9780470400531.

Esenduran, G., Kemahlıoğlu-Ziya, E., & Swaminathan, J. M. (2017). Impact of take-back regulation on the remanufacturing industry. Production and Operations Management, 26(5), 924-944.

Gupt, Y., & Sahay, S. (2015). Review of extended producer responsibility: A case study approach. Waste Management & Research, 33(7), 595-611

Topic S08: Sustainable Product Design Approaches for a Circular Economy – with Applications to the Case of Fairphone

Sustainable Product Design for a Circular Economy entails designing products with end-of-life considerations, ensuring that products and their components can be easily repaired, recovered, re-used, or recycled. This concept is crucial in addressing pressing global challenges like climate change, resource depletion and increasing amounts of waste. By adopting circular design principles, businesses can drive innovation, cost savings, and competitive advantage. Consumers benefit from longer-lasting, more repairable products. Ultimately, Sustainable Product Design for a Circular Economy offers a pathway to a more sustainable future, promoting economic growth, social equity, and environmental stewardship.

At Fairphone, circularity is core to their mission of creating a fairer, more sustainable electronics industry. Their modular design philosophy ("design for R") ensures easy repair and upgradeability, extending product lifespan and facilitating reuse, repair, refurbishment, and recycling. Fairphone also prioritizes responsible material sourcing and operates a Buyback program to encourage refurbishment of old devices. By advocating for systemic change, Fairphone leads the charge to-wards a more circular and sustainable electronics sector.

The objectives of this thesis are to:

- motivate why we need to rethink the current approach how to design our products and the underlying supply chain from a linear to a circular system;
- define the term "sustainable product" and discuss the common design strategies to make our products more sustainable;
- introduce conjoint analysis and conjoint-based product design models and discuss how they can provide decision support for designing sustainable products;
- review Fairphone's business model, including its product and supply chain design, customer value proposition, economic viability and environmental performance;
- discuss how sustainable business models in the electronics industry in general and Fair-phones business model in particular might look like in the future, and what research can contribute.

Selected Literature Recommendations:

Barros, M., & Dimla, E. (2021). From planned obsolescence to the circular economy in the smartphone industry: An evolution of strategies embodied in product features. Proceedings of the Design Society, 1, 1607-1616. Link

Sánchez, D., Proske, M., & Baur, S. J. (2022). Life Cycle Assessment of the Fairphone 4. In Fraunhofer IZM. https://www.fairphone.com/wp-content/uploads/2023/08/Fairphone_4_TWS-earbuds_LCA_for-public-sharing.pdf

Smith, N. C., & Duke, L. (2023). Fairphone 3: Commercializing Radical Sustainability [Case Reference No. 723-0002-1]. INSEAD. https://www.thecasecentre.org/products/view?id=188791.

Steiner, W. J., & Hruschka, H. (2002). A probabilistic one-step approach to the optimal product line design problem using conjoint and cost data. Review of Marketing Science Working Paper, 441.

Suzanne, E., Absi, N., & Borodin, V. (2020). Towards circular economy in production planning: Challenges and opportunities. European Journal of Operational Research, 287(1), 168-190

Note: Suitable cases will be provided by the chair based on request.

Topic S09: Sustainable Fashion: Strategies for Achieving Environmental and Social Responsibility in the Fashion Industry

The fashion industry is one of the largest contributors to environmental degradation and social injustice worldwide. As consumer awareness of sustainability issues grows, there is increasing pressure on fashion brands and retailers like Zara or Zalando to adopt more responsible practices throughout their supply chains. This proposal seeks to investigate strategies for promoting sustainability in the fashion industry, with a focus on environmental conservation, social equity, and economic viability.

The objectives of this thesis are to:

- analyze the environmental and social impacts of the fashion industry, including issues such as textile waste, water pollution, carbon emissions, and labor exploitation;
- explore current trends and initiatives in sustainable fashion, including eco-friendly materials, circular economy models, and fair labor practices;
- review predictive or prescriptive analytics models from the academic literature providing recommendations for fashion companies to improve sustainability across their value chains;
- assess consumer perceptions and behaviors regarding sustainable fashion, including factors influencing purchasing decisions and willingness to pay for sustainable products;
- examine the role of fashion brands, policymakers, and other stakeholders in driving sustainable practices and fostering industry-wide change.

