**OPM 701 – Research Seminar Supply Chain Management**
FSS 2019

General Information:

1. The goal of this seminar is to introduce the participants to the conducting of scientific research. It thereby prepares the students for the writing of their MSc thesis. The seminar is geared towards students intending to write their thesis at the Chair of Logistics.

2. Each participant will explore one of the research papers listed below. The task is to review and critically assess the assigned research paper and to relate it to the corresponding stream of scientific literature. Each participant presents his/her findings in a written report (about 20 pages) as well as an in-class presentation (20 min + 20 min discussion).

3. Each participant also acts as a discussant for one of the other presentations. The discussant is responsible for critically assessing the presented work and for opening the ensuing discussion.

4. A **kick-off meeting** for all participants will be held on **Monday, 3 December 13:45** in Room **SO 318**. During this meeting, general guidelines for conducting a scientific literature review will be discussed and the tasks of seminar will be explained in detail.

5. The written reports have to be **submitted** electronically and as a hard copy in two-fold by **3 May**.

6. The **presentations** will be held as a blocked session around week 20, most probably on 16 and 17 May (exact times and room to be announced, might still be subject to change!). Attendance at all presentations is **obligatory**.

7. The final grade for the seminar is composed of the following components: Written report (60%), presentation (30%), contribution to discussion (10%).

8. As the seminar is usually attended by a class of international students, the report and the presentations should be delivered in English.

9. There is a joint application process for all seminars offered by the chairs of the Area Operations Management. In the FSS 2019, this includes the following seminars:

    - OPM 701: Research Seminar Supply Chain Management (Chair of Logistics and Supply Chain Management), **topics labeled with 'L'**

    - OPM 761: Research Seminar Production Management (Chair of Production Management), **topics labeled with 'P'**

- OPM 781: Research Seminar Service Operations (Chair of Service Operations Management), **topics labeled with 'S'**

- OPM 792: Applied Seminar Procurement (Chair of Procurement), **topics labeled with 'B'**

Detailed information on the seminar topics is available on the home pages of the respective chairs. In their application, students can indicate three to five preferred topics from all seminars.

10. Applications are open from **12 November** until **26 November**. Students have to join the ILIAS group **Seminar Application Area Operations** (link) and complete the **application form** there.

11. Additionally, students applying for a topic of OPM 701 must send an e-mail to logistik@bwl.uni-mannheim.de titled "Seminar Application Documents", including a current **CV** and official **grades overview**. If you are applying for topics of the other chairs, please check if you have to send documents to them as well.

12. For any questions concerning the seminar feel free to contact Kilian Seifried at kilian.seifried@bwl.uni-mannheim.de.

Seminar topics

Each participant will be assigned one of the topics listed below. The task then is to identify the main issues addressed by the paper, explain its methodology, including potential quantitative models, position it in the corresponding stream of scientific literature, and critically assess the paper's contribution to the literature as well as to practice.

**Topic L01: Ales, L.; Cho, S.-H.; & Körpeoğlu, E (2017). Innovation tournaments with multiple contributors. Working paper, Carnegie Mellon University. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2277215.**

This paper studies an innovation tournament in which an organizer seeks solutions to an innovation-related problem from a number of independent agents. We develop an analytical model of an innovation tournament in which agents face uncertainty about their solution performance and the organizer is interested in obtaining multiple good solutions - agents whose solutions contribute to the organizer's utility are called contributors. We study when it is optimal for the organizer to conduct an open tournament with unrestricted entries. Our model generalizes several existing models of tournaments in the literature, and helps explain recent empirical / experimental findings as well as open innovation initiatives in practice. Specifically, whereas the prior literature shows conflicting results that a free-entry open tournament is either always suboptimal or always optimal, we show that an open tournament is optimal only when agents face a high level of uncertainty or when the organizer expects a high number of contributors. Our results indicate that companies should consider open tournaments when their problems are highly uncertain or when they are interested in obtaining a large number of solutions. In other situations, companies may restrict entries to their innovation tournaments in order to mitigate the negative incentive effects on agents from increased competition.

**Topic L02: Hoen, K. M. R.; Tan, T.; Fransoo, J. C.; & van Houtum, G.-J. (2014). Switching transport modes to meet voluntary carbon emission targets. Transportation Science 48: 592—608.**

The transport sector is the second-largest carbon emissions contributor in Europe, and its emissions continue to increase. Many producers are committing themselves to reducing transport emissions voluntarily, possibly in anticipation of increasing transport prices. In this paper we study a producer that has outsourced transport and has decided to cap its carbon emissions from outbound logistics for a group of customers. Setting an emission constraint for a group of customers allows for taking advantage of the portfolio effect. We focus on reducing emissions by switching transport modes within an existing network, because this has a large impact on emissions. In addition, the company sets the sales prices, which influence demand. The problem is solved by decomposing the multiproduct problem into several single-product problems, which we then analyze separately. Using the single-product solutions, we create an efficient frontier that reflects the trade-off between total carbon emissions and the total profit. It is observed that a diminishing rate of return applies in reducing emissions by switching transport modes. In a case study, we apply our method to a producer of bulk liquids and find that emissions can be reduced by 10% at only a 0.7% increase in total logistics cost.

