UNIVERSITY OF MANNHEIM
Business School

CHAIR OF SERVICE
OPERATIONS MANAGEMENT
Prof. Dr. Cornelia Schön

Bachelor Thesis FSS 2023

"Current topics in Service Operations Management"

Topic overview

Topic B01: Market Size for Air Transportation Routes

One of the basic inputs for route evaluation in air transport is the market size which represents all (potential) travelers between origin and destination. While there has been much effort to understand the effect of service, frequency, and competition for route demand, the overall market size is often taken as input without deeper thought. Nonetheless, a correct estimate here has a huge importance for strategic decisions such as planning of airline schedules and fleet composition. Furthermore, operational tasks such as revenue management also rely on these estimates.

The objectives of this thesis are

- to provide an overview of empirical studies offering the market size for air transportation routes,
- to introduce and compare the different model types used in those studies,
- to show which sources are available in the commercial market for practitioners, and
- to provide open research gaps and future trends.

Basic Literature:

Belobaba, P., Odoni, A., & Barnhart, C. (Eds.). (2015). *The global airline industry*. John Wiley & Sons.

Bhadra, D. (2002). Demand for air travel in the United States: Bottom-up econometric estimation and implications for forecasts by origin-destination pairs. In *AIAA's Aircraft Technology, Integration, and Operations (ATIO) 2002 Technical Forum* (p. 5861).

Garrow, L. A. (2016). *Discrete choice modelling and air travel demand: theory and applications*. Routledge.

Sivrikaya, O., & Tunç, E. (2013). Demand forecasting for domestic air transportation in Turkey. *The Open Transportation Journal*, *7*(1).

Topic B02: Olympic success performance benchmarking with Data Envelopment Analysis

The Olympics are the biggest global sports event with over 10,000 athletes from over 200 National Olympic Committees. A good performance at the games is a priority for several countries as it shows the global competitiveness of a countries' sports system. While the medal

count represents usually the ranking, factors such as different population size or wealth among countries are ignored. Data Envelopment Analysis (DEA) is a benchmarking method that allows to take such consideration into account, as Lozano, Villa, Guerrero & Cortés (2002) show. It uses linear programming to assign weights to the importance of inputs and outputs. Further applications in other sports settings evaluate teams, players etc.

The objectives of this thesis are

- to introduce the concept of DEA and summarize the requirements for its effective use,
- to provide an overview of the use of the DEA method in sports and particularly the Olympics,
- to apply the DEA methodology to a recent dataset from the Olympics (optional), and
- to provide open research gaps and future trends.

Basic Literature:

Charles, V., Mukesh Kumar, & ProQuest. (2012). *Data envelopment analysis and its applications to management.* Newcastle upon Tyne: Cambridge Scholars Publishing.

Lozano, S., Villa, G., Guerrero, F., & Cortés, P. (2002). Measuring the performance of nations at the Summer Olympics using data envelopment analysis. *Journal of the Operational Research Society*, *53*, 501-511.

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

Wu, J., Liang, L., & Chen, Y. (2009). DEA game cross-efficiency approach to Olympic rankings. *Omega*, *37*(4), 909-918.

Topic B03: Scheduling in Sports Leagues

Schedules of professional sport leagues are a huge challenge due to many requirements, multiple parallel competitions (such as cup rounds, national team games, and sharing of infrastructure with other teams), and a huge public interest. Also, a fair assignment needs to be considered while fulfilling the sometimes-conflicting objectives from different stake holders such as players, clubs, fans, sponsors and the media.

. Due to its combinatorial nature and many relations between different rounds and teams, this problem may be tackled with Integer Programming techniques as the listed literature shows. Here, also soft constraints for tradeoffs between different requests and hard constraints to ensure certain requirements are used.

The objectives of this thesis are

- to introduce the scheduling problem for sports leagues including requirements and objectives from different stake holders,
- to provide an overview of recent models in the literature,
- to apply Integer programming to a case study of a professional soccer league (the tasks will be provided by the chair), and
- to provide open research gaps and future trends.

