**Service Operations Research Seminar FSS 2025 (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 **Nov. 8th** and ends on **Nov. 22nd, 2024**.

6. **Admission** to the seminar is **binding** and will be confirmed by E-mail by **Nov. 29th, 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, **Dec 4th 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 **Apr. 19th (2025),** 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 May 6th (2025),** 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 one week before the regular final presentations, i.e., on **Apr. 29th** (in SO 318). 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 meeting, we will provide some guidance and resources 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 and Dynamic Pricing – Recent Advances and Selected Models in the Age of AI

This seminar explores the evolving landscape of Revenue Management (RM) and Dynamic Pricing (DP), highlighting recent advancements and cutting-edge models in the age of artificial intelligence (AI). As industries increasingly rely on AI-driven approaches to predict consumer behavior, optimize pricing, and enhance decision-making, this work will delve into innovative models that integrate AI based methods into revenue management and dynamic pricing decisions. How are AI and data-driven techniques transforming RM practices and models across sectors different industries and applications? What are the advantages or disadvantages of emerging technologies over established ones?

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 AI-based approach within RM/DP, focusing on the model/method, advantages, limitations, and applications;
- suggest extensions of the selected approach;
- assess any gaps between the specific approach in the academic literature and the practical needs 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.

Famil Alamdar, P., & Seifi, A. (2023). Dynamic pricing of differentiated products under competition with reference price effects using a neural network-based approach. Journal of Revenue and Pricing Management, 1-13.

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.

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

## Topic S03: Revenue Management in Sports and Live Entertainment

Revenue management (RM) is essential to the financial success of sports and live entertainment (SLE) industries, where ticket pricing, attendance, and demand fluctuations directly impact profitability. However, RM in the sports and live entertainment sectors faces unique challenges due to highly variable demand, seasonality, and consumer behavior. A recent example of these complexities—and the consequences of mismanaging demand—was the 2022 ticket sale for Taylor Swift's "The Eras Tour." The massive ticket demand overwhelmed systems, leading to customer dissatisfaction, scalping, and lost revenue opportunities. This debacle highlighted the need for sophisticated revenue management and dynamic pricing strategies that can handle high-demand events and balance profitability with a positive fan experience. This seminar thesis will explore the tools and techniques that sports franchises, concert promoters, and entertainment venues use to optimize revenue. The study will focus on dynamic pricing models, customer segmentation, inventory management, and AI-driven demand forecasting. By analyzing these methods in real-world settings, the thesis will identify best practices for managing pricing and capacity at large-scale events. Additionally, it will examine how analytics can provide insights into customer preferences and spending behavior, helping organizations maximize revenue while maintaining fan engagement and experience.

The objectives of the thesis are to:

- review the opportunities and challenges of RM in sports and live entertainment;
- review and classify existing predictive and prescriptive analytics approaches in RM in SLE, 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 RM-SLE approach, focusing on the model/method, advantages, limitations, and applicability in the real world;
- suggest extensions of the specific approach.

**Selected Literature Recommendations:**

Arslan, H. A., Tereyağoğlu, N., & Yılmaz, Ö. (2023). Scoring a touchdown with variable pricing: Evidence from a quasi-experiment in the NFL ticket markets. Management Science, 69(8), 4435-4456.

Banciu, M., Hinterhuber, A., & Ødegaard, F. (2023). Revenue management in sports, live entertainment and arts. Journal of Revenue and Pricing Management, 22(3), 185-187.

Yılmaz, Ö., Easley, R. F., & Ferguson, M. E. (2023). The future of sports ticketing: Technologies, data, and new strategies. Journal of Revenue and Pricing Management, 22(3), 219-230.

## Topic S04: Smart "Predict, then Optimize"

Real-world optimization problems generally require a combination of predictive analytics and prescriptive analytics (optimization). The prediction or estimation task and the optimization task are commonly two distinct stages carried out sequentially in a so-called predict-then-optimize approach (see, e.g., Bertsimas and Kallus, 2020; Qi and Shen, 2022):

- Prediction stage: The prediction task typically comes first, where statistical or machine learning models are used to make point predictions or distributional estimates of unknown parameters relevant to the decision problem, such as cost, demand, or supply levels. Although typically not framed as an optimization task, the estimation itself is also based on an optimization model that aims to minimize the error between the predicted values and the actual outcomes. For example, ordinary least squares regression minimizes the sum of squared errors, which is an optimization problem.
- Optimization Stage: Once the predictions are made, the final optimization model is solved to determine the best decisions based on the forecasted values. This model typically aims to maximize or minimize a specific objective function, subject to various constraints.

