

## Bachelor Thesis FSS 2025

### “Current topics in Service Operations Management”

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## **Topic B01: 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 bachelor 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 bachelor 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
- Critically assess your findings and provide open research gaps and future trends

### **Basic Literature:**

**Arslan, H. A., Tereyağoglu, 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 B02: From Surveys to Synthetic Respondents: Can LLMs replace consumer choice data?**

Understanding consumer preferences between alternatives is critical for optimizing many business decisions, such as pricing strategies, product assortments, and targeted marketing. Traditionally, discrete choice models, which rely on extensive consumer surveys or historical sales data, underpin such optimization procedures. However, such data collection efforts are often time-consuming, expensive, or historical data is simply not available. With the rapid advancement of large language models (LLMs) such as GPT-3.5 and GPT-4, there is growing interest in using these models as synthetic respondents to simulate consumer choices. Recent research suggests that LLMs can mirror certain aspects of human decision-making, including intertemporal preferences, behavioural biases, and perceptual judgments. This presents a promising opportunity to simulate consumer choice behavior. However, it also raises important questions about the realism, limitations, and potential biases embedded in such AI-generated data.

This thesis aims to evaluate the potential of LLMs to generate synthetic consumer choice data that can be used in optimization procedures and broader market research contexts. The study will begin with a comprehensive review of recent literature on the ability of LLMs to simulate human decision behaviour. This will be followed by an empirical experiment designed to assess how well different LLMs can reproduce realistic consumer choice patterns in specific scenarios. The findings will be critically analysed and implications for businesses and researchers will be discussed. Finally, the thesis will highlight research gaps, and directions for future investigation in this emerging area.

The objectives of the bachelor thesis are to:

- Review of literature on the use of LLMs as substitutes for human respondents in market research and behavioral decision-making studies
- Conduct an empirical study to evaluate the usefulness of generating synthetic choice data using different LLMs for optimizing business decisions
- Critically assess the findings from literature and the empirical study
- Discuss the limitations of using LLMs for consumer choice simulation in optimization contexts
- Identify open research gaps and propose future directions for applying LLMs in this way

### **Basic Literature:**

**Chen, Y., Kirshner, S. N., Ovchinnikov, A., Andiappan, M., & Jenkin, T. (2025).** A Manager and an AI Walk into a Bar: Does ChatGPT Make Biased Decisions Like We Do? *Manufacturing & Service Operations Management*, 27(2), 354–368. <https://doi.org/10.1287/msom.2023.0279>

**Goli, A., & Singh, A. (2024).** Frontiers: Can Large Language Models Capture Human Preferences? *Marketing Science*, 43(4), 709–722. <https://doi.org/10.1287/mksc.2023.0306>

**Kök, A. G., Fisher, M. L., & Vaidyanathan, R. (2008).** Assortment planning: Review of literature and industry practice. In *Retail supply chain management* (pp. 99–153). Springer.

**Li, P., Castelo, N., Katona, Z., & Sarvary, M. (2024).** Frontiers: Determining the Validity of Large Language Models for Automated Perceptual Analysis. *Marketing Science*, 43(2), 254–266. <https://doi.org/10.1287/mksc.2023.0454>

## **Topic B03: Predicting Consumer Decisions: Econometric Models vs. Neural Networks**

Recognized with the Nobel Prize in Economic Sciences in 2000, discrete choice models (DCMs) offer a theory-driven framework to analyse how individuals make choices among a set of alternatives (e.g. which product to buy, which political party to vote for, etc.). In contrast, neural networks (NNs) have emerged as a powerful, more versatile, data-driven tool capable of tackling a wide range of tasks, with their significance underscored by a recent Nobel Prize as well. Due to their ability to capture complex patterns and relationships, NNs present a potential alternative to traditional DCMs. This thesis will provide an in-depth analysis of methodologies used to estimate customer choice models, comparing traditional econometric DCM such as the multinomial logit model with neural networks. It will explore the fundamental principles behind each approach and evaluate their relative advantages and disadvantages (e.g. with regard to empirical fit, performance in downstream optimization problems, interpretability, flexibility, computational efficiency, data requirements, etc.), by reviewing the relevant literature, including empirical studies that compare DCMs and NNs in terms of predictive accuracy. Furthermore, it will investigate how the choice modelling approach influences downstream optimization problems (e.g., revenue management, product line design, pricing optimization) and examine the trade-offs between model accuracy and usability in real-world applications.