Basic Literature:

Bartsch, T., Drexl, A., & Kröger, S. (2006). Scheduling the professional soccer leagues of Austria and Germany. *Computers & Operations Research*, *33*(7), 1907-1937.

Durán, G., Guajardo, M., & Sauré, D. (2017). Scheduling the South American Qualifiers to the 2018 FIFA World Cup by integer programming. *European Journal of Operational Research*, *262*(3), 1109-1115.

Kendall, G., Knust, S., Ribeiro, C. C., & Urrutia, S. (2010). Scheduling in sports: An annotated bibliography. *Computers & Operations Research*, *37*(1), 1-19.

Nurmi, K., Goossens, D., Bartsch, T., Bonomo, F., Briskorn, D., Duran, G., Kyngäs, J., Marenco, J., Ribeiro, C. C., Spieksma, F. C. R., Urrutia, S., Wolf-Yadlin, R., Ao, S.-I., Katagir, H., Xu, L., & Chan, A. H.-S. (2010). A Framework for Scheduling Professional Sports Leagues. *AIP Conference Proceedings*, *1285*(1), 14–28.

Topic B04: 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 B05: 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 B06: Service Encounter Design – Introduction and Application to the Case Study of Hamburguesas El Corral

Within the field of Service Operations Management, Service Design in general and service encounter design in specific play a key role in research and practice. This mainly stems from the fact that services are processes at the interaction between a service provider and a customer and the optimal design of this interplay leads to benefits for both sides. While customers may gain satisfaction, companies can benefit from increased and repeated sales or positive word-of-mouth.

The objectives of this thesis are to:

- Introduce and differentiate the terms service operations management, service design, and service encounter design;
- Identify, cluster and analyze research articles related to service encounter design;
- Apply relevant tools and knowledge to the case study of Hamburguesas El Corral.

Hamburguesas El Corral is a Colombian hamburger fast food chain founded in 1983. From the beginning, Hamburguesas El Corral was recognized as a traditional Colombian brand, positioning itself with the motto "the original recipe" as a provider with focus on fresh and highest

quality products. The case allows students to examine the service encounter design of Hamburguesas El Corral and to compare it with McDonald's, which entered the Colombian market in 1995 and took over market leadership from Hamburguesas El Corral in 2012. The case furthermore tackles the trend towards delivery services in the fast food sector, addressing the specific service encounter design components of this delivery mode as well as its potential benefits and risks within the context of a changing competitive environment. The case finally asks students to analyze potential responses of El Corral's management to regain market share and market leadership, leading to the following question: Should El Corral hold firm to its traditional "no-delivery-service" policy or should it adapt to a major market trend and create a new brand, "El Corral Home", as a 100% home-delivery chain?

Basic Literature:

Larivière, B., Bowen, D., Andreassen, T. W., Kunz, W., Sirianni, N. J., Voss, C., & De Keyser, A. (2017). "Service Encounter 2.0": An investigation into the roles of technology, employees and customers. *Journal of business research*, 79, 238-246.

Noone, B. M., Kimes, S. E., Mattila, A. S., & Wirtz, J. (2009). Perceived service encounter pace and customer satisfaction: An empirical study of restaurant experiences. *Journal of Service Management,* 20 (4), 380-403.

Thiell, M., Orozco, L. E., & Sinisterra, Daniela (2017). Hamburguesas El Corral: Does Delivery Service Matter? *Harvard Business Publishing*. – Case to be provided by the chair

Voorhees, C. M., Fombelle, P. W., Gregoire, Y., Bone, S., Gustafsson, A., Sousa, R., & Walkowiak, T. (2017). Service encounters, experiences and the customer journey: Defining the field and a call to expand our lens. *Journal of Business Research*, 79, 269-280.

Topic B07: Data Analytics for Time-Sensitive Service Operations – Theory and Application to the Case of the Patelco Credit Union Call Center

In today's fast-moving world, customers increasingly value prompt and timely service. In fact, responsiveness is one of the key dimensions of service quality and described how prompt a service is provided. Responsiveness is hence frequently operationalized as waiting time. Literature has addressed responsiveness consequently and different approaches exists to improve the service quality in this specific dimension. In banking, a traditional service industry, responsiveness is also of high relevance (Lassar et al., 2000).