The sequential predict-then-optimize framework has been widely employed in theory and practice. It is straightforward and modular, allowing separate model improvements and easy implementation with off-the-shelf prediction and optimization tools. However, building the predictive model without considering how the predictions will be used in the optimization step also bears some disadvantages. In particular, the sequential optimization may result in suboptimal decisions since the predictive model is not optimized for the downstream decision problem. Therefore, improving prediction accuracy in a classical sense may adversely affect the optimization outcomes (see, e.g.; Qi and Shen, 2022).

Due to the above mentioned limitations of the classical predict then-optimize approach, more integrative approaches have recently gained increasing interest in the literature (see, e.g., Qi and Shen, 2022 for a recent review). For example, instead of predicting the input parameters for the optimization model in the classical way, some researchers have suggested to optimize the prediction model directly with respect to the objective of the final downstream decision (see, e.g., Elmachtoub and Grigas, 2022). In this so-called Smart Predict-then-Optimize (SPO) approach, the ultimate optimization objective and even constraints are incorporated into the error function used during the prediction phase, such that the predictive model minimizes the decision-making error rather than a purely statistical prediction error.

The objectives of this thesis are to:

- review and classify the literature on approaches aiming to integrate prediction and optimization, and discuss pros and cons compared to the classic predict-then-optimize approach;

- focus on a selected model (e.g., Elmachtoub and Grigas, 2022), and discuss it in detail, including a critical assessment of assumptions and limitations;
- identify future research opportunities for integrating prediction and optimization.

**Selected Literature Recommendations:**

Elmachtoub, A. N., & Grigas, P. (2022). Smart “predict, then optimize”. Management Science, 68(1), 9–26

Qi, M., & Shen, Z.-J. (2022). Integrating prediction/estimation and optimization with applications in operations management. In Tutorials in operations research: Emerging and impactful topics in operations (pp. 36–58). INFORMS

## Topic S05: 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 S06: Discrete Choice vs. Machine Learning Demand Models in Revenue Management, Pricing 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.

## Topic S07: 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:**

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 S08: 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:**

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.

**Topic S09: Sustainable Product Design Approaches for a Circular Economy – Fairphone vs. Apple's iPhone**

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. For example, 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. In contrast, Apple iPhones can be traded-in and potentially remanufactured or recycled, but the design does not allow users easily to repair the phone or replace batteries easily by themselves. For example, the batteries in iPhones are sealed, which makes it difficult for consumers to replace them without professional assistance. This design choice may unnecessarily limit the lifespan of their products and contribute to increased electronic waste, as consumers are often forced to replace entire devices rather than simply changing out a degraded battery. However, recent EU regulations mandate that all smartphones, including iPhones, must have user-replaceable batteries by 2027. Furthermore, customers might value earlier efforts of Apple to make its iPhone more sustainable.

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, and provide an overview of most common product lifetime extension (PLE) strategies;
- review and compare Apple's and Fairphone's business models, in particular their mobile phone product design and PLE strategy, customer value proposition, economic viability and environmental performance;
- survey the operations literature (leading academic journals, such as INFORMS journals, European Journal of Operational Research, Production and Operations Management, Journal of Operations Management, etc.) for model-based insights into economic and environmental performance of PLE strategies in the electronics industry, in particular trade-in programs, replacement and repair services and design-for-repair strategies;
- discuss how sustainable business models in the electronics industry 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

Bian, Y., Xie, J., Archibald, T. W., & Sun, Y. (2019). Optimal extended warranty strategy: Offering trade-in service or not?. European Journal of Operational Research, 278(1), 240-254.

Ertz, M., Leblanc-Proulx, S., Sarigöllü, E., & Morin, V. (2019). Made to break? A taxonomy of business models on product lifetime extension. Journal of Cleaner Production, 234, 867-880.

Jin, C., Yang, L., & Zhu, C. (2023). Right to repair: pricing, welfare, and environmental implications. Management Science, 69(2), 1017-1036.

Serafeim, G. (2023). Apple's iPhone Revolution: Pioneering the Circular Economy (Case No. 9-123-089). Harvard Business Publishing.
https://www.thecasecentre.org/products/view?id=193535

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

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

## Topic S10: Sustainable Fashion: Analytics for 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 analytics approaches that seek to promote sustainability in the fashion industry, with a focus on environmental conservation and social equity while preserving 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; examine the role of fashion brands, policymakers, and other stakeholders in driving sustainable practices and fostering industry-wide change;
- review predictive or prescriptive analytics models from the academic literature providing recommendations for fashion companies to improve sustainability across their value chains;
- select and discuss one model in detail, along with limitations and improvement opportunities;
- discuss gaps between theory and practice as well as future research opportunities on how analytics could help further to make fashion more sustainable.