The objectives of the bachelor thesis are to:

- Explain the basics of discrete choice modeling and model estimation
- Introduce neural networks as an alternative approach to predicting consumer decisions, detailing their functioning, structure, training processes
- Conduct a literature review comparing the predictive performance of DCM and NN approaches, highlighting empirical findings on accuracy, interpretability, computational efficiency, and data requirements
- Evaluate both approaches in terms of their relative advantages and disadvantages including practical implications for downstream optimization problems
- Identify emerging trends and potential future developments in the field

### **Basic Literature:**

**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. <https://doi.org/10.1287/opre.2021.2158>

**Hillel, T., Bierlaire, M., Elshafie, M. Z. E. B., & Jin, Y. (2021).** A systematic review of machine learning classification methodologies for modelling passenger mode choice. *Journal of Choice Modelling*, 38, 100221. <https://doi.org/10.1016/j.jocm.2020.100221>

**van Cranenburgh, S., Wang, S., Vij, A., Pereira, F., & Walker, J. (2022).** Choice modelling in the age of machine learning—Discussion paper. *Journal of Choice Modelling*, 42, 100340. <https://doi.org/10.1016/j.jocm.2021.100340>

**Wang, H., Cai, Z., Li, X., & Talluri, K. (2023).** A Neural Network Based Choice Model for Assortment Optimization (arXiv:2308.05617). arXiv. <https://doi.org/10.48550/arXiv.2308.05617>

## **Topic B04: More Data, Better Predictions? Machine Learning and Consumer Choice Modeling**

Understanding consumer behaviour is crucial for businesses aiming to optimize product recommendations, refine pricing strategies, and develop targeted marketing efforts. Discrete choice models (DCMs) are widely used in this context due to their ability to capture how individuals make decisions among a finite set of alternatives. In recent years, machine learning (ML) approaches have emerged as powerful and versatile tools capable of modelling complex patterns and relationships within data. Unlike DCMs, ML models do not require strong assumptions about underlying decision-making processes, making them potentially more flexible and accurate. However, ML approaches also come with distinct challenges, particularly concerning data requirements. This thesis will investigate the fundamental principles behind both DCM and ML approaches in consumer choice prediction. It will compile and compare a selection of publicly available open-source datasets related to consumer choice (using for search e.g. [www.kaggle.com/datasets](http://www.kaggle.com/datasets), [www.datasetsearch.research.google.com](http://www.datasetsearch.research.google.com), <https://www.openml.org/>, <https://archive.ics.uci.edu/datasets/>, <https://academictorrents.com/>, <https://dataverse.harvard.edu/>, etc.). Subsequently, an appropriate ML model will be implemented and trained on one of the identified datasets to demonstrate how the size and quality of training data affects the performance of ML models in predicting discrete consumer choices.. Finally, the thesis will reflect on the differences in data requirements and data collection processes between DCMs and ML models, highlighting key challenges and opportunities.