The objective of the thesis is to review the existing literature of improvement measures for responsiveness in time-sensitive service operations in general, and in banking services in particular. Furthermore, in the second part of thesis, the student should perform some statistical analysis of raw data to investigate the unsatisfactory call center performance in the case of

Patelco Credit Union, one of California's largest credit unions. The gained insights from the case study should be merged to the gathered theoretical recommendations.

In the case study, the management of Patelco Credit Union is confronted by customer complaints about long delays when calling one of the organization's four call centers. The challenge is to find the root cause for this unsatisfactory service, as it is clear that the long delays are rather an outcome of operational factors affecting the performance of the whole service system. While many ideas of potential issues were discussed in a management meeting, a thorough data analysis should be conducted to provide evidence and transparency on the factor(s) causing those long delays and ultimately customer complaints. Thus, the data analyst faces several dilemmas: what is the root cause for the delays at one of the four call centers, and how can the service level be consequently improved?

Basic Literature:

Agrawal, N. (2022). Case—Analysis of Call Center Data at Patelco Credit Union. *INFORMS Transactions on Education* 0(0), https://doi.org/10.1287/ited.2022.0272cs.

Campbell, D., & Frei, F. (2004). The persistence of customer profitability: Empirical evidence and implications from a financial services firm. *Journal of Service Research*, 7(2), 107-123.

Stock, J. H. & Watson, M. W. (2020): Introduction to Econometrics; Pearson Global Edition 4th ed.

Topic B08: Personnel Scheduling – Review and Application

Personnel scheduling problems have been studied in different contexts. As labor cost is one major component in many industries, reducing this cost can be seen as very beneficial. Personnel scheduling problems face the challenge to assign employees to different jobs while satisfying certain constraints, like required skills, or collective agreement rules. A common objective is to minimize the total number of employees needed, travel costs, overtime costs or outsourcing costs, which all effect the bottom line of a production or service facility.

Mostly, a personnel scheduling problem is expressed as a (mixed) integer problem (MIP), which is often difficult to solve. Different approaches can be applied to counter this challenge. For example, Al-Yakoob and Sherali (2007) used a two-step model in a gas station context. In the first stage, employees are assigned to the stations, while in the second stage, shifts and off-days for each employee are specified.

The basic models from the personnel scheduling literature can be applied to a timetable management problem for students. In the class scheduling case, Kelly is a senior finance major at the Smith University who must take five more courses till her graduation audit. After gathering

data about the course topics, meeting time and average rating, she wants to choose the optimal schedule for herself using knowledge learned from the personnel scheduling literature stream.

The objectives of this bachelor thesis are:

- to give an overview over the personnel scheduling literature,
- to describe a basic mathematical optimization model,
- to explain the challenges of MIP in the context of personnel scheduling problems and applied solution methods,
- to solve "Kelley's Class Scheduling" case by applying the presented basic mathematical optimization model and solving it with the Excel Solver (Part 2 of the case),
- to suggest extensions to the basic model that are currently discussed in the literature and are applicable to this case.

Basic Literature:

Van den Bergh. et al. (2013). Personnel scheduling: A literature review. *European Journal of Operational Research. Volume 226, Issue 3, 369-385*.
https://doi.org/10.1016/j.ejor.2012.11.029

Al-Yakoob, S.M., Sherali, H.D (2007). Mixed-integer programming models for an employee scheduling problem with multiple shifts and work locations. *Ann Oper Res 155, 119–142.* https://doi.org/10.1007/s10479-007-0210-4

Pinedo, Michael L (2012). *Scheduling*. Vol. 29. New York: Springer.

Janice K. Winch, Jack Yurkiewicz (2014). Case—Kelly's Class Scheduling. *INFORMS Transactions on Education. 15(1), pp. 148–149*. https://doi.org/10.1287/ited.2014.0128cs

Topic B09: Predictive and Prescription Analytics for Decision Making in Fashion Retail Pricing – Theory and Application to the Case of Flashion

The topic of data and analytics has become more and more important in many organizations. Data-driven decision-making processes are on the CEOs agenda in many industries. Often, this type of decision-making outperforms employee's intuition and experience. Using modern price optimization techniques require knowledge in demand forecast (predictive analytics) and price optimization (prescriptive analytics).

