OPM 701 – Research Seminar Supply Chain Management
HWS 2020

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 **Wednesday, 20 May 15:00** via **Zoom** (details will follow once the application process is complete). 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 **2 November**.

6. The **presentations** will be held as a blocked session, most probably on 12 and 13 November (exact times and rooms 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 HWS 2020, 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 **27 April** until **10 May**. 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 a **grades overview** (the one you can print yourself is enough). 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 Luca Biscaro at biscaro@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: Mihm, J. (2010). Incentives in new product development projects and the role of target costing. Management Science 56(8), 1324—1344.

This paper investigates how self-optimizing engineers affect new product development (NPD) project outcomes and development times. A variety of widely used NPD project management approaches, including heavyweight project management, may allow or even encourage engineers to introduce late design changes and exhibit weak cost compliance, reducing the product's profit or competitiveness. Providing specifically designed incentives for individuals can eliminate such encouragement, and thus improve cost compliance and project timeliness. This paper discusses several practical incentive schemes, including profit-sharing contracts and component-level target costing. For many industrial projects, component-level target costing makes the most efficient use of available information to optimize project outcomes and reduce development times.

Topic L02: Ma, G., Lim, M. K., Mak, H., and Wan, Z. (2019). Promoting clean technology adoption: to subsidize products or service infrastructure?. Service Science 11(2), 75—95.

We study the dynamic adoption process of clean-technology products (e.g., electric vehicles and solar photovoltaic panels), which is often hampered by the chicken-and-egg dilemma: at the early stage of commercialization, firms are reluctant to invest in service infrastructure before sufficient consumers adopt the products; on the other hand, consumers hesitate to adopt the products without such infrastructure. We examine two forms of government subsidies (as well as their combination) that aim to overcome this dilemma, namely service infrastructure subsidy and product subsidy. Although our analysis shows that both types of subsidies are generally conducive to clean technology adoption, it also reveals an interesting result: both infrastructure subsidy and product subsidy can be detrimental under certain conditions. In particular, the former may cause early adopters to delay their purchase, and the latter may interfere with the firm's investment incentives and lead to reduced overall adoption. As a policy guideline, we find that the optimal subsidy strategy follows a "sandwich rule," in that it is optimal to provide only the product subsidy when the deployment cost is sufficiently high or sufficiently low; however, if the cost falls in the moderate range, it is optimal to subsidize both.

Topic L03: Jagabathula, S., and Rusmevichientong, P. (2017). A Nonparametric joint assortment and price choice model. Management Science 63(9), 3128-3145.

The selection of products and prices offered by a firm significantly impacts its profits. Existing approaches do not provide flexible models that capture the joint effect of assortment and price. We propose a nonparametric framework in which each customer is represented by a particular price threshold and a particular preference list over the alternatives. The customers follow a two-stage choice process; they consider the set of products with prices less than the threshold and choose the most preferred product from the set considered. We develop a tractable nonparametric expectation maximization (EM) algorithm to fit the model to the aggregate transaction data and design an efficient algorithm to determine the profit-maximizing combination of offer set and price. We also identify classes of pricing structures of increasing complexity, which determine the computational complexity of the estimation and decision problems. Our pricing structures are naturally expressed as business constraints, allowing a manager to trade off pricing flexibility with computational burden.

Topic L04: Köhler, C., Ehmke, J. F., and Campbell, A. M. (2020). Flexible time window management for attended home deliveries. Omega 91, 102023.

In the competitive world of online retail, customers can choose from a selection of delivery time windows on a retailer's website. Creating a set of suitable and cost-efficient delivery time windows is challenging, since customers want short time windows, but short time windows can increase delivery costs significantly. Furthermore, the acceptance of a request in a short time window can greatly restrict the ability to accommodate future requests. In this paper, we present customer acceptance mechanisms that enable flexible time window management in the booking of time-window based attended home deliveries. We build tentative delivery routes and check which time windows are feasible for each new customer re- quest. We offer the feasible long delivery time windows and let our approaches decide when to offer short time windows. Our approaches differ in the information they consider with regard to customer characteristics as well as detailed characteristics of the evolving route plan. We perform a computational study to investigate the approaches' ability to offer short time windows and still allow for a large number of customers to be served. We consider various demand scenarios, partially derived from real order data provided by a German online supermarket.

Topic L05: Gebreslassie, B. H., Yao, Y., and You, F. (2012). Design under uncertainty of hydrocarbon biorefinery supply chains: multiobjective stochastic programming models, decomposition algorithm, and a comparison between CVaR and downside risk. AIChE J. 58, 2155-2179.

A bicriterion, multiperiod, stochastic mixed-integer linear programming model to address the optimal design of hydrocarbon biorefinery supply chains under supply and demand uncertainties is presented. The model accounts for multiple conversion technologies, feedstock seasonality and fluctuation, geographical diversity, biomass degradation, demand variation, government incentives, and risk management. The objective is simultaneous minimization of the expected annualized cost and the financial risk. The latter criterion is measured by conditional value-at-risk and downside risk. The model simultaneously determines the optimal network design, technology selection, capital investment, production planning, and logistics management decisions. Multicut L-shaped method is implemented to circumvent the computational burden of solving large scale problems. The proposed modeling framework and algorithm are illustrated through four case studies of hydrocarbon biorefinery supply chain for the State of Illinois. Comparisons between the deterministic and stochastic solutions, the different risk metrics, and two decomposition methods are discussed. The computational results show the effectiveness of the proposed strategy for optimal design of hydrocarbon biorefinery supply chain under the presence of uncertainties.