The objectives of the bachelor thesis are to:

- Explain the fundamental ideas of discrete choice modeling and model estimation techniques
- Introduce suitable ML models as alternatives to DCM for predicting discrete consumer decisions, detailing their functioning, training processes, and data requirements
- Compile a list of open-source (and closed-source) datasets that can be used to train machine learning models for predicting purchasing decisions or recommending products, and systematically compare them
- Implement an appropriate machine learning model (e.g., in Python with SciKit-Learn or TensorFlow) to predict discrete consumer choices using one of the identified datasets
- Summarize key findings and discuss practical implications
- Suggest potential model extensions and future research directions

### **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.

**Géron, A. (2022).** Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. O'Reilly Media, Inc. <https://learning.oreilly.com/library/view/hands-on-machine-learning/9781098125967/>

**van Cranenburgh, S., Wang, S., Vij, A., Pereira, F., & Walker, J. (2022).** Choice modelling in the age of machine learning—Discussion paper. *Journal of Choice Modelling*, 42, 100340. <https://doi.org/10.1016/j.jocm.2021.100340>

## **Topic B05: 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 were 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.

The objectives of the bachelor 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

### **Basic Literature:**

**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 B06: Integrating ESG Considerations into Product and Supply Chain Design: Measurement and Impact at the Product Level**

Environmental, Social, and Governance (ESG) considerations are becoming increasingly important for businesses as they strive to align with sustainability goals, regulatory requirements, and consumer expectations. While ESG performance is typically measured at the corporate or industry level, there is a growing need to integrate these principles into product and supply chain design. Companies are facing increasing pressure to ensure that their products are not only financially viable but also environmentally responsible throughout their lifecycle. This thesis aims to explore how ESG factors can be incorporated into product and supply chain decisions and how ESG performance can be effectively measured at the product level.

The objectives of the bachelor thesis are to:

- To investigate how ESG considerations influence product and supply chain design
- To identify key ESG metrics from the literature and discuss to what extent they can be applied at the product level and where you see challenges in ESG data collection and measurement at a granular level
- To propose a structured modeling approach for assessing ESG performance in product and supply chain design, including an academic example

### **Basic Literature:**

**Dai, T., & Tang, C. (2022).** Frontiers in Service Science: Integrating ESG Measures and Supply Chain Management: Research Opportunities in the Postpandemic Era. *Service Science (Hanover, Md.)*, 14(1), 1–12.

**Kaplan, R. S., & Ramanna, K. (2021).** Accounting for climate change. *Harvard Business Review*, 99(6), 120–131.

**Andreou, N., & Besharov, M. (2022).** Rethinking how we measure companies on social and environmental impact. *MIT Sloan Management Review*, 64(1), 1–4.

**Tundys, B., Kędzia, G., Wiśniewski, T., & Ziło, M. (2024).** *Sustainable Supply Chains 2.0 : Towards Environmental, Social, and Economic Resilience*. Cham.

**Yen, B., Chow, N., Wang, N. Wong, N. & Choi, B. (2024).** Cathay Pacific: Balancing Inherent Risks and ESG Concerns. HKU Business School.

## **Topic B07: Optimization Models in Designing Election Campaigns**

The planning of an election campaign is an extremely complex task that involves numerous strategic decisions. Campaign managers must allocate limited resources—such as budget, staff, and media exposure—across different regions and voter groups to maximize their impact. Given the constraints of time and funding, achieving the highest possible electoral success requires careful decision-making and efficient resource distribution. This challenge can be addressed using operations research, which provides powerful optimization models to support campaign planning. By leveraging mathematical techniques, models help identify the most effective allocation of resources, ensuring that every decision contributes to the overall success of the campaign.

The objectives of the bachelor thesis are to:

- Provide an introduction into optimization models
- Discuss advantages, disadvantages, opportunities and challenges of these models for the design of election campaigns
- Give a summary of sources that build models by comparing objective and constraints
- Elaborate opportunities how it could be adapted for a specific use case. For example, examine of which elements an objective or constraints could consist for a Bundestag election campaign (no mathematical formulation needed).

### **Basic Literature:**

**Güney, E., Ehmke, J. F., Borndörfer, R., & Kliewer, N. (2018).** A Mixed Integer Linear Program for Election Campaign Optimization Under D'Hondt Rule. In *Operations Research Proceedings 2017* (pp. 73–79). Switzerland: Springer International Publishing AG.