**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

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

## Topic S11: 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:**

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

**Topic S12: Strategic Aircraft Scheduling for Competitive and Sustainable Airline Operations**

Strategic aircraft scheduling is a cornerstone of airline operations, encompassing key decisions on route selection, frequency of flights, fleet assignment, and the timing of services across a network. This thesis will explore the strategic components involved in aircraft scheduling, focusing on how airlines determine which routes to serve, optimal flight frequencies, and how best to allocate aircraft types to specific routes. These decisions are influenced by multiple factors, including demand forecasting, market competition, regulatory constraints, airport capacity, and fleet composition. Furthermore, with climate change at the forefront of global concerns, airlines are now tasked with developing strategies to reduce its environmental impact particularly related to carbon emissions. As sustainability regulations become stricter and passenger expectations evolve, there is an urgent need for strategic scheduling that reduces environmental impact while maintaining competitive service. Through a comprehensive review of airline schedule planning models, this research will analyze how airlines balance customer-orientation and operational feasibility with profitability and environmental considerations.

The objectives of this thesis are to:

- discuss the complex challenges that airlines encounter in schedule planning;
- review and classify recent analytics approaches in the literature for airline scheduling and fleet assignment; also explore approaches in the literature that integrating sustainability into airline schedule planning models;
- explain a selected model in detail, including limitations and improvement opportunities.
- Identify gaps and future research opportunities in strategic airline schedule planning on the path towards sustainable aviation.

**Selected Literature Recommendations:**

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

Lau, R., Buche, I. S., & Yeung, S. M.-C. (2018). Cathay Pacific Airways: Implementing a sustainable development strategy (Case No. ST20-PDF-ENG). Harvard Business School Publishing.

Naughton, J. (2024). Decarbonization at Ryanair: Quantifying emissions for sustainable aviation (Case No. UVA-C-2487). Darden Business Publishing.

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

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 S13: Driving Change: Leveraging Analytics for Sustainable Freight Transportation**

The global population, currently estimated at 7.6 billion, is projected to increase by roughly 50% by 2100, as forecasted by the United Nations Department of Economic and Social Affairs. This growth will amplify the demand for freight transport, which is fundamental not only for economic growth but also for ensuring social welfare. Freight, moved by multiple modes of transport—road, rail, sea, and air—serves as a critical link in global supply chains. Despite advances in efficiency and distribution, the environmental impact of freight transportation remains substantial. Greenhouse gas emissions, fuel consumption, and pollution associated with transport have spurred an urgent need for more sustainable logistics practices. Here, analytics has a significant role to play, offering powerful tools for enhancing both the sustainability and efficiency of freight transportation.

The objectives of this thesis are to:

- identify and analyze the primary challenges faced by the freight transportation sector in transitioning to greener practices, including issues related to emissions reduction, regulatory compliance, infrastructure limitations, and cost implications;
- review and classify the literature for models, tools, and technologies available for optimizing green freight logistics;
- discuss the role that analytics has played and may play in the future towards greener freight transportation, along with its limitations;
- discuss future research opportunities and practice needs.

**Selected Literature Recommendations:**

Bektaş, T., Ehmke, J. F., Psaraftis, H. N., & Puchinger, J. (2019). The role of operational research in green freight transportation. European Journal of Operational Research, 274(3), 807-823.

Moghdani, R., Salimifard, K., Demir, E., & Benyettou, A. (2021). The green vehicle routing problem: A systematic literature review. Journal of Cleaner Production, 279, 123691.

McKinsey & Co. (2024). Decarbonizing logistics: Charting the path ahead. https://www.mckinsey.com/capabilities/operations/our-insights/decarbonizing-logistics-charting-the-path-ahead

**Topic S14: Strategic Optimization in Ride-Hailing Operations: Leveraging Analytics and AI to Navigate Challenges and Explore Opportunities**

The ride-hailing industry, represented by companies like Uber and Lyft, has transformed urban transportation. Despite its growth, profitability remains elusive due to high operational costs, regulatory challenges, and intense competition. This thesis will investigate the strategic operations of ride-hailing services, focusing on the challenges they face and how analytics and artificial intelligence (AI) can provide solutions to enhance profitability.

