UNIVERSITY OF MANNHEIM
Business School

CHAIR OF SERVICE OPERATIONS MANAGEMENT
Prof. Dr. Cornelia Schön

Bachelor Thesis FSS 2024

"Current topics in Service Operations Management"

Topic overview

Topic B01: Discrete Choice Models with Position Bias and Social Influence

Discrete choice models represent a powerful framework for understanding how individuals make decisions in various contexts, ranging from consumer behavior to electoral preferences. These models assume that individuals select from a finite set of alternatives based on their preferences and the attributes of the alternatives. Traditionally, consumers are not assumed to be influenced by the order or way in which products are displayed, nor by social signals such as the past purchases.

Those assumptions, however, are violated in many real-world situations. For instance, supermarket profits are considerably affected not only by which products they place in shelves, but also by how those products are allocated among the shelves. This effect is named position effect, which can also be seen in search engines, where top ranked results receive more clicks than lower ranked ones, in online markets, and in online recommendations systems. Another important effect that is mostly left out is influence of social signals. People are often influenced by the choices and opinions of others in their social networks, leading to conformity or mimicking behavior. This influence can affect various decisions, from product purchases to political affiliations, and can create patterns of behavior within communities or societies. For instance, the number of downloads or views on a particular item can serve as a social signal, influencing others to follow and contribute to the item's popularity.

Not much research has been done if discrete choice models are combined with position and social effects. The paper of Abeliuk et al. (2018) is one of the first work that apply this effect in an assortment optimization setting. They show that under some conditions the social influence can have severe effects on the expected profit of a company.

The objectives of this bachelor thesis are to:

- provide an introduction into discrete choice models,
- give an overview over the empirical evidence of the effects of positional bias and social influence,
- give a summary of sources that combine discrete choice models and one of both effects,
- discuss the findings of these papers and critically assess when one of both effects should be incorporated in the decision-making process.

Basic Literature:

Abeliuk, Andrés; Berbeglia, Gerardo; Cebrian, Manuel; van Hentenryck, Pascal (2016): Assortment optimization under a multinomial logit model with position bias and social influence. *In: 4OR-Q J Oper Res 14 (1),* S. 57–75. DOI: 10.1007/s10288-015-0302-y.

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

Krumme C, Cebrian M, Pickard G, Pentland S (2012): Quantifying social influence in an online cultural market. *PloS One* 7(5):e33785. doi:10.1371/journal.pone.0033785

Topic B02: A Framework for Consumer Behavior Prediction Models for Discrete Choice

Understanding consumer behavior is crucial for businesses striving to tailor their products, services, and marketing strategies effectively. Over the years, various models have been developed to predict consumer behavior. Among these, discrete choice models have emerged as powerful tools due to their ability to capture complex decision-making processes. These models, like the multinomial logit, nested logit, mixed logit, and Markov chain models among others, provide a structured approach to analyzing individual preferences and predicting choices among a set of alternatives. By capturing the intricate trade-offs inherent in consumer decision-making processes, discrete choice models enable businesses to optimize product offerings, refine pricing strategies, and segment markets effectively. As an alternative, machine learning algorithms have gained considerable attention in recent years, as fewer assumption about consumer behavior must be made. These models can uncover complex interactions between input features and consumer behavior and might be a suitable choice in some settings but suffer from the interpretability compared to discrete choice models.

However, the choice between a specific discrete choice and machine learning model often hinges on their predictive performance on available data and the environment where it should be used. Many scholars compared different choice prediction models based on different measures. For example, the work of Berbeglia et al. (2022) compared nine different common discrete choice models for various input data. Until now no complete framework has been developed when which model should be used and what to consider.

The objectives of this bachelor thesis are to:

- provide an introduction to prediction modes for consumer behavior, focus on discrete choice models,
- give an overview how scholars compared these models empirically and discuss the findings,
- summarize, if possible, all findings in a set of rules and discuss if a holistic framework can be deducted,
- critically assess the limits of the rules and outline any research gaps.

Basic Literature:

Berbeglia, Gerardo; Garassino, Agustín; Vulcano, Gustavo (2022): A Comparative Empirical Study of Discrete Choice Models in Retail Operations. In: *Management Science* 68 (6), S. 4005–4023. DOI: 10.1287/mnsc.2021.4069.