**Güney, E. (2018).** Efficient Election Campaign Optimization Using Integer Programming. *Journal of Industrial Engineering and Management*, 11(2), 341–348.

**Shahmanzari, M., Aksen, D., & Salhi, S. (2020).** Formulation and a two-phase matheuristic for the roaming salesman problem: Application to election logistics. *European Journal of Operational Research*, 280(2), 656–670.

**Yang Jie, Lv Wenge, He Mingyu, & Zhang Hong. (2011).** Verify Election Campaign Optimization Algorithm by Several Optimization Problems. *2011 International Conference on Information Management, Innovation Management and Industrial Engineering*, 1, 543–546. IEEE.



## **Topic B08: Operations Research in the Banking Industry – a Research Landscape**

The banking industry encompasses various sectors such as retail banking, corporate banking, and investment banking, and plays a crucial role in the economy by facilitating financial transactions, providing credit, and supporting economic growth. 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 21<sup>st</sup> 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 the bachelor thesis are to:

- Introduce both banking 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 banking 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 B09: Logistic Regression – Review and Application to the Case of Observation Unit at Montanaro**

Logistic regression is an approach for estimating the relationship between a binary dependent variable and a set of independent variables. It models the probability that the binary dependent variable equals 1 as a logistic cumulative distribution function of independent variables. Logistic regression has been used in various fields, including engineering (e.g., predicting the probability of failure of a given process), marketing (e.g., predicting a customer's propensity to purchase a product or subscribe to a service), healthcare (e.g., predicting the risk of developing a given disease).

The objective of the thesis is to review logistic regression in terms of its model, estimation, measure of fit, hypothesis testing, confidence intervals, and applications. Furthermore, in the second part of thesis, logistic regression shall be applied to the case of observation unit at Montanaro, a 260-bed hospital in a medium-sized U.S. city.

In the case study, Dr. Erin Kelly was responsible for managing a 23-bed observation unit (OU) at Montanaro Hospital, which serves as a transition space for patients needing short-term observation and treatment after visiting the emergency department. Not all patients requiring observation are placed in the OU—factors like the availability of beds or the patient's medical needs could lead to their placement in an inpatient ward. If a patient's stay in the OU exceeds 48 hours, medical professionals will reassess the patient's condition to determine if an extended stay in the inpatient ward is necessary. Montanaro's OU admitted, on average, 44 patients per week for observation, of which 45% were later transferred to inpatient care. At the same time, 115 observation-level patients were placed in inpatient wards due to a lack of OU bed capacity or exclusion from the unit based on diagnosis. Dr. Kelly felt it was necessary to reevaluate the patient placement rules for her unit. Based on the dataset provided by OU, how should a logistic model be developed to produce new patient placement rules?

### **Basic Literature:**

**Pachamanova, D., Tilson, V., & Dwyer-Matzky, K. (2022).** Case—A Data-Driven Approach to Improving Hospital Observation Unit Operations. *INFORMS Transactions on Education*, 22(3), 188-194 (data will be provided by the chair).

**Wood, E. H. (2006).** The internal predictors of business performance in small firms: A logistic regression analysis. *Journal of Small Business and Enterprise Development*, 13(3), 441-453.

**Stock, J. H. & Watson, M. W. (2019).** *Introduction to Econometrics*, Global Edition. Boston, MA: Pearson Education.

## **Topic B10: Logistic Regression – Review and Application to the Case of Scholastic Travel Company**

Logistic regression is an approach for estimating the relationship between a binary dependent variable and a set of independent variables. It models the probability that the binary dependent variable equals 1 as a logistic cumulative distribution function of independent variables. Logistic regression has been used in various fields, including engineering (e.g., predicting the probability of failure of a given process), marketing (e.g., predicting a customer's propensity to purchase a product or subscribe to a service), healthcare (e.g., predicting the risk of developing a given disease).