Selected Literature Recommendations:

Denizel, M., & Schumm, C. Z. (2024). Closed loop supply chains in apparel: Current state and future directions. Journal of Operations Management, 70(2), 190-223.

Long, X., & Nasiry, J. (2022). Sustainability in the fast fashion industry. Manufacturing & Service Operations Management, 24(3), 1276-1293.

Pucker, K. P. (2022). The Myth of Sustainable Fashion. Harvard Business Review. Retrieved from Harvard Business Review. https://hbr.org/2022/01/the-myth-of-sustainable-fashion

Zanjirani Farahani, R., Asgari, N., & Van Wassenhove, L. N. (2022). Fast fashion, charities, and the circular economy: challenges for operations management. Production and Operations Management, 31(3), 1089-1114.

Lee, H., Keh, E., & Tang, C. S. (2020). Upcycling in the Circular Economy: Novetex Upcycling Spinning Mill in Hong Kong. HBS Case No. GS93-PDF-ENG. Stanford Graduate School of Business. https://hbsp.harvard.edu/product/GS93-PDF-ENG

McKinsey & Company (2020): Fashion on climate: How the fashion industry can urgently act to reduce its greenhouse-gas emissions, https://www.mckinsey.com/industries/retail/our-insights/fashion-on-climate

Note: Suitable cases will be provided by the chair based on request.

Topic S10: Literature Review on Smart Charging of Electric Vehicles

Electric vehicles represent a transformative force in urban mobility that may offer an eco-friendly alternative to traditional vehicles in terms of CO2 emissions. However, prevailing charging practices, characterized by charging batteries at maximum speed upon plugging in, have elicited concerns among experts. This approach may incur unnecessary costs and emissions due to fluctuations in the marginal cost of electricity generation and associated emissions throughout the day. To address these challenges and achieve significant cost and emission reductions, researchers are increasingly focusing on smart charging methods such as battery-swapping and vehicle-to-grid (V2G) technologies. In the battery-swapping business model, service providers lease fully charged batteries to vehicle owners through swapping them with depleted ones. V2G technology allows electric vehicle batteries to store power for the grid, thereby aiding in grid stability against short-term demand and generation fluctuations (Mak, 2022). By achieving the following objectives, this thesis seeks to contribute to a deeper understanding of smart charging practices for electric vehicles and provide valuable insights for stakeholders in the electric mobility sector.

The objectives of this thesis are to:

- conduct a comprehensive review of the literature on smart charging methods for electric vehicles;
- summarize the various business models proposed in the literature for utility firms and electric vehicle owners in terms of their mechanisms, benefits, and challenges;
- identify and discuss open research gaps and future trends in the field.

Selected Literature Recommendations:

Bjørndal, E., Bjørndal, M., Bøe, E. K., Dalton, J., & Guajardo, M. (2023). Smart home charging of electric vehicles using a digital platform. Smart Energy, 12, 100118.

Ensslen, A., Ringler, P., Dörr, L., Jochem, P., Zimmermann, F., & Fichtner, W. (2018). Incentivizing smart charging: Modeling charging tariffs for electric vehicles in German and French electricity markets. Energy research & social science, 42, 112-126.

Mak, H. Y. (2022). Enabling smarter cities with operations management. Manufacturing & Service Operations Management, 24(1), 24-39.

Topic S11: Towards Sustainable Skies: Innovations in Airline Operations for Environmental Conservation

In an era marked by growing concerns over climate change and environmental sustainability, the aviation industry faces increasing pressure to minimize its carbon footprint and adopt more eco-friendly practices. This thesis seeks to explore strategies and initiatives aimed at making airline operations more sustainable. By examining concepts, models, and real-world cases, the aim is to shed light on innovative approaches that can mitigate the environmental impact of air travel while ensuring the industry's viability in the long term.

This research will employ a mixed-method approach, combining qualitative and quantitative analysis. Data shall be gathered from scholarly articles, industry reports, case studies, and – if possible – interviews with industry experts. The qualitative analysis will involve thematic coding to identify key themes and trends in sustainable airline operations, while quantitative analysis will focus on assessing the environmental and economic impacts of various sustainability initiatives.

The objectives of this thesis are to:

- analyze current challenges and environmental impacts associated with traditional airline operations;
- explore conceptual frameworks and models in the literature for integrating sustainability into airline operations;
- examine real-world case studies of airlines implementing sustainable practices successfully;
- identify key strategies, best practices and major challenges for making airline operations more sustainable.