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

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

Topic B03: Evaluation of Choice-Based Conjoint Analysis Tools for Predicting Discrete Choices

Conjoint analysis stands as a cornerstone methodology in market research, product design, and consumer behavior analysis, offering valuable insights into individuals' preferences and decision-making processes. By systematically decomposing products or services into attributes and levels, conjoint analysis allows researchers to quantify the relative importance of different features and predict how changes in these attributes influence consumer choices. However, as the landscape of choice modeling evolves and the complexities of decision-making phenomena become more apparent, the need for robust and versatile conjoint analysis tools tailored to discrete choice models is increasingly evident.

In recent years many new software providers offer different capabilities for conjoint studies. One prominent software provider is Sawtooth Software which offers various options for choice based conjoint studies and different estimation methods. Other providers like OptionX, conjointly or Pollfish might have the same or superior capabilities.

The objectives of this bachelor thesis are to:

- provide an introduction into conjoint analysis and discrete choice models,
- discuss which type of conjoint analysis is suited best for discrete choice models,
- create a framework on how to evaluate software to be the best choice for scholars in this field,
- evaluate different conjoint software based on this framework,
- summarize and discuss all findings,
- critically assess the limits of your findings and outline any research gaps.

Basic Literature:

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

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

Louviere, Jordan J.; Flynn, Terry N.; Carson, Richard T. (2010): Discrete Choice Experiments Are Not Conjoint Analysis. In: *Journal of Choice Modelling* 3 (3), S. 57–72. DOI: 10.1016/S1755-5345(13)70014-9.

Topic B04: 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 bachelor 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.

Basic Literature:

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.

Mandal, Jyotsna K.; Mukhopadhyay, Somnath; Dutta, Paramartha (Eds.) (2018): Multi-Objective Optimization. Evolutionary to Hybrid Framework. Singapore: *Springer Singapore,* Imprint: Springer.

Topic B05: 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 bachelor 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.
- To explore current trends and initiatives in sustainable fashion, including eco-friendly materials, circular economy models, and fair labor practices.
- To review predictive or prescriptive analytics models from the academic literature providing recommendations for fashion companies to improve sustainability across their value chains.
- To assess consumer perceptions and behaviors regarding sustainable fashion, including factors influencing purchasing decisions and willingness to pay for sustainable products.
- To examine the role of fashion brands, policymakers, and other stakeholders in driving sustainable practices and fostering industry-wide change.

Basic Literature:

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.

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 B06: 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 bachelor 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.
- To 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.
- To examine real-world cases of airports implementing innovative solutions to address operational challenges, highlighting successful strategies and lessons learned.
- To assess the impact of efficient airport operations on key performance metrics such as on-time performance, passenger throughput, revenue generation, and environmental footprint.
- To develop recommendations for airports to enhance their operations based on insights gained from the analysis of challenges, tools, and cases.

Basic Literature:

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 B07: Circular Economy – with Applications to the Furniture industry

Producer-consumer connections are dominated by the linear "take-make-dispose" model, which is approaching its limit. This is a business strategy wherein corporations mine resources to produce goods that are subsequently offered for sale to customers. The product is thrown away when it is no longer useful to the consumer. Due to the items' post-use disposal, this has resulted in massive waste creation and unsustainable raw material extraction. The use of a linear model results in emissions and landfills that harm both humans and the environment. Therefore, innovative approaches are required to satisfy consumer demands and generate revenue without endangering the lives of future generations. As costs rise due to a shortage of raw materials, businesses are increasingly becoming more conscious of the financial dangers associated with linear business models. One industry tackling this issue is the furniture cooperative, which seeks to replace the present linear business model with a circular one. The shift to a circular economy involves adjustments with the purpose of reducing waste and promoting resource reuse. The entire product line must be designed using concepts that allow for the recycling, remanufacturing, refurbishing, and, as a last resort, reuse in various cycles of production. Customers become even more crucial in such a system after the point of purchase since the items must be returned to the system after usage.

The tasks and objectives of the bachelor thesis are to:

- Provide an overview of reverse logistics related to customer returns and circular supply chains and explain the main factors influencing reverse logistics activities.
- Identify and discuss challenges and opportunities in a transition towards a circular business model.
- Review existing sustainable business models in furniture industries, including its product and supply chain design, customer value proposition, economic viability and environmental performance.