One industry that can benefit from pricing is the fashion industry. Many customers are price sensitive, and competition is though. An example is illustrated in the case study "Flashion: Art vs. Science in Fahsion Retailing". Flashion Retail is an online flash sales retailer, selling designer fashion apparel, accessories, and home goods for a limited time (24 hours). The

selection of the events and their products was based on experience and should now be replaced with a price optimization technique. Fortunately, the company collected helpful data to predict demand and to optimize prices.

The objectives of this bachelor thesis are:

- to review papers from the fashion industry regarding predictive and prescriptive models,
- to describe a basic mathematical optimization model,
- to apply this model on the Flashion Retail case study,
- to suggest extensions to the basic model that are currently discussed in the literature and are applicable to this case.

Basic Literature:

Ferreira K, Lakhani K (2017). Flashion: Art vs. Science in Fashion Retailing. Harvard Business Publishing Education (case study will be provided by the chair)

Kris Ferreira, Bin Lee, David Simchi-Levi (2015). Analytics for an Online Retailer: Demand Forecasting and Price Optimization. Manufacturing & Service Operations Management 18(1): 69-88. https://doi.org/10.1287/msom.2015.0561

Caro, Felipe and Gallien, Jérémie (2012). Clearance Pricing Optimization for a Fast-Fashion Retailer. Operations Research. 60(6):1404-1422. https://doi.org/10.1287/opre.1120.1102

Topic B10: Sequence effects in the design of experiential services

Past researchers have found empirical evidence that customers consider the sequence of event utility when evaluating past and future service experiences. Dixon and Verma (2013) provide a thorough review of the psychology and behavioral economics literature concerned with sequence effects and cite four main effects that emerge as relevant to sequencing service encounters: (i) the impact of the highest point, most intense, or highest utility part of an experience (Peak Effect); (ii) the impact of the last point of an experience (End Effect); (iii) the impact of the timing of the peak (Spread Effect); (iv) and the overall trend of the experience over time (Trend Effect).

Based on the empirical results, Dixon & Thomson (2016) formulate an optimization problem with a focus on optimizing schedule sequence characteristics in order to maximize customer experiences. Other researchers (e.g., Das Gupta et al. 2016, Roels 2019) have developed mathematical models to optimize the service experience by incorporating selected psychological

constructs like memory decay or acclimation and thereby mapping the underlying mental processes in the consumer's brain.

The objectives of this thesis are to:

- review and systematically classify current empirical knowledge on sequence effects as well as state-of-the-art optimization models incorporating sequence effects,
- compare different optimization approaches and discuss their advantages and limitations,
- discuss one optimization model in detail or compare two approaches,
- provide open research gaps and future trends.

Basic Literature:

Bellos, I., & Kavadias, S. (2020). Service design for a holistic customer experience: A process framework. Management Science. Published Online: 21 Aug 2020 https://doi.org/10.1287/mnsc.2020.3609

Das Gupta, A., Karmarkar, U. S., & Roels, G. (2016). The design of experiential services with acclimation and memory decay: Optimal sequence and duration. Management Science, 62(5), 1278- 1296.

Dixon, M. J., & Thompson, G. M. (2016). Bundling and scheduling service packages with customer behavior: Model and heuristic. Production and Operations Management, 25(1), 36-55.

Topic B11: Product design for sustainability under extended producer responsibility (EPR)

Extended Producer Responsibility (EPR) is a policy approach that requires 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. It encourages the design of products that are more sustainable, durable, and easily recyclable, leading to a more circular economy and reduced environmental impact. Recycling involves the process of converting waste materials into new products or materials, which can help conserve resources and reduce waste. The focus of this thesis is on product design for recycling under EPR and investigating the specific design-for-recycling feature choices like using fewer screws to reduce the time of disassembly or avoiding using adhesives. Also, there are different aspects in the literature of recycling which has influence on the efficiency and the environmental benefits of recycling. For example, an individual recycling system requires every producer to be responsible only for its own products while a collective recycling system is set up and operated

by a group of producers who are jointly responsible for the collection and recycling all producers' products and who share associated costs based on sales volumes.