Selected Literature Recommendations:

Dodd, T., & Yengin, D. (2021). Deadlock in sustainable aviation fuels: A multi-case analysis of agency. Transportation Research Part D: Transport and Environment, 94, 102799.

Krömer, M. M., Topchishvili, D., & Schön, C. (2024). Sustainable airline planning and scheduling. Journal of Cleaner Production, 434, 139986.

Toffel, M., & Riedel, R. (2024): Decarbonizing Aviation with McKinsey, Climate Rising – Harvard Business School Business & Environment Initiative, https://www.hbs.edu/environment/podcast/Pages/podcast-details.aspx?episode=7133431465

Walker, T., Bergantino, A. S., Sprung, N., & Loiacono, L. (2019). Sustainable Aviation. Cham: Springer Nature Switzerland.

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World Economic Forum & McKinsey (2020): Clean Skies for Tomorrow – Sustainable Aviation Fuels as a Pathway to Net-Zero Aviation, Insight Report, November 2020, https://www3.weforum.org/docs/WEF_Clean_Skies_Tomorrow_SAF_Analytics_2020.pdf

Zhao, X., Ke, Y., Zuo, J., Xiong, W., & Wu, P. (2020). Evaluation of sustainable transport research in 2000–2019. Journal of cleaner production, 256, 120404.

Topic S12: Airport Operations Management: Challenges, Decision Support Tools, and Cases

Airports are complex environments, with decision-making processes divided among numerous authorities, and many stakeholders pursuing their own interests. Airport operations play a critical role in the aviation industry, serving as key hubs for passenger travel, cargo transportation, and aircraft maintenance. However, airports face numerous challenges in managing their operations efficiently, effectively and sustainably. This thesis proposal aims to explore the challenges faced by airports, the analytics tools available to address these challenges, and real-world cases (e.g. from Lomdon Heathrow, Europe's busiest international airport) that demonstrate innovative solutions in airport operations.

The objectives of this thesis are to:

- identify and analyze the key challenges faced by airports in managing their operations, including issues such as congestion, capacity constraints, safety regulations, environmental sustainability, and customer satisfaction;
- review models, tools and technologies available to airports for optimizing their operations, including predictive and prescriptive analytics, airport management systems and air traffic control software, and automation technologies;
- examine real-world cases of airports implementing innovative solutions to address operational challenges, highlighting successful strategies and lessons learned;
- assess the impact of efficient airport operations on key performance metrics such as on-time performance, passenger throughput, revenue generation, and environmental footprint;
- develop recommendations for airports to enhance their operations based on insights gained from the analysis of challenges, tools, and cases.

Selected Literature Recommendations:

Atkin, J., Hoogeveen, H., & Stolletz, R. (2019). Airport operations management. OR Spectrum, 41, 613-614.

Brummer, F., Chéret, O., Goulmy, M., & Riedel, R. (2021, November 19). Final approach: How airports can prepare for advanced air mobility. McKinsey. https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/final-approach-how-airports-can-prepare-for-advanced-air-mobility

Chen, S., Wu, L., Ng, K. K., Liu, W., & Wang, K. (2024). How airports enhance the environmental sustainability of operations: A critical review from the perspective of Operations Research. Transportation Research Part E: Logistics and Transportation Review, 183, 103440.

Guo, X., Grushka-Cockayne, Y., & De Reyck, B. (2020). London heathrow airport uses real-time analytics for improving operations. INFORMS Journal on Applied Analytics, 50(5), 325-339.

Guo, X., Grushka-Cockayne, Y., & De Reyck, B. (2022). Forecasting airport transfer passenger flow using real-time data and machine learning. Manufacturing & Service Operations Management, 24(6), 3193-3214.

Topic S13: Flight Schedule Design under Consideration of Customer Choice Behavior

The task of the schedule design (SD) is to assign frequencies and departure times for specific routes by choosing from a set of proposed flights while aiming for the highest possible profit. Schön (2008) states that the schedule in combination with the fare conditions is the main criterion for passengers to choose an airline; similarly, Barnhart and Cohn (2004) call it the "single most important product of an airline". These arguments underline on one hand the large impact of the schedule on profitability but on the other hand, suggest to include customer behavior in the modelling approach to account for the market side. All these influences make the subproblem so complex that airlines are still challenged by using models for their schedule design and rely on a manual approach.