The objective of the thesis is to review logistic regression in terms of its model, estimation, measure of fit, hypothesis testing, confidence intervals, and applications. Furthermore, in the second part of thesis, logistic regression shall be applied to the case of Scholastic Travel Company.

In the case study, David Powell, the new data analyst for Scholastic Travel Company (STC), took charge of a customer retention program in the spring of 2013, which centered around a new data-driven initiative. In less than two weeks, contract renewal opportunities would open for customers who had taken a trip with STC in 2012. David's supervisor, Blackford, had given him a dataset containing all the available information about the previous year's clients. Blackford was optimistic that David could build models to predict whether customers would rebook with STC in 2013. With this model, Blackford hoped to create a more targeted marketing strategy, saving costs and improving the company's yield by focusing on specific segments of the client population. Based on the data set provided by STC, how should a logistic model be developed to predict which customer would rebook with STC in 2013?

### **Basic Literature:**

**Ovchinnikov, A. (University of Virginia, 2018)**, <https://hbsp.harvard.edu/product/UV7579-PDF-ENG> (case study will be provided by the chair)

**Wood, E. H. (2006)**. The internal predictors of business performance in small firms: A logistic regression analysis. *Journal of Small Business and Enterprise Development*, 13(3), 441-453.

**Stock, J. H. & Watson, M. W. (2019)**. *Introduction to Econometrics*, Global Edition. Boston, MA: Pearson Education.

## **Topic B11: 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 the bachelor 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 B12: 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.

## **Topic B13: Online Reinforcement Learning for Transportation Problems**

Reinforcement Learning (RL) is a machine learning paradigm that enables an agent to learn from an environment through direct interaction. In a Markov Decision Process (MDP), such an agent observes the current state of the environment, takes actions, and receives feedback in the form of rewards, which guides future decisions. The agent seeks to maximize long-term rewards by balancing exploration, i.e., trying new actions, and exploitation, i.e., leveraging past experiences. Common RL approaches include value-based methods, such as Q-learning, policy-based methods, like Policy Gradient, and hybrid methods, such as Actor-Critic. In recent years, RL has been applied across various fields of Operations Research, providing a powerful method for solving dynamic problems characterized by high complexity and uncertainty. A prominent example is the application of RL at Lyft to optimize ride-matching, where an online RL system continuously improves driver allocation and platform efficiency. By adapting to real-time fluctuations in demand and supply, Lyft's RL-based approach facilitates a more dynamic and data-driven matching process, leading to improved driver earnings, reduced waiting times for riders, and enhanced overall marketplace efficiency (Azagirre et al, 2024).

This thesis aims to introduce RL, explore different RL algorithms at a high level, and analyze how online RL is employed as a solution to transportation problems in Operations Research, with a particular focus on its application in ride-matching at Lyft.

The objectives of the bachelor thesis are to:

- Explain the fundamental concepts of RL, including the formulation of MDPs and the trade-off between exploration and exploitation.
- (Provide a brief overview of different RL algorithms, distinguishing between value-based, policy-based, and hybrid methods.)
- Analyze the challenges of implementing online RL in real-world settings, including computational efficiency, sample efficiency, and real-time decision-making.
- Examine the application of RL in ride-matching at Lyft, based on the work of Azagirre et al. (2024), with a focus on how online RL improves driver-rider matching efficiency.
- Discuss the broader implications of RL for transportation systems, identifying key advantages, limitations, and potential areas for future research.

### **Basic Literature:**

**Azagirre, X., et al. (2024).** A better match for drivers and riders: Reinforcement learning at lyft. *INFORMS Journal on Applied Analytics*, 54(1), 71-83.