The objectives of this thesis are to …

- review the literature of EPR and its influence on product design;
- focus on the product design for recycling and discussing the specific design-for-recycling features and factors which play role on efficiency and the environmental benefits of recycling;
- provide open research gaps and future trends.

Basic Literature:

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

Rahmani, M., Gui, L., & Atasu, A. (2021). The implications of recycling technology choice on extended producer responsibility. *Production and Operations Management, 30(2), 522-542.*

Huang, X., Atasu, A., & Toktay, L. B. (2019). Design implications of extended producer responsibility for durable products. *Management Science, 65(6), 2573-2590.*

De Brito, M. P., & Dekker, R. (2004). A framework for reverse logistics (pp. 3-27). *Springer Berlin Heidelberg.*

Topic B12: Product design for remanufacturing

Remanufacturing is the process of restoring used products or components to their original condition or better. It involves disassembling the product, cleaning, and inspecting its components, replacing any worn or damaged parts, and reassembling the product to meet or exceed its original specifications. It is very difficult to carry out the process of remanufacturing if the product is not designed with the mindset of the end-of-life strategy. Therefore, the decision to include remanufacturing as part of product life cycle should be made as early as possible, as many barriers that occur during the remanufacturing process can be mitigated through proper product design at an early stage. This concept is known as design for remanufacturing (DfRem) in the literature.

As DfRem is very impactful on the remanufacturing process, it is of great interest to identify forces that incentivize DfRem whether it be legislation e.g. extended producer responsibility (EPR) or market forces e.g. the preferences of environmentally conscious customer segments.

The objectives of this thesis are to …

- introduce the remanufacturing and its key steps;
- review the literature of DfRem and identify the design features that are relevant to remanufacturing performance;
- provide open research gaps and future trends.

Basic Literature:

Gehin, A., Zwolinski, P., & Brissaud, D. (2008). A tool to implement sustainable end-of-life strategies in the product development phase. *Journal of Cleaner Production, 16(5), 566-576.*

Hatcher, G. D., Ijomah, W. L., & Windmill, J. F. (2013). Design for remanufacturing in China: a case study of electrical and electronic equipment. *Journal of Remanufacturing, 3, 1-11.*

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.*

Topic B13: The bait and hook (razor and blade or tied-products) business model – Case of Inkjet Printing Pricing

The “bait and hook” or “tied-products” business strategy is a well-known business model that has been widely adopted in various industries. In this model, the businesses offer a basic product or service at a very low price (the bait) with the intention of making substantial profit from selling the associated complementary products or services (the hook). In another word, businesses choose to initially make a loss in the hope of making a future profit from ongoing purchases. The objective of the thesis is to review the tied products pricing literature and applications. Furthermore, in the second part of thesis, the bait and hook strategy shall be applied to the Inkjet printer pricing case.

In the case study, the printers are offered with a relatively inexpensive price. This is a business tactic used to attract more people to buy the printer. The manufacturers are trying to improve their overall profit margin by charging higher prices than they would have normally done for their proprietary ink cartridges. The setting of printer and cartridge prices must therefore be closely linked and studied, as they affect the overall profitability and survival of the printer

company. The objective is to develop the pricing model, with the usual consideration of the tradeoff between demand and price and the need to maximize the company's profit. The special additional question in this case is how the prices of the two interrelated products should be determined. In particular, if you offer the printer at an extremely low price, printer profit will fall but sales from printers and thus ink cartridges will rise, leading to an increase in ink cartridge profit. If the increase in ink cartridge profit outweighs the fall in printer profit, it would be worthwhile to keep the printer price low to boost cartridge demand. However, if the increase in ink cartridge profit can-not cover the reduction in printer profit, it would be better to sell the printer at a higher price.