The objectives of this thesis are to:

- introduce schedule design models and compare the most important models;
- discuss a selected recent state-of-the-art model in detail;
- create an academical example in Excel (optional);
- provide open research gaps and future trends.

Selected Literature Recommendations:

Barnhart, C., & Cohn, A. (2004). Airline schedule planning: Accomplishments and opportunities. Manufacturing & service operations management, 6, 3-22.

Barnhart, C., & Vikrant, V. (2016). Airline Schedule Optimization, in: Belobaba, P., Odoni, A., & Barnhart, C. (Eds.). The global airline industry. John Wiley & Sons.

Schön, C. (2008). Integrated airline schedule design, fleet assignment and pricing. DSOR-Beiträge zur Wirtschaftsinformatik, 5, 73-88.

Yan, C., Barnhart, C., & Vaze, V. (2022). Choice-based airline schedule design and fleet assignment: A decomposition approach. Transportation Science, 56(6), 1410-1431.

Topic S14: Demand Forecast with Machine Learning in the Aviation Industry

Demand forecasting models are essential tools in supply chain and operations management. The aim is to predict future demand for products or services based on historical data, external factors, and various modeling techniques. In general, two main categories of models are common in practice. Firstly, time series models which base their forecast prediction on historical demand data and assume that the future will follow patterns observed in the past. Examples include moving averages and exponential smoothing. Secondly, causal models such as machine learning (ML) techniques use a wide range of features, including historical demand data and additional data sources, to make predictions. They are more flexible and can capture complex relationships in the data. Examples include decision trees, random forests, and neural networks.

In the recent work from Dodin et al. (2023), the authors discuss the challenges in forecasting aftermarket demand for business aircraft spare parts. They highlight the difficulties with intermittent demand patterns, and they apply five types of ML forecasting models. The models showed superiority on real world data from Bombardier to a traditional time series model, which is currently in use by that firm. The ML-based forecasting system has been successfully deployed to forecast over 1 billion Canadian dollars in aftermarket demand regularly.

The objectives of this thesis are to:

- provide an introduction into forecasting models, distinguish between time series models and causal models, in particular ML techniques;
- give an overview which models have been predominantly used in recent years for managing inventory;
- describe the problem that Dodin et al. (2023) face;
- elaborate how this problem is solved by Dodin et al. (2023), including the data used, the forecasting models, and the results;
- explain one ML technique used by Dodin et al. (2023) in detail and explain what other models could have been used for the same product category (rotatable or expendable);
- critically assess the contribution of Dodin et al. (2023) to theory and practice and discuss any gaps.

Selected Literature Recommendations:

Dodin, Pierre; Xiao, Jingyi; Adulyasak, Yossiri; Alamdari, Neda Etebari; Gauthier, Lea; Grangier, Philippe et al. (2023): Bombardier Aftermarket Demand Forecast with Machine Learning. INFORMS Journal on Applied Analytics, Article inte.2023.1164. DOI: 10.1287/inte.2023.1164.

Topic S15: Optimizing Personnel Scheduling for Improved Business Processes and Employee Satisfaction

Effective personnel scheduling plays a crucial role in the success of any organization, particularly in service-oriented industries such as healthcare, retail, hospitality, and transportation. Efficient scheduling not only ensures adequate coverage but also promotes employee satisfaction, productivity, and well-being. This thesis seeks to explore the importance of personnel scheduling and present optimization models and strategies for optimizing scheduling processes to meet organizational goals while considering employee preferences and work-life balance.

After reviewing relevant approaches, a suitable model shall be applied to the case of Donatus, a pharmacy in Berlin that encountered a personnel scheduling problem in March 2017. The pharmacy's key activity was serving customers in-store with ready-made medication. These services had to be offered during regular opening hours, on occasional Sundays, and during pre-assigned emergency-service shifts. In addition, customer-specific formulations had to be prepared, and certain office duties had to be performed. A particular aspect of the problem was that, in addition to differences in the employment contracts, the employees' preferred attendance times had to be considered. Although the issue was presented as an operational problem, long-term considerations of determining the cornerstones of the employment contracts should be addressed.

The objectives of this thesis are to:

- examine the significance and common challenges of personnel scheduling in various industries and its impact on organizational performance;
- explore different approaches and technologies for optimizing personnel scheduling, including the use of scheduling software, prescriptive analytics/optimization, and employee-centric scheduling practices;
- develop practical recommendations for the case of Donatus pharmacy by suggesting a suitable optimization model and implementing/solving it e.g. in Excel or AMPL.