Basic Literature:

Bocken, N. M., De Pauw, I., Bakker, C., & Van Der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of industrial and production engineering, 33(5), 308-320.

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. Harvard business review, 87(9), 56-64.

Wilson, M., & Heilgenberg, K. (2023). IKEA: Becoming a Circular Business [Case Reference no. W27342]. Ivey Publishing.
https://www.thecasecentre.org/products/view?id=192104

IKEA Sustainability Report FY23 (2023)
https://www.ikea.com/global/en/images/IKEA_SUSTAINABILITY_Report_FY_23_20240125_1b190c008f.pdf

Topic B08: 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, reused, or recycled.
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 towards a more circular and sustainable electronics sector.

The tasks and objectives of the bachelor 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.
- Review Fairphone's business model, including its product and supply chain design, customer value proposition, economic viability and environmental performance.

Basic Literature:

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.

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

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.

FAIRPHONE'S IMPACT 2022 (2022). https://www.fairphone.com/wp-content/uploads/2023/10/Full-Report-Impact-Report-2022.pdf

Topic B09: Towards a Circular Business Model through Remanufacturing

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. On the one hand, remanufacturing can be a quite profitable business model towards circularity and also it could be environmentally so beneficial. On the other hand, remanufacturing demands more complex operations and resources, understanding consumer preferences is essential, and there's a risk of cannibalizing sales of new products. Additionally, incentivizing product returns and ensuring quality and compliance with regulations remain uncertain.

The tasks and objectives of the bachelor thesis are to:

- Review current industry trends in remanufacturing as well as different remanufacturing business models.
- Review some showcase examples of successful companies that have successfully embraced a circular business model through remanufacturing.
- Review and classify the academic OM literature on remanufacturing with a focus on approaches to model the impact of remanufacturing-related decisions on revenue/cost and the environment.

Basic Literature:

Abbey, J. D., Meloy, M. G., Guide Jr, V. D. R., & Atalay, S. (2015). Remanufactured products in closed-loop supply chains for consumer goods. Production and Operations Management, 24(3),488-503.

Atasu, A., Guide Jr, V. D. R., & Van Wassenhove, L. N. (2010). So what if remanufacturing cannibalizes my new product sales?. California Management Review, 52(2), 56-76.

Parker, D., Riley, K., Robinson, S., Symington, H., Tewson, J., Jansson, K., ... & Peck, D. (2015). Remanufacturing Market Study. https://www.remanufacturing.eu/assets/pdfs/remanufacturing-%20market-study.pdf

Topic B10: Consumer Preference for 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 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 tasks and objectives of the bachelor 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.

Basic Literature:

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.

Sawtoothsoftware: https://sawtoothsoftware.com/

Topic B11: 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 bachelor thesis are:

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

Basic Literature:

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.

McKinsey & Company (2023): Decarbonizing aviation: Executing on net-zero goals, https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/decarbonizing-aviation-executing-on-net-zero-goals

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.

Winston, A. (2008): Innovating for Sustainability: What's Your Heresy? Harvard Business Review, 2008, December 19. https://hbr.org/2008/12/innovating-for-sustainability-whats-your-heresy.

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 B12: 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 bachelor thesis are:

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

Basic Literature:

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 B13: Digitalization and Digital Transformation in the Finance Industry

The Finance industry has been facing major pressure in the last two years due to the covid19-pandemic, increasing inflation rates, and the Ukraine conflict. Banks and insurance companies need to adapt to strongly changing customer needs to still grow profitable under these conditions. Although initiatives for digitalization and digital transformation were already in place, their significance improved strongly during this time – both in the business and the research world. In both worlds, the two terms are often used interchangeably, although they can also be defined individually and differentiated them from each other. While digitalization is often described as digitally enabled improvements along the value chain, digital transformation refers to strategic business (model) changes taking advantage of digital progress. Both forms have a fundamental impact for the respective company changing the way it operates in the market.

The objectives of this thesis are to:

- Introduce and differentiate the terms digitalization and digital transformation;
- Identify, cluster and analyze related research topics and questions in the context of financial services / the finance industry;
- Present potential topics for future research in this area.

Basic Literature:

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

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

Nicoletti, B. (2020). Insurance 4.0: Benefits and challenges of digital transformation. Springer Nature.