Topic L06: Hilger, T., Sahling, F., and Tempelmeier, H. (2016). Capacitated dynamic production and remanufacturing planning under demand and return uncertainty. OR Spectrum 38, 849-876.

This paper considers a stochastic dynamic multi-product capacitated lot sizing problem with remanufacturing. Finished goods come from two sources: a standard production resource using virgin material and a remanufacturing resource that processes recoverable returns. Both the period demands and the inflow of returns are random. For this integrated stochastic production and remanufacturing problem, we propose a nonlinear model formulation that is approximated

by sample averages and a piecewise linear approximation model. In the first approach, the expected values of random variables are replaced by sample averages. The idea of the piecewise linear approximation model is to replace the nonlinear functions with piecewise linear functions. The resulting mixed-integer linear programs are solved to create robust (re)manufacturing plans.

Topic L07: **Becker-Peth, M., Hoberg, K., and Protopappa-Sieke, M. (2020). Multiperiod inventory management with budget cycles: rational and behavioral decision-making. Production and Operations Management 29(3), 643-663.**
We examine inventory decisions in a multiperiod newsvendor model. In particular, we analyze the impact of budget cycles in a behavioral setting. We derive optimal rational decisions and characterize the behavioral decision-making process using a short-sightedness factor. We test the aforementioned effect in a laboratory environment. We find that subjects reduce order-up-to levels significantly at the end of the current budget cycle, which results in a cyclic pattern during the budget cycle. This indicates that the subjects are short-sighted with respect to future budget cycles. To control for inventory that is carried over from one period to the next, we introduce a starting-inventory factor and find that order-up-to levels increase in the starting inventory.

Topic L08: **Klapp, M. A., Erera, A. L., and Toriello, A. (2018). The one-dimensional dynamic dispatch waves problem. Transportation Science 52(2), 402-415.**
We study same-day delivery systems by formulating the dynamic dispatch waves problem (DDWP), which models a depot where delivery requests arrive dynamically throughout a service day. At any dispatch epoch (wave), the information available to the decision maker is (1) a set of known, open requests that remain unfulfilled, and (2) a set of potential requests that may arrive later in the service day. At each wave, the decision maker decides whether or not to dispatch a vehicle, and if so, which subset of open requests to serve, with the objective of minimizing expected vehicle operating costs and penalties for unserved requests. We consider the DDWP with a single delivery vehicle and request destinations on a line, where vehicle operating times and costs depend only on the distance between points. We propose an efficient dynamic programming approach for the deterministic variant, and leverage it to design an optimal a priori policy with predetermined routes for the stochastic case. We then show that fully dynamic policies may perform arbitrarily better than a priori ones, and propose heuristics and dual bounds for this case.

Topic L09: **Mutha, A., Bansal, S., and Guide, V. D. R. (2019). Selling assortments of used products to third-party remanufacturers. Production and Operations Management 28(7), 1792—1817.**
This paper analyzes the business-to-business transactions in which a supplier sells assortments of used products to third-party remanufacturers. The supplier offers used products in different quality conditions, called grades. We model this buyer–supplier transaction as a Stackelberg game in which the buyer chooses his optimal purchase quantity of various grades, and the supplier chooses the optimal assortment and the prices of the grades in the assortment anticipating buyer's behavior. We first develop an analytically tractable solution to the buyer's and supplier's problems. Subsequently, we show several structural properties of the optimal assortment offered by the supplier, including (i) the optimal prices set by the supplier are such that high quality grades have a higher profit margin for the buyer; and (ii) the grades in the

optimal assortment constitute a convex hull of the remanufacturing and acquisition costs. We also extend the results to the case when the supplier's acquisition costs are marginally increasing in the quantity acquired.

Topic L10: van Loon, P., Delagarde, C., and Van Wassenhove, L. N. (2018). The role of second-hand markets in circular business: a simple model for leasing versus selling consumer products. Operations Research 56(1/2), 960—973.

This paper explores the role of the second-hand market when transitioning to a closed-loop system where products are leased multiple times. The total cost of ownership for consumers and profitability for manufacturers are compared in circular and linear business cases. We find that while second-hand markets were beneficial for manufacturers of durable goods in a linear system, since they increased the consumers' willingness-to-pay for new products, the same second-hand markets might restrict the profitability of a closed-loop business model. A high resale value results in a relatively low cost of ownership in the sales system and additional activities in the closed-loop model (such as managing the lease contracts and refurbishment) add significant costs to the supply chain. Consequently, the economic (and environmental) benefits of leasing products already traded on second-hand markets in the linear system are often limited. Our simple analytical model allows a quick and dirty analysis of multiple scenarios with a minimum of inputs. We argue that manufacturers lack these kinds of models to guide them in navigating circular economy business models.