Selected Literature Recommendations:

Haehling von Lanzenauer, C., & Pohl, O. (2018). Donatus Pharmacy: Personnel Scheduling with Employee Preferences. Case Study. Ivey Publishing, HBS Case #W18744, https://hbsp.harvard.edu/product/W18744-PDF-ENG.

Van den Bergh, J., Beliën, J., De Bruecker, P., Demeulemeester, E., & De Boeck, L. (2013). Personnel scheduling: A literature review. European journal of operational research, 226(3), 367-385.

Xu, S., & Hall, N. G. (2021). Fatigue, personnel scheduling and operations: Review and research opportunities. European Journal of Operational Research, 295(3), 807-822.

Topic S16: Transforming Service Operations and the Customer Experience with AI

Artificial Intelligence (AI) can significantly aid service operations management in various ways, optimizing processes, reducing costs, and improving efficiency. Examples from professional services and service shops industries include:

1. **Demand Forecasting**: AI algorithms can analyze historical data, market trends, and other factors to forecast demand more accurately. This enables businesses to optimize inventory levels, production schedules, and resource allocation.
2. **Process Automation**: AI-driven robotic process automation (RPA) can automate repetitive tasks, such as data entry and invoice processing, freeing up human resources for more strategic activities.
3. **Resource Optimization**: AI algorithms can optimize resource allocation, such as workforce scheduling and energy usage, to minimize costs while meeting operational requirements.
4. **Customer Service**: AI-powered chatbots and virtual assistants can handle customer inquiries and support requests, providing round-the-clock assistance and improving customer satisfaction.
5. **Performance Monitoring and Analysis**: AI-powered analytics tools can monitor key performance indicators (KPIs) in real-time and identify areas for improvement, enabling faster decision-making and continuous optimization.

Overall, AI can play a transformative role in service operations management by enabling data-driven decision-making, automation of routine tasks, and optimization of processes across the entire value chain.

The objectives of the thesis are to:

- broadly review the application areas of AI in Service Operations Management based on a literature review;
- select a specific domain/industry and discuss applications in detail;
- discuss a related case study of your choice (to be agreed upon with supervisor) from https://hbsp.harvard.edu/ in this context. Example cases (Commonwealth Bank, Lemonade, WeWork) are mentioned below.
- discuss how AI might impact existing and create new service business models in the future.

Selected Literature Recommendations:

Iansiti, M., & Lakhani, K. R. (2020). Competing in the age of AI: Strategy and leadership when algorithms and networks run the world. Harvard Business Press.

Sampson, S. E., & dos Santos, R. P. (2023). Reengineering professional services through automation, remote outsourcing, and task delegation. Journal of Operations Management, 69(6), 911-940.

Spring, M., Faulconbridge, J., & Sarwar, A. (2022). How information technology automates and augments processes: Insights from Artificial-Intelligence-based systems in professional service operations. Journal of Operations Management, 68(6-7), 592-618.

Doumpos, M., Zopounidis, C., Gounopoulos, D., Platanakis, E., & Zhang, W. (2023). Operational research and artificial intelligence methods in banking. European Journal of Operational Research, 306(1), 1-16.

Case Study Examples

Lakhani K.R., Grushka-Cockayne, Y., Paik, J.H. & Randazzo, S.: Customer-Centric Design with Artificial Intelligence: Commonwealth Bank, Case No. 622065, Harvard Business School Publishing

Ofek, E. & Golan D. (2019): Lemonade: Disrupting Insurance with Instant Everything, Killer Prices, and a Big Heart, Case No. 520020, Harvard Business School Publishing

Ulaga, W., Carmon, Z. & Heely, L. (2020): Lemonade: Delighting Insurance Customers with AI and Behavioural Economics - A Disruptive InsurTech Business Model for Outstanding Customer Experience and Cost-Effective Service Excellence, Case No. IN1673, Harvard Business School Publishing

Ulaga, W., Niessing, J., & Brandwein, N. J. (2019). WeWork - Service excellence through business model innovation: Creating outstanding customer experiences by leveraging data, analytics and digital technologies. Case No. IN1584, Harvard Business School Publishing

Note: Suitable cases will be provided by the chair based on request.