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

Topic B14: Operations Research in the Finance Industry – a Research Landscape

The finance industry spans multiple businesses like banking, insurance, accounting or investing and plays an important role accounting for four percent of the German GDP. This thesis should focus on this industry and build a bridge to operations research by providing a review and overview of the corresponding research in the 21st century. By this, it should follow a systematic approach as it is for example presented by Snyder (2019). There, the author subdivided a literature review in four phases (design, conduct, analysis, and structuring & writing) and provided guiding questions for each of the phases.

The objectives of this thesis are to:

- Introduce both finance industry and operations research to set a common understanding for these fundamental terms;
- Present literature review as a research methodology and discuss how a structured approach can look like for this thesis;
- Systematically review academic literature on operations research in the finance industry since the year 2000 by following the approach elaborated before;
- Provide an outlook on open questions for future research in this field.

Basic Literature:

Braun, A., Schmeiser, H., & Schreiber, F. (2016). On consumer preferences and the willingness to pay for term life insurance. *European Journal of Operational Research*, 253(3), 761-776.

Dirnberger, E., Freese, C., Hu, M., & Urban, M. (2020). What lies beyond digital for insurance operations. *Boston Consulting Group-BCG. Featured Insights*, Boston.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of business research*, 104, 333-339.

Xing, Y., Li, L., Bi, Z., Wilamowska-Korsak, M., & Zhang, L. (2013). Operations research (OR) in service industries: a comprehensive review. *Systems Research and Behavioral Science*, 30(3), 300-353.

Topic B15: Machine Learning for the Crew Scheduling Problem

The crew scheduling problem for airlines and railways is one of the toughest challenges in integer programming due to the sheer size of feasible solutions as well as complex regulations and flight time limitations, which need to be considered in every solution. A common method in the literature is Column Generation but also Integer Programming and several heuristics are used. Machine learning has the potential to generate heuristic solutions for the crew scheduling problem in a comparatively fast time but it may not provide a guarantee for a feasible solution. This challenge is tackled by recent literature e.g. by including it in other solution methods.

The objectives of this thesis are:

- to introduce crew scheduling and the underlying basic assumptions,
- to summarize the use of machine learning in the field,
- to discuss a specific model with machine learning in detail (optional), and
- to provide open research gaps and future trends.

Basic Literature:

Gattermann-Itschert, T., Poreschack, L. M., & Thonemann, U. W. (2023): Using Machine Learning to Include Planners' Preferences in Railway Crew Scheduling Optimization. *Transportation Science*, *57*(3), 796-812.

Heil, J., Hoffmann, K., & Buscher, U. (2020): Railway crew scheduling: Models, methods and applications. *European Journal of Operational Research*, *283*(2), 405-425.

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

Tahir, A., Quesnel, F., Desaulniers, G., El Hallaoui, I., & Yaakoubi, Y. (2021): An improved integral column generation algorithm using machine learning for aircrew pairing. *Transportation Science*, *55*(6), 1411-1429

Topic B16: Flight Schedule Design under Customer Choice

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 as Barnhart, Belobaba and Odoni (2016) suggest. Lately, sustainability has been an often-discussed factor for airlines and first scheduling models take it into account.

The objectives of this thesis are:

- to review schedule design models including sustainability,
- to compare the different approaches,
- to discuss a specific model in detail,
- to provide open research gaps and future trends.

Basic Literature:

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

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

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

Noorafza, M., Santos, B. F., Sharpanskykh, A., Zengerling, Z. L., Weder, C. M., Linke, F., & Grewe, V. (2023). Airline Network Planning Considering Climate Impact: Assessing New Operational Improvements. *Applied Sciences*, *13*(11), 6722.

Topic B17: Artificial Intelligence in Fashion Retail: Trends and Potential Business Models

The fashion retail industry is undergoing an unprecedented transformation with the rise of Artificial Intelligence (AI). This shift presents challenges and opportunities for both traditional and new players in the sector. The application of AI ranges from personalizing customer experiences to optimizing supply chains and improving sustainability in the industry. At the same time vastly, different methodologies are combined in the term "AI" introducing additional complexity. Given the rapidly changing technology landscape and consumer behavior, it is important to understand the potentials and limits of AI in fashion retail. These transformations open new avenues for organizations in this space to create a host of new businesses models.