The objectives of this thesis are to:

- Examine the Operational Strategies: Analyze the current operational strategies employed by leading ride-hailing companies, including pricing models, fleet management, and customer acquisition.
- Identify Key Challenges: Discuss the primary challenges hindering profitability in ride-hailing operations, such as market saturation, driver retention, regulatory compliance, and competition from traditional taxi services.
- Role of Analytics and AI: Investigate how analytics and AI can improve ride-hailing operations. This includes dynamic pricing strategies, demand forecasting, route optimization, rider-driver matching algorithms, and customer experience enhancement. Evaluate the potential impact of adopting advanced analytics and AI on key performance indicators, such as operational efficiency, customer satisfaction, and overall profitability.
- Future Opportunities: Discuss future research opportunities as well as potential innovations in the ride-hailing sector, including the integration of autonomous vehicles and new business models that leverage analytics for improved operational decision-making.

**Selected Literature Recommendations:**

Azagirre, X., Balwally, A., Candeli, G., Chamandy, N., Han, B., King, A., ... & Zamoshchin, A. (2024). A better match for drivers and riders: Reinforcement learning at Lyft. INFORMS Journal on Applied Analytics, 54(1), 71-83.

Özkan, E. (2020). Joint pricing and matching in ride-sharing systems. European Journal of Operational Research, 287(3), 1149-1160.

Sawhney, M., Shah, B., Yu, R., Rubtsov, E., & Goodman, P. (2020). Uber: Applying machine learning to improve the customer experience (Product No. KE1161-PDF-ENG).

**Topic S15: Strategic Service Facility Location: Advanced Analytics for Balancing Profitability, Customer Satisfaction, and Sustainability**

Strategic facility location decisions are vital in service industries such as retail, healthcare, transportation, and public services, where factors like customer proximity, convenience, service speed, and overall service experience significantly impact customer satisfaction and business performance. For retailers such as Apple, Amazon, and Zara, optimal placement of stores, distribution centers, and fulfillment hubs is essential to meet customer demand quickly and effectively. For instance, Apple's choice of high-traffic, iconic retail locations supports its premium brand image and customer engagement, while Amazon's extensive network of strategically placed warehouses enables rapid delivery to customers. Similarly, Zara relies on well-positioned distribution facilities to execute its fast fashion strategy, enabling quick restocking and responsiveness to market trends. Effective facility location decisions are thus essential for these companies to sustain competitive advantage and align with their unique business models. This seminar thesis will explore frameworks and analytics approaches for determining optimal locations for service facilities to balance operational efficiency with customer satisfaction and sustainability goals. It will blend theoretical models with practical applications, providing insights into the complex yet essential decision-making process behind strategic service facility locations.

The objectives of this thesis are to:

- Examine the critical factors in service facility location decision-making by analyzing industry-specific examples. This analysis aims to illustrate effective location strategies while highlighting prevalent challenges, trade-offs, and decision complexities.
- Review and classify state-of-the-art facility location optimization models; in this context, also explore how sustainability considerations such as carbon footprint assessment can be integrated into facility location planning.
- Discuss a selected state-of-the-art optimize model and solution methods in detail, including the underlying solution methods, limitations, and potential for further development.
- Identify and discuss gaps between theoretical models and practical application, suggesting areas for future research that address current challenges in facility location optimization.

**Selected Literature Recommendations:**

Carrick, A.-M., & Sosa, M. (2018). Eight Inc and Apple Retail Stores (Case No. 617-0065-1). INSEAD Business School. (Original work published 2017, revised December 19, 2018).

Farahani, R. Z., Fallah, S., Ruiz, R., Hosseini, S., & Asgari, N. (2019). OR models in urban service facility location: A critical review of applications and future developments. European journal of operational research, 276(1), 1-27.

Haket, C., van der Rhee, B., & de Swart, J. (2020). Saving time and money and reducing carbon dioxide emissions by efficiently allocating customers. INFORMS journal on applied analytics, 50(3), 153-165.

Kang, N., Shen, H., & Xu, Y. (2022). JD.com improves delivery networks by a multiperiod facility location model. INFORMS Journal on Applied Analytics, 52(2), 133-148.

Schön, C., & Saini, P. (2018). Market-oriented service network design when demand is sensitive to congestion. Transportation Science, 52(5), 1253-1275.

## Topic S16: Enhancing Railway Operations through Strategic Planning and Advanced Analytics

This seminar thesis will explore the strategic and operational challenges within railway systems, focusing on how effective planning, predictive analytics, and digital transformation can enhance efficiency and reliability in particular in long-distance passenger transport. As rail transport plays an increasingly critical role in sustainable urban and intercity mobility, the pressure to meet demand for high capacity, punctuality, and environmental sustainability has led to renewed interest in operational optimization. From timetabling and capacity management to delay management and passenger flow forecasting, advanced analytics such as optimization and machine learning present significant opportunities to improve rail operations.