**Topic L03: Xu, J. P.; Allgor, R.; & Graves, S. C. (2009). Benefits of reevaluating real-time order fulfillment decisions. Manufacturing & Service Operations Management 11: 340—355.**

When a customer orders online, an online retailer assigns the order to one or more of its warehouses and/or drop-shippers to minimize procurement and transportation costs based on the available current information. However, this assignment is necessarily myopic because it cannot account for any subsequent customer orders or future inventory replenishment. We examine the benefits of periodically reevaluating these real-time assignments. We construct near-optimal heuristics for the reassignment for a large set of customer orders to minimize the total number of shipments. Finally, we present evidence of significant saving opportunities by testing the heuristics on order data from a major online retailer.

**Topic L04: Billing, C.; Jaehn, F.; & Wensing, T. (2018). A multiperiod auto-carrier transportation problem with probabilistic future demands. Journal of Business Economics 88: 1009—1028.**

In this paper we study the problem of delivering finished vehicles from a logistics yard to dealer locations at which they are sold. The requests for cars arrive dynamically and are not announced in advance to the logistics provider who is granted a certain time-span until which a delivery has to be fulfilled. In a realworld setting, the underlying network is relatively stable in time, since it is usually a rare event that a new dealership opens or an existing one terminates its service. Therefore, probabilities for incoming requests can be derived from historical data. The study explores the potential of using such probabilities to improve the day-today decision of sending out or postponing cars that are ready for delivery. Apart from the order selection, we elaborate a heuristic to optimize delivery routes for the selected vehicles, whereby special loading constraints are considered to meet the particular constraints of car transportation via road. In a case study, we illustrate the value of introducing probabilistic information to the planning process and compare the quality of different configurations of our approach.

**Topic L05: Xiao, W.; & Xu, Y. (2018). Should an online retailer penalize its independent sellers for stockout?. Production and Operations Management 27: 1124—1132.**

We consider an online retailer selling a seasonal product provided by an independent third-party seller who has superior information about the demand potential of the product. The online retailer receives customer orders and then sends the orders to the seller for fulfillment, using pre-installed capacity. The supplier privately installs capacity prior to the selling season. The online retailer faces the challenge to accomplish two goals: to incentivize the seller to install the right level of capacity and to extract full surplus from the seller. We show that the commonly used commission contracts in online retailing cannot effectively allow the online retailer to accomplish the two goals to achieve the first-best outcome. We then show that the retailer can effectively accomplish the two goals to achieve the first-best, using a lost-sale penalty contract which has three

components: a fixed fee, a commission and a lost-sale penalty which will be charged to the seller if a lost sale occurs.

**<u>Topic Lo6:</u> Govindan, K.; & Fattahi, M. (2017). Investigating risk and robustness measures for supply chain network design under demand uncertainty: a case study of glass supply chain. International Journal of Production Economics 183: 680—699.**

This paper addresses a multi-stage and multi-period supply chain network design problem in which multiple commodities should be produced through different subsequent levels of manufacturing processes. The problem is formulated as a two-stage stochastic program under stochastic and highly time-variable demands. To deal with the stochastic demands, a Latin Hypercube Sampling method is applied to generate a fan of scenarios and then, a backward scenario reduction technique reduces the number of scenarios. Weighted mean-risk objectives by using different risk measures and minimax objective are examined to obtain risk-averse and robust solutions, respectively. Computational results are presented on a real-life case study to illustrate the applicability of the proposed approaches. To compare these different decision-making situations, a simulation approach is used. Furthermore, by several test problems, the performance of the stochastic model is investigated and the scenario generation method is evaluated in terms of in-sample and out-of-sample stability. Finally, sensitivity analysis on main parameters of the problem is performed to drive some managerial insights.