**Sutton, R. S., & Barto, A. G. (2018).** Reinforcement learning: An introduction. MIT Press.

**Qin, Z. T., Zhu, H., & Ye, J. (2022).** Reinforcement learning for ridesharing: An extended survey. *Transportation Research Part C: Emerging Technologies*, 144, 103852.

## **Topic B14: Revenue Management and Pricing in the Chemical Industry**

Revenue Management and pricing (RMP) strategies are critical in the chemical industry, where fluctuating raw material costs, regulatory constraints, and demand volatility pose significant challenges. Unlike industries with perishable inventory, chemical companies must manage bulk production, long lead times, and contract-based B2B pricing. Understanding how RMP principles can be applied to optimize demand management decisions in face of resource constraints is essential for improving profitability and competitiveness. The thesis shall first provide a general overview on RMP in the chemical industry and second, analyze a related case study on Eastman Chemical Company. Some years ago, Eastman had created a new specialty plastic, Tritan, which demonstrated heat resistance and durability properties that might allow Eastman to compete in the lucrative polycarbonate plastics market. Development of this product was a major breakthrough for both Eastman and the broader chemical industry. The Eastman specialty plastics team had to contend with numerous challenges, however, before producing Tritan at full scale. First, Eastman had to commercialize a completely new material that only had been produced in the lab; second, the team had to develop a supply chain to manufacture a new component (monomer) and a new product (polymer) simultaneously; and finally, it had to analyze market entrance options given capacity constraints. Thus, the specialty plastics team faced several dilemmas: who should be the initial launch partners, given Eastman's limited manufacturing capacity, and how aggressively should Eastman price Tritan, given that price would drive demand in the launch markets and in new markets?

The objectives of the bachelor thesis are to:

- Review the literature on RMP approaches in the chemical industry, including the Newsvendor model, and analyze key challenges, such as cost volatility, supply-demand imbalances, and long-term contracts.
- Assess successful real-world RMP implementation in the chemical sector.
- Analyze the Eastman Tritan case study based on the Newsvendor model (or extensions) and provide recommendations on how to enter the market.

### **Basic Literature:**

**Porteus, E. L. (2008).** The newsvendor problem. In D. Chhajed & T. J. Lowe (Eds.), *Building intuition: Insights from basic operations management models and principles* (Vol. 115, pp. 115-134). Springer Science & Business Media.

**Raz, G., Kraft, T., & Elias, A. (2013).** Eastman Tritan (Case No. UV6748). Darden Business School. including the video interviews Lucian Boldea, VP for Specialty Plastics, and Chris Killian, VP of Technology.

**Zatta, D., & Kolisch, R. (2014).** Profit impact of revenue management in the process industry. *Journal of Revenue and Pricing Management*, 13, 483-507.

## **Topic B15: Strategies, Operations, and Analytics in Freight Transportation – Insights from a DHL Case Study**

Freight transportation plays a crucial role in global supply chains, ensuring the timely and cost-effective movement of goods. Companies like DHL face significant operational challenges, including fluctuating demand, capacity constraints, rising sustainability requirements, and technological disruptions. Efficient logistics operations are essential to maintaining service quality while optimizing costs and environmental impact. This thesis aims to analyze these challenges and explore strategies for improving freight transportation efficiency through analytics. As an application, the case of DHL Supply Chain North America shall be discussed. DHL Supply Chain North America moves more than one billion packages each year for corporate customers. Its transportation planners perform routing, bidding, and improvement tasks for many business projects. Prospective customers require DHL to compete to win their business by solving their delivery problems, improving existing supply chain designs, and guaranteeing savings by using fewer trucks or less fuel. Their new transport network optimization (TNO) software suite gives DHL a significant edge in these bidding and improvement tasks. The four modules in the TNO software are as follows: (1) freight optimization, (2) fleet (sizing) optimization, (3) connection hub or pool point-related optimization, and (4) round-trip optimization. The TNO software uses innovative integer programming approaches, which were developed and implemented in collaboration with Ohio State University, including a new type of two-color ant colony search to efficiently address outsourcing in the first module and the use of dynamic programming for subproblems. Over 2.5 years since 2020, TNO has led to over \$117 million in estimated savings for DHL Supply Chain North America and its customers, contributing a 20% win-rate increase and reducing CO<sub>2</sub> emissions by at least 0.1 megatons.