The objectives of this thesis are to:

- Introduce the use of different Artificial Intelligence methods and structure the literature.
- Provide an overview of the current research trends on AI in fashion retail, including technologies for personalizing the shopping experience and optimizing supply chains,
- develop potential business models enabled by the use of AI in fashion retail and explain selected models in detail, and
- provide open research gaps and future trends.

Basic Literature:

Dogru, A.K., Keskin, B.B. (2020). AI in operations management: applications, challenges and opportunities. *J. of Data, Inf. and Manag. 2, 67–74*.

Luce, L. (2019). Artificial Intelligence for Fashion: How AI is Revolutionizing the Fashion Industry (1st ed.). Berkeley, CA: Apress.

Huchzermeier, A., Markoff, R., Schroder, D., Seifert R. W. (2022). Zalando: A Digital Foundation for Fashion Supply Chain Success. *Harvard Business Publishing*. – Case to be provided by the chair

Mishra, P., Pillarisetty, R. (2022). A review of AI (Artificial Intelligence) tools and customer experience in online fashion retail. *International Journal of E-Business Research (IJEBR)*, *18*(2), 1-12.

Shankar, V. (2018). How artificial intelligence (AI) is reshaping retailing. *Journal of retailing*, *94*(4), vi-xi.

Topic B18: Literature Review on the Estimation of Consumer Anticipated Regret

Regret is a negative cognitive emotion that individuals experience upon comparing, ex post, the outcomes of the chosen alternative and the forgone alternative and realizing that it would have been better if they had acted differently. For example, in the case that some consumers are uncertain about their future usage of an innovative product, if they buy the innovative product and end up not using its innovative feature as much as they had expected, they may regret having wasted money and not bought a less expensive old product (Jiang et al. 2016). Extensive research has found that individuals often anticipate potential regret when making decisions to minimize future emotional losses, significantly influencing their behavior across various contexts. Building upon this finding, researchers have begun exploring how firms can integrate consumer anticipated regret into their strategies.

The objectives of this thesis are to:

- conduct a comprehensive review of empirical literature on consumer anticipated regret and summarize its impact on decision-making process,
- summarize the methodologies used in the literature to estimate consumer anticipated regret and their applications in different context,
- provide open research gaps and future trends.

Basic Literature:

Engelbrecht-Wiggans, R., & Katok, E. (2008). Regret and feedback information in first-price sealed-bid auctions. *Management Science*, 54(4), 808-819.

Filiz-Ozbay, E., & Ozbay, E. Y. (2007). Auctions with anticipated regret: Theory and experiment. *American Economic Review*, 97(4), 1407-1418.

Jiang, B., Narasimhan, C., & Turut, Ö. (2017). Anticipated regret and product innovation. *Management Science*, 63(12), 4308-4323.

Özer, Ö., Sul, I., & Şimşek, A. S. (2020). Damned if You Buy, Damned if You Wait: An Empirical Investigation of Customer Regret Under Markdown Pricing. Working Paper, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3729497.

Weng, D. (2009). Does regret explain why people search too little? A model of sequential search with anticipated regret and rejoicing. Working paper, https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=167eb3ef592d8333663d4831ee8a0c2900587b07.

Topic B19: Literature Review on Agricultural Policies Aimed at Mitigating Climate Change

The global hunger crisis persists amidst the backdrop of the COVID-19 pandemic, geopolitical conflicts, climate-related shocks, economic recessions, and escalating demands for Earth's resources. Factors such as population growth, increased longevity due to improved healthcare, and rising consumption in developing nations, have intensified the strain on food production, making agriculture more crucial than ever (Boyabatlı et al., 2022). Particularly, one important topic is the intersection between agriculture and climate change. Agriculture contributes to global warming but is also affected by this climate change. European Union provides policy support to promote more sustainable and environmentally friendly agricultural practices and help farmers combat the challenges of climate change. Puertas et al. (2023) investigate the impact of agricultural innovation efficiency on climate change by using a panel data sample of 22 European countries.

The objectives of this thesis are to:

- conduct a comprehensive review of real-world government interventions, as well as the existing literature, regarding measures to mitigate climate change and promote sustainable agricultural practices,
- summarize the governmental measures implemented in real-world agricultural practices and proposed in the literature to mitigate climate change and promote sustainable agricultural practices,
- focus on Puertas et al. (2023) by introducing the research content and critically discussing the research methods employed (i.e., data envelopment analysis (DEA), Malmquist index (MI), and the generalized method of moments (GMM)) in terms of their fundamentals, advantages, limitations, and potential alternatives,
- provide open research gaps and future trends.