In this case, it is expected that you understand the problem and make appropriate assumptions about printer and cartridge prices and demand given the unit cost for both products. Then, you should identify the key input and output variables of the problem and make some basic assumptions about the printer price and possible market responses for developing the basic demand model. Finally, you have to illustrate a what-if tradeoffs between the relative prices of the printer and its ink cartridge which helps to understand some key performance indicators such as profit and doping a sensitivity analysis on uncontrollable input variables and their influence on profit is interesting.

Basic Literature:

Leong, T. Y., & Ma, N. L. (2011). Case—Inkjet Printer Pricing. *INFORMS Transactions on Education, 11(3), 136-137.* (https://pubsonline.informs.org/doi/pdf/10.1287/ited.1100.0052cs)

Yan, R., & Bandyopadhyay, S. (2011). The profit benefits of bundle pricing of complementary products. *Journal of Retailing and Consumer Services, 18(4), 355-361.*

Oppewal, H., Holyoake, B., (2004). Bundling and retail agglomeration effects on shopping behavior. *Journal of Retailing and Consumer Services 11 (2), 61–74.*

Topic B14: Conjoint-based Product Encroachment Strategies – with Application to the Case of Seagate – Quantum

Conjoint analysis is a survey-based statistical technique used to estimate the contributions that various product attributes make to overall product evaluation. It proceeds with (1) building many product concepts by varying product attributes and their potential levels, (2) asking respondents to rate, rank, or choose among a subsect of these product concepts, and (3) based on respondents' evaluation of product concepts estimating how much unique value

(utility or part-worth) each attribute in each level adds. Today conjoint analysis has been frequently used in predicting consumer acceptance, market share, revenue, and profitability of new designs.

The objective of the thesis is to review the conjoint analysis in terms of its framework, types, and applications in competition contexts. Furthermore, in the second part of thesis, the student should analyze the data, which is obtained from a conjoint analysis by Seagate (a disk drive company), to provide a recommendation on the encroachment strategy for Seagate.

In the case study, Quantum is the market leader selling 8-inch disk drives, and Seagate Technologies is contemplating the introduction of a new smaller 5.25-inch drive. To decide how to compete against Quantum, Seagate conducted a conjoint analysis and figured out the key attributes in a drive for consumers and part-worths of these attributes across consumers. Based on this data, if you were Seagate, would you introduce the smaller 5.25-inch drive, anticipating what Quantum might do in response? What customer segments would buy your drive? Would your drive encroach on the market of Quantum's 8-inch drive? How would you choose the encroachment strategy?

Basic Literature:

Arenoe, B., van der Rest, J. P. I., & Kattuman, P. (2015). Game theoretic pricing models in hotel revenue management: An equilibrium choice-based conjoint analysis approach. *Tourism Management, 51*, 96-102.

Choi, S. C., & DeSarbo, W. S. (1993). Game theoretic derivations of competitive strategies in conjoint analysis*. Marketing Letters, 4(4)*, 337-348.

Choi, S. C., & DeSarbo, W. S. (1994). A conjoint‐based product designing procedure incorporating price competition. *Journal of Product Innovation Management, 11(5)*, 451-459.

Schmidt, G. M. & Mieghem, J. A. V. (2005). Case—Seagate-Quantum: Encroachment strategies. *INFORMS Transactions on Education 5(2)*, 68-76.

Topic B15: Logistic Regression – Review and Application to the Case of Fjord Motor

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 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 Fjord Motor case.

In the case study, Fjord Motor Company offers Coronet Elizabeth, which is a popular model for fleet purchases, particularly by corporations and police departments. Fjord sells Coronet Elizabeth through its sales team bidding on buyers' fleet procurement projects. Each bid proceeds with a buyer specifying the number of vehicles he wishes to buy, followed by Fjord submitting a sealed bid for the order which specifies its price for satisfying the bid. The buyer evaluates all bids (from Fjord and other Motor companies) and tells Fjord whether it has won the deal. Fjord management has recently become concerned about that its fleet sales staff has made inconsistent and inaccurate bidding and plans to institute a more rational pricing process for fleet sales. Based on the sales data provided by Fjord, how should a logistic model be developed that estimates the probability of winning each bid as a function of certain factors?