The objectives of the bachelor thesis are to:

- Review the literature on planning problems in freight transportation logistics, focusing on operational challenges in companies like DHL.
- Discuss the role that model-based analytics has played to address these challenges and support decision-making for these planning problems.
- Review and discuss the case of DHL Supply Chain North America by Dang et al. (2024). Regarding the model, focus on exploring the freight optimization model in detail, and optionally, implement an academic example to illustrate its application.
- Provide recommendations for improvement and future research opportunities.

### **Basic Literature:**

**Dang, Y., Allen, T. T., Singh, M., Gillespie, J., Cox, J., & Monkmeyer, J. (2024).** Innovative Integer Programming Software and Methods for Large-Scale Routing at DHL Supply Chain. *INFORMS Journal on Applied Analytics*, 54(1), 20-36.

**Dang, Y., Singh, M., & Allen, T. T. (2021).** Network mode optimization for the DHL supply chain. *INFORMS Journal on Applied Analytics*, 51(3), 179-199.



## **Topic B16: Improving Product Return Programs for Remanufacturing: Strategies for Effective Core Acquisition**

As companies increasingly adopt circular economy strategies, remanufacturing has become a crucial approach to reduce waste and reclaim product value. A central challenge in remanufacturing is securing a steady supply of high-quality used products—called “cores.” Return programs such as buy-back schemes, take-back incentives, or voluntary collection programs play a key role in this process.

This thesis explores how companies in industries like electronics, automotive, and home appliances design and implement product return programs. It analyzes common challenges such as return quality variability, consumer participation, and reverse logistics complexity. To support the academic foundation, the student will conduct a literature review of operations research models addressing product return and core acquisition. The review will focus on model structures, decision variables (e.g., return volume, inspection strategies), and common assumptions (e.g., predictable behavior, uniform quality), and critically assess their alignment with practical realities.

The objectives of the bachelor thesis are to:

- Investigate industry practices for core acquisition in remanufacturing.
- Identify operational and behavioral challenges in managing return flows.
- Review and analyze OR models on product acquisition and reverse logistics.
- Discuss the gap between theoretical assumptions and real-world implementation.
- Provide recommendations for designing more effective and realistic return programs.

### **Basic Literature:**

**Guide, V. D. R., & Van Wassenhove, L. N. (2001).** Managing product returns for remanufacturing. *Production and Operations Management*, 10(2), 142–155.

**Daniel, R., Guide, V., & Van Wassenhove, L. (2000).** Product acquisition management: Current industry practice and a proposed framework. *Production and Operations Management*, 9(2), 148–162.

**Mutha, A., & Pokharel, S. (2016).** Managing demand uncertainty through core acquisition in remanufacturing. *International Journal of Production Economics*, 175, 35–49.

**Bansal, S., Guide, V. D. R., & Naumov, S. (2024).** Closed-loop supply chains with product remanufacturing: Challenges and opportunities. *Journal of Operations Management*, 70(2), 184–189.

**Kianpour, K., Jusoh, A., Asghari, M., & Mahdiraji, H. A. (2017).** Factors influencing consumers' intention to return end-of-life electronics. *Journal of Cleaner Production*, 149, 495–505.

## **Topic B17: Trade-In Programs in the Electronics Industry: Strategies for Circular Product Acquisition and the Case of Apple**

As the electronics industry moves toward more sustainable practices, trade-in programs have become a vital tool for enabling circular product flows. These programs allow companies to collect used products directly from consumers—often in exchange for financial credit—so that the devices can be refurbished, resold, or recycled. Trade-in systems play a key role in reducing electronic waste, recovering materials, and supporting sustainability goals.