The objectives of this thesis are to:

- provide an overview on the different operational planning problems of a railway service provider, from strategic decisions of network design and line planning to tactical problems like train timetabling and crew scheduling to short-term real-time control and delay management;
- explore current operational challenges of Germany's railway service provider Deutsche Bahn;
- investigate how optimization and predictive analytics/AI can improve decision-making, improve safety, and enhance customer experience.
- Explore strategies for reducing carbon emissions and energy usage through operational adjustments.

**Selected Literature Recommendations:**

Heil, J., Hoffmann, K., & Buscher, U. (2020). Railway crew scheduling: Models, methods and applications. European journal of operational research, 283(2), 405-425.

König, E., & Schön, C. (2021). Railway delay management with passenger rerouting considering train capacity constraints. European Journal of Operational Research, 288(2), 450-465.

Qi, J., Cacchiani, V., Yang, L., Zhang, C., & Di, Z. (2021). An Integer Linear Programming model for integrated train stop planning and timetabling with time-dependent passenger demand. Computers & Operations Research, 136, 105484.

Tang, R., De Donato, L., Besinović, N., Flammini, F., Goverde, R. M., Lin, Z., ... & Wang, Z. (2022). A literature review of Artificial Intelligence applications in railway systems. Transportation Research Part C: Emerging Technologies, 140, 103679.

Zhang, Y., Peng, Q., Lu, G., Zhong, Q., Yan, X., & Zhou, X. (2022). Integrated line planning and train timetabling through price-based cross-resolution feedback mechanism. Transportation Research Part B: Methodological, 155, 240-277.

**Topic S17: Enhancing Project Success: Best Practices and Cutting-Edge Techniques in Modern Project Management**

The global economic value generated by projects amounts to several trillions of dollars (Nieto-Rodriguez, 2021), representing a significant share of the world's economic activity. Moreover, in recent years, the range of applications that are managed as projects has expanded greatly, to include, for example, information technology, research and development, new product and service development, pharmaceutical development, and change management. However, only only 35% of the projects undertaken worldwide are successful (Nieto-Rodriguez, 2021), and planning projects accurately is notoriously difficult. According to the 2018 "Pulse of the Profession" study conducted by the Project Management Institute, between 2011 to 2018 only 50% of projects where completed on time and 55% were within budget. Although firms have been investing in project management techniques since the 1970s, improvements in forecasting project durations, costs, resources, and benefits have been limited. Inaccurate project forecasts continue to introduce considerable risks, impacting organizational growth opportunities, the stability of economic initiatives, and even leaders' career trajectories.

This seminar thesis will examine the challenges, best practices, and techniques associated with project management, focusing on areas such as project planning, scheduling, and risk management. The study will delve into various state-of-the-art methodologies, including agile and lean project management, advanced analytics, and predictive modeling, to assess how these tools can improve project outcomes.

The objectives of the thesis are to:

- Examine challenges, best practices, and techniques associated with project management, focusing on areas such as project planning, scheduling, and risk management.
- Discuss state-of-the-art methodologies, including agile and lean project management, advanced analytics, and predictive modeling, to assess how these tools can improve project outcomes.
- Elaborate opportunities for better project management through data-driven prediction and AI technologies. For example, examine the role of data analytics in project cost estimation, resource allocation, and risk forecasting.

**Selected Literature Recommendations:**

Browning, T. R., & Ramasesh, R. V. (2007). A survey of activity network-based process models for managing product development projects. Production and Operations Management. 16(2), 217-240.

Lieberum, T., Schiffels, S., & Kolisch, R. (2022). Should we all work in sprints? How agile project management improves performance. Manufacturing & Service Operations Management, 24(4), 2293-2309.

Lorko, M., Servátka, M., & Zhang, L. (2021). Improving the accuracy of project schedules. Production and Operations Management, 30(6), 1633-1646.

Nieto-Rodriguez, A., & Vargas, R. V. (2023). How AI will transform project management. Harvard Business Review. https://hbr.org/2023/02/how-ai-will-transform-project-management

Nieto-Rodriguez, A. (2021). The project economy has arrived. Harvard Business Review, 99(6), 38-45.

## 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:**

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 solution approach used in the paper and discuss alternative approaches to solve multi-objective optimization problems;
- 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.

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.

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