Topic S17: Managing Customer-Induced Variability in Services

Customers impose considerable variability on the operating systems of service organizations. They show up when they wish (arrival variability), they ask for different things (request variability), they vary in their willingness and ability to help themselves (effort and capability variability), and they have different preferences (subjective preference variability). On the one hand, variability may be desirable from a customer perspective if customization is valued. On the other hand, variability often leaves the front lines of many service organizations struggling to deliver consistent, high-quality service.

These challenges were visible for example in the Eastern Lotus Bank in 2019. At this time, the general manager of the Xiamen branch of Eastern Lotus Bank was facing difficulties overcoming customer-introduced variability, which significantly influenced the efficiency of the bank's front-office service. She needed to analyze and summarize the different types of customer-introduced variability. Then she had to identify potential strategies that would enable the bank to accommodate this customer-introduced variability while maintaining a high-quality customer service experience. She also needed to decide how to allocate and arrange the limited human resources at the bank efficiently and effectively. To make these decisions, she had to systematically evaluate the efficiency and effectiveness of the front office under both pooled- and separated-resource allocation scenarios. For instance, how long did customers have to wait for services in each different resource allocation scenario? Moreover, how well were the limited human resources (staff) utilized under each scenario?

The objectives of the thesis are to:

- review the academic literature with regard to different types of variability that service providers typically need to manage;
- explore suitable tools such as queuing theory and simulation as well as common strategies to manage variability in service systems;
- apply the concepts and tools to analyze the case of Eastern Lotus Bank (Wu, Pun & Zhu 2019) and make recommendations on how to improve the service.

Selected Literature Recommendations:

Buell, R. W., Campbell, D., & Frei, F. X. (2021). The customer may not always be right: Customer compatibility and service performance. Management Science, 67(3), 1468-1488.

Wu, C., Pun, H., & Zhu, X. (2019). Eastern Lotus Bank, Xiamen: Service Operations Management. Ivey Publishing Case Study, Harvard Business Publishing Case No. W19319. https://hbsp.harvard.edu/product/W19319-PDF-ENG

Frei, F. X. (2006). Breaking the trade-off between efficiency and service. Harvard business review, 84(11), 92.

Sampson, S. E., & Chase, R. B. (2022). Optimizing customer involvement: how close should you be to your customers?. California Management Review, 65(1), 119-146.

Secchi, E., Roth, A., & Verma, R. (2019). The impact of service improvisation competence on customer satisfaction: evidence from the hospitality industry. Production and Operations Management, 28(6), 1329-1346.

Wirtz, J., & Zeithaml, V. (2018). Cost-effective service excellence. Journal of the Academy of Marketing Science, 46, 59-80.

Topic S18: Activity Sequencing and Selection for Designing Memorable Service Experiences

Putting customer experience at the heart of service design has become a governing principle of today's experience economy. Echoing this principle, the article by Li et al. (2022) addresses a service designer's problem of how to select and sequence activities in designing a service package. Empirical literature shows an ideal sequence often entails an interior peak; that is, the peak (i.e., highest-utility) activity is placed neither at the beginning nor the end of the package. Theoretic literature, by contrast, advocates placing the peak activity either at the beginning or at the end. The article in focus bridges this gap by developing a theory accounting for interior peaks and modeling the activity sequencing and selection problem as a nonlinear optimization problem. It also provides managerial implications for activity sequencing and selection.

The objectives of this thesis are to:

- explain the problem addressed by the paper and motivate its relevance;
- position the paper in the corresponding stream of scientific literature, and provide a literature review for it;
- explain model and methodology incl. the underlying theory and examples for practical implications;
- critically assess the paper's contribution to theory and practice, discuss its limitations, and provide a future outlook.

Selected Literature Recommendations:

Li, Y., Dai, T., & Qi, X. (2022). A theory of interior peaks: Activity sequencing and selection for service design. Manufacturing & Service Operations Management, 24(2), 993-1001.

Kahneman, D., & Riis, J. (2005). Living, and thinking about it: Two perspectives on life. In: Huppert, F. A., Baylis, N., & Keverne, B. (Eds.). The science of well-being. Oxford University Press, Chapter 11, 285-304.