**<u>Topic Lo7:</u> Meistering, M.; & Stadtler, H. (2017). Stabilized-cycle strategy for capacitated lot sizing with multiple products: fill-rate constraints in rolling schedules. Production and Operations Management 26: 2247—2265.**

In practice, deterministic, multi-period lot-sizing models are implemented in rolling schedules since this allows the revision of decisions beyond the frozen horizon. Thus, rolling schedules are able to take realizations and updated forecasts of uncertain data (e.g., customer demands) into account. Furthermore, it is common to hold safety stocks to ensure given service levels (e.g., fill rate). As we will show, this approach, implemented in rolling schedules, often results in increased setup and holding costs while (over-)accomplishing given fill rates. A well-known alternative to deterministic planning models are stochastic, static, multi-period planning models used in the static uncertainty strategy, which results in stable plans. However, these models have a lack of flexibility to react to the realization of uncertain data. As a result, actual costs may differ widely from planned costs, and downside deviations of actual fill rates from those given are very high. We propose a new strategy, namely the stabilized cycle. This combines and expands upon ideas from the literature for minimizing setup and holding costs in rolling schedules, while controlling actual product-specific fill rates for a finite reporting period. A computational study with a multi-item capacitated medium-term production planning model has been executed in rolling schedules. On the one hand, it demonstrates that the stabilized-cycle strategy yields a good compromise between costs and downside deviations. Furthermore, the stabilized-cycle strategy weakly dominates the order-based strategy for both constant and seasonal demands.

**Topic L08: Taigel, F.; & Meller, J. (2018). Data-driven inventory management: integrated estimation and optimization. Working paper, University of Würzburg. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3256643.**

In this paper we present and analyze a novel approach to determine optimal inventory targets in a single-period newsvendor setting with non-stationary demand. For this, we integrate the optimization problem into tree-based machine learning.

We find our work in line with the upcoming stream of research on joint estimation and optimization that aims at directly learning a functional relationship between observable features and inventory decision instead of first estimating a prediction model and subsequently optimizing the decision. Our contribution to this field is threefold: 1) We provide a solution that integrates the newsvendor logic into the learning algorithm of decision tree learning -- a non-parametric machine learning technique. 2) We identify heteroscedasticity, i.e., feature-dependent uncertainty as a main performance driver in favor of integrated approaches. 3) We benchmark our approach on a complex real-world data set against several sequential estimation-optimization approaches and obtain cost improvement of up to 7%.

**Topic L09: Steinker, S.; Hoberg, K.; & Thonemann, U. W. (2017). The value of weather information for e-commerce operations. Production and Operations Management 26: 1854—1874.**

To be efficient, logistics operations in e-commerce require warehousing and transportation resources to be aligned with sales. Customer orders must be fulfilled with short lead times to ensure high customer satisfaction, and the costly under-utilization of workers must be avoided. To approach this ideal, forecasting order quantities with high accuracy is essential. Many drivers of online sales, including seasonality, special promotions and public holidays, are well known, and they have been frequently incorporated into forecasting approaches. However, the impact of weather on e-commerce operations has not been rigorously analyzed. In this study, we integrate weather data into the sales forecasting of the largest European online fashion retailer. We find that sunshine, temperature, and rain have a significant impact on daily sales, particularly in the summer, on weekends, and on days with extreme weather. Using weather forecasts, we have significantly improved sales forecast accuracy. We find that including weather data in the sales forecast model can lead to fewer sales forecast errors, reducing them by, on average, 8.6% to 12.2% and up to 50.6% on summer weekends. In turn, the improvement in sales forecast accuracy has a measurable impact on logistics and warehousing operations. We quantify the value of incorporating weather forecasts in the planning process for the order fulfillment center workforce and show how their incorporation can be leveraged to reduce costs and increase performance. With a perfect information planning scenario, excess costs can be reduced by 11.6% compared with the cost reduction attainable with a baseline model that ignores weather information in workforce planning.

**<u>Topic L10:</u> Ehrenthal, J. C. F.; Honhon, D.; & Van Woensel, T. (2014). Demand seasonality in retail inventory management. European Journal of Operational Research 238: 527—539.**

We investigate the value of accounting for demand seasonality in inventory control. Our problem is motivated by discussions with retailers who admitted to not taking perceived seasonality patterns into account in their replenishment systems. We consider a single-location, single-item periodic review lost sales inventory problem with seasonal demand in a retail environment. Customer demand has seasonality with a known season length, the lead time is shorter than the review period and orders are placed as multiples of a fixed batch size. The cost structure comprises of a fixed cost per order, a cost per batch, and a unit variable cost to model retail handling costs. We consider four different settings which differ in the degree of demand seasonality that is incorporated in the model: with or without within-review period variations and with or without across-review periods variations. In each case, we calculate the policy which minimizes the long-run average cost and compute the optimality gaps of the policies which ignore part or all demand seasonality. We find that not accounting for demand seasonality can lead to substantial optimality gaps, yet incorporating only some form of demand seasonality does not always lead to cost savings. We apply the problem to a real life setting, using Point-of-Sales data from a European retailer. We show that a simple distinction between weekday and weekend sales can lead to major cost reductions without greatly increasing the complexity of the retailer's automatic store ordering system. Our analysis provides valuable insights on the tradeoff between the complexity of the automatic store ordering system and the benefits of incorporating demand seasonality.