Basic Literature:

Boyabatlı, O., Kazaz, B., & Tang, C. S. (2022). Agricultural Supply Chain Management Research. Springer International Publishing.

Puertas, R., Marti, L., & Calafat, C. (2023). Agricultural and innovation policies aimed at mitigating climate change. *Environmental Science and Pollution Research*, 30(16), 47299-47310.

Ray, Subhash C., Ray, Subhash C, & ProQuest. (2004). Data envelopment analysis: Theory and techniques for economics and operations research. Cambridge: Cambridge University Press.

Topic B20: Literature Review on Smart Charging of Electric Vehicles

Electric vehicles represent a transformative force in urban mobility, offering an eco-friendly alternative to traditional vehicles. 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 (Mak et al., 2013). 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).

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.

By achieving these 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.

Basic Literature:

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.

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

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.

Hildermeier, J., Kolokathis, C., Rosenow, J., Hogan, M., Wiese, C., & Jahn, A. (2019). Smart EV charging: A global review of promising practices. *World Electric Vehicle Journal*, 10(4), 80.

Topic B21: The Newsvendor Model – Review and Application to ReCellular's Closed-Loop Remanufacturing Decisions

The newsvendor model is a mathematical model with a wide range of applications, e.g., to determine optimal inventory levels in operations management or optimal booking levels in airline revenue management. The basic model is typically characterized by a perishable product with uncertain demand and a fixed price whose order size is to be determined. It assumes the situation faced by a newspaper vendor who must decide how many copies of the day's paper to stock in the face of uncertain demand and knowing that unsold copies will be worthless at the end of the day. The basic newsvendor model has been extended in many ways, e.g. by considering multiple inventory types or integrating pricing decisions.

The objective of the thesis is to review the basic Newsvendor problem in terms of its mathematical structure, solution methods, and extensions. Furthermore, in the second part of the thesis, an extension of the traditional Newsvendor model shall be applied to the ReCellular case.

In the case study, ReCellular was a large cellphone remanufacturer and ranked among the top five firms in this domain in the United States. A substantial part of its business was focused on acquiring used cellphones, remanufacturing them, and selling them to other businesses. The demand for remanufactured cellphones was uncertain. Before the demand is realized, used cellphones were acquired; after it is realized, acquired used cellphones were remanufactured. Excess quantities of used cellphones were often salvaged at a loss. To deal with the risk of unsatisfied demand for remanufactured cellphones and excess inventory of used cellphones, ReCellular acquired used cellphones in different quality conditions: high-quality, medium-quality, low-quality. High-quality phones were phones that were lightly used and required very little remanufacturing effort but were expensive to acquire. Low-quality phones were phones that were extremely worn out and often had broken parts. Although such phones were very cheap to acquire, remanufacturing them would be expensive. For medium-quality phones, the acquisition cost and remanufacturing cost was in between the high- and low-quality ones. All used cellphones were remanufactured to the same specification, sold at the same price, and customers could not tell if the remanufactured cellphone was of high, medium, or low quality before remanufacturing. ReCellular needed to determine how many used cellphones in each quality grade to acquire to meet the uncertain demand, based on the trade-off between the acquisition cost and remanufacturing cost.

Basic Literature:

Guide, V. D. R., Neeraj, K., Newman, C., & Van Wassenhove, L. N. (2005). Cellular telephone reuse: The ReCellular Inc. case. In: Flapper S. D. P., van Nunen, J. A. E.E., & Van Wassenhove, L. N. (Ed.): Managing closed-loop supply chains, Springer, 151-156.

Mutha, A., Bansal, S., & Guide Jr, V. D. R. (2021). ReCellular Inc: Managing demand uncertainty in closed-loop remanufacturing. INFORMS Transactions on Education. https://pubsonline.informs.org/doi/epdf/10.1287/ited.2021.0254cs.

Qin, Y., Wang, R., Vakharia, A. J., Chen, Y., & Seref, M. M. (2011). The newsvendor problem: Review and directions for future research. *European Journal of Operational Research*, 213(2), 361-374.