Topic S19: Transforming Business Models through Servitization

Servitization, the transformation of traditional product-centric businesses into service-oriented organizations, has emerged as a strategic imperative for firms seeking to enhance competitiveness and capture additional value. Under some conditions, servitization can be a win-win for both, profitability and the environment. This seminar thesis proposal aims to explore the concept of servitization, its drivers, challenges, and implications for businesses in various industries. For example, Rolls-Royce, a renowned aerospace and defense company, has shifted its business model from selling aircraft engines to offering "Power by the Hour" services, where customers pay for engine usage rather than ownership. This servitization approach allows Rolls-Royce to provide maintenance, repair, and overhaul services, ensuring optimal engine performance while generating recurring revenue streams. Other examples of firms that have embraced servitization to transition from product-centric to service-oriented business models include Xerox, Caterpillar, Philips, Bosch, and Michelin.

The objectives of this thesis are to:

- provide an overview of the concept of servitization, including its definition, evolution, and theoretical foundations;
- explore the literature and case studies for drivers and motivations behind servitization, as well as the challenges and barriers that firms may face when implementing servitization strategies;
- review the literature on quantitative models that analyze the implications of servitization for business models, value propositions, profitability and the environment (e.g., Agrawal & Bellos 2017, Örsdemir et al. 2019);
- discuss one of the models in detail including its assumptions, managerial insights, and limitations;
- discuss future research opportunities in the field from an Operations Management perspective.

Selected Literature Recommendations:

Abdelkafi, N., Pero, M., Masi, A., & Capurso, I. (2022). Revisiting the servitization-sustainability link: a case study in the professional printing supply chain. Cleaner Logistics and Supply Chain, 4, 100061.

Agrawal, V. V., & Bellos, I. (2017). The potential of servicizing as a green business model. Management Science, 63(5), 1545-1562.

Örsdemir, A., Deshpande, V., & Parlaktürk, A. K. (2019). Is servicization a win-win strategy? Profitability and environmental implications of servicization. Manufacturing & Service Operations Management, 21(3), 674-691.

Resta, B., Gaiardelli, P., Cavalieri, S., & Dotti, S. (2017). Enhancing the design and management of the product-service system supply chain: an application to the automotive sector. Service Science, 9(4), 302-314.

Rothenberg, S. (2007). Sustainability through servicizing. MIT Sloan management review.

Topic S20: Multi-Objective Curricular Optimization

Curricular optimization is the process of designing academic programs or course schedules to maximize certain objectives, such as student performance, resource utilization, or institutional efficiency. It involves selecting courses, arranging schedules, and managing resources to meet various criteria and constraints. Most of these problems are very difficult to solve as many stakeholders are involved. Specifically, the personalized student course plan problem (PSCP) is a challenge in academic advising and course scheduling faced by educational institutions. It involves creating an optimized sequence of courses tailored to each individual student's academic goals, constraints, and preferences. The PSCP aims to optimize several objectives simultaneously, which may include minimizing time to degree, balancing course difficulty, and maximizing academic performance.

The recent study by Ionnis et al. (2024) takes a deep dive into the challenges faced by students at the American College of Greece. Ionnis et al. (2024) tackle this problem with a mixed-integer linear programming formulation, with binary variables representing each student's course selection and an aggregated objective function. Ioannis demonstrates that the proposed approach can efficiently solve the optimization problem and provide optimal or near-optimal course schedules for students. They compare the algorithm to the manual advising process, which was time consuming and often resulted in suboptimal schedules.

The objectives of this thesis are to:

- provide an introduction into curricular optimization;
- give an overview over other studies that are similar to the approach of Ionnis et al. (2024);
- discuss the approach of the paper and evaluate if another approach for multi objective optimization would be more suitable;
- critically assess the limits of your findings and outline any research gaps.

Selected Literature Recommendations:

Christou, Ioannis T.; Vagianou, Evgenia; Vardoulias, George (2024): Planning Courses for Student Success at the American College of Greece. In INFORMS Journal on Applied Analytics, Article inte.2022.0083. DOI: 10.1287/inte.2022.0083.

Ünal, Yusuf Ziya; Uysal, Özgür (2014): A new mixed integer programming model for curriculum balancing: Application to a Turkish university. In European Journal of Operational Research 238 (1), pp. 339–347. DOI: 10.1016/j.ejor.2014.03.015.

Deb, K. (2021). Evolutionary Computation: An Emerging Framework for Practical Single and Multicriterion Optimization and Decision Making. In Tutorials in Operations Research:

Emerging Optimization Methods and Modeling Techniques with Applications (pp. 255-286). INFORMS. https://pubsonline.informs.org/doi/abs/10.1287/educ.2021.0231