Basic Literature:

Phillips, R. (Columbia Business School, 2011). https://hbsp.harvard.edu/product/CU330-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 B16: Markdown Pricing – Review and Application to the Case of Sports Unlimited

Markdown pricing refers to a deliberate reduction in the selling price. It enables sellers to clear inventory, enlarge the market share, and extract consumer surplus across multiple segments. However, it may hurt the firm's immediate profits, since patient consumers who anticipate the future markdown pricing would wait for the future cheaper product instead of buying now.

The objective of the thesis is to review the literature on markdown pricing in terms of the design (i.e., the timing and level of markdowns), the profitability and the impact on consumer surplus compared with other pricing strategies (e.g., everyday low price, markup), and applications. Furthermore, in the second part of thesis, the student should analyze the Sport Unlimited case and recommend an optimal markdown policy.

In the case study, Sports Unlimited, a sporting goods retailer, operates nationally and is concerned about its markdown management. Its buyers, after buying items and setting an initial price, determine the timing of markdown for every item by using a price optimization tool which identifies the items with low weekly sell-through rates to be marked down. However, managers are not satisfied this expensive and sophisticated software. They hired a consulting team to produce a more efficient and easily applicable markdown policy that could increase revenues and specify the timing and magnitude of the first markdown. To select the best markdown policy, the consulting team plans to use clustering strategies to generate a standard measure that would allow the various markdown policies to be comparable. Given this target, how should items be clustered to homogeneous groups, how should different markdown policies be evaluated, and what is the optimal markdown policy?

Basic Literature:

Adida, E., & Özer, Ö. (2019). Why markdown as a pricing modality? *Management Science, 65(5)*, 2161-2178.

Özer, Ö., & Zheng, Y. (2016). Markdown or everyday low price? The role of behavioral motives. *Management Science, 62(2),* 326-346.

Talebian, M. & van Ryzin, G. (2014), Case—Markdown management at Sports Unlimited. *INFORMS Transactions on Education 14(2)*, 100-104.

Topic B17: Literature Review on Impact of Consumer Search on Assortment Planning and Pricing

For many products, consumers are uncertain about the price, functionality, durability, and tastes before physically looking at or experiencing them. To resolve these uncertainties, they visit multiple stores and websites and consult friends for fit information, during which the cost involved is named as search cost (or evaluation cost, discrimination cost, shop cost). Driven by this phenomenon, early studies explored the impact of the consumer search on pricing. Recently, researchers integrated this behavior in assortment planning. Cachon et al. (2005) and (2008) consider consumer search process (e.g., parallel search, sequential search) in a monopolistic assortment setting and a competitive and non-overlapping symmetric assortment setting, respectively. Kuksov and Lin (2017), using a very stylized model, disclose the signaling function of the assortment breadth that may affect consumer search behavior. Sun and Gilbert (2019) examine how search cost affects the competitive assortment types (i.e., overlapping or not). Moreover, the concept of “consideration set” is raised to follow the reality that consumers have limited ability in search breadth and has received much academical attention (e.g., Wang and Sahin 2018).

The objectives of this thesis are to:

- review the literature on assortment planning (or product line design) and pricing with consumer search,
- summarize the results in terms of the impact of consumer search process (e.g., parallel search, sequential search) and search cost on the assortment planning, price, profit, and consumer surplus,
- provide open research gaps and future trends.

Basic Literature:

Cachon, G. P., Terwiesch C., & Xu Y. (2005). Retail assortment planning in the presence of consumer search. *Manufacturing & Service Operations Management, 7(4),* 330-346.

Cachon, G. P., Terwiesch C., & Xu Y. (2008). On the effects of consumer search and firm entry in a multiproduct competitive market. *Marketing Science, 27(3),* 461-473.

Kuksov, D. & Lin, Y. (2017). Signaling low margin through assortment. *Management Science, 63(4),* 1166-1183.

Wang, R. & Sahin, O. (2018). The impact of consumer search cost on assortment planning and pricing. *Management Science, 64(8),* 3649-3666.