This thesis investigates how trade-in programs are structured and used across the electronics industry, focusing on key components such as incentive mechanisms, quality control, and reverse logistics. The Apple Trade-In program serves as a central case to examine how a leading company integrates trade-in practices into its business and environmental strategy. To provide academic grounding, the student will conduct a literature review of operations research models related to product acquisition and reverse supply chains in electronics. The review will assess common model assumptions—such as stable return volumes, rational consumer behavior, and uniform product condition—and compare them with real-world complexities faced by trade-in programs.

The objectives of the bachelor thesis are to:

- Analyze the role of trade-in programs in promoting circularity in the electronics sector.
- Explore how companies design and manage trade-in systems, using Apple as a case example.
- Review OR models on trade-in and reverse logistics and identify key assumptions.
- Evaluate the applicability of these models to real-world trade-in challenges.
- Suggest improvements for more effective and scalable trade-in programs.

### **Basic Literature:**

**Apple Inc. (2023).** Environmental Progress Report. Retrieved from: [https://www.apple.com/environment/pdf/Apple\\_Environmental\\_Progress\\_Report\\_2024.pdf](https://www.apple.com/environment/pdf/Apple_Environmental_Progress_Report_2024.pdf)

**Apple. (n.d.).** Apple Trade In. Retrieved from: <https://www.apple.com/shop/trade-in>

**Barros, M., & Dimla, E. (2021).** From planned obsolescence to the circular economy in the smartphone industry. *Proceedings of the Design Society*, 1, 1607–1616.

**Miao, Z., Fu, K., Xia, Z., & Wang, Y. (2017).** Models for closed-loop supply chain with trade-ins. *Omega*, 66, 308-326.

**Reinhardt, F. L., Toffel, M. W., & Jackson, B. (2023).** Apple Inc.: Managing a Global Supply Chain for Circularity (Case No. 123089-PDF-ENG). Harvard Business School. <https://hbsp.harvard.edu/product/123089-PDF-ENG>

## **Topic B18: Circular Business Models in Fashion: The Role of Take-Back and Reuse Programs for Sustainable Apparel**

The fashion industry is a major contributor to global waste and environmental degradation. In response, many brands are adopting circular business models, including take-back schemes, resale platforms, clothing rental, and recycling initiatives. These models help extend the life of garments, reduce raw material use, and promote responsible consumption.

This thesis examines how take-back and reuse programs are implemented in the fashion industry, exploring their design, operational challenges, and impact on sustainability. It also includes a literature review of operations research models in circular fashion logistics. The review will assess common modeling assumptions, such as constant return rates, homogeneous product quality, and consumer willingness to participate—comparing them with the uncertainties and variability faced by real-world fashion brands.

The objectives of the bachelor thesis are to:

- Review the literature on planning problems in freight transportation logistics, focusing on operational challenges in companies like DHL.
- Investigate how fashion brands implement take-back and reuse strategies.
- Identify logistical and behavioral challenges in circular apparel systems.
- Review OR models related to circular supply chains in fashion.
- Analyze how model assumptions compare with real-world challenges.
- Recommend practical strategies for improving circular logistics in fashion.

### **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.

**Zanjirani Farahani, R., Asgari, N., & Van Wassenhove, L. N. (2022).** Fast fashion, charities, and the circular economy. *Production and Operations Management*, 31(3), 1089–1114.

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

**McKinsey & Company. (2020).** Fashion on Climate. <https://www.mckinsey.com/industries/retail/our-insights/fashion-on-climate>

## **Topic B19: 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 about environmental issues. Remanufactured products are normally developed by collecting and recovering previously sold new products. Then, they are usually labeled 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 CO<sub>2</sub> footprint reduction, quality, warranty, price, and so on compared to new products.

The 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/>