

OPM 701 – Research Seminar Supply Chain Management

HWS 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, 20 May 15:30** 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 **1 November**.
6. The **presentations** will be held as a blocked session around week 46, most probably on 14 and 15 November (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 HWS 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 791: Research 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 **29 April** until **12 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 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 Lo1: Cohen, M. C.; Lobel, R.; & Perakis, G. (2016). The impact of demand uncertainty on consumer subsidies for green technology adoption. *Management science* 62: 1235—1258.

This paper studies government subsidies for green technology adoption while considering the manufacturing industry's response. Government subsidies offered directly to consumers impact the supplier's production and pricing decisions. Our analysis expands the current understanding of the price-setting newsvendor model, incorporating the external influence from the government, who is now an additional player in the system. We quantify how demand uncertainty impacts the various players (government, industry, and consumers) when designing policies. We further show that, for convex demand functions, an increase in demand uncertainty leads to higher production quantities and lower prices, resulting in lower profits for the supplier. With this in mind, one could expect consumer surplus to increase with uncertainty. In fact, we show that this is not always the case and that the uncertainty impact on consumer surplus depends on the trade-off between lower prices and the possibility of underserving customers with high valuations. We also show that when policy makers such as governments ignore demand uncertainty when designing consumer subsidies, they can significantly miss the desired adoption target level. From a coordination perspective, we demonstrate that the decentralized decisions are also optimal for a central planner managing jointly the supplier and the government. As a result, subsidies provide a coordination mechanism.

Topic Lo2: Berman, O.; Fazel-Zarandi, M. M.; & Krass, D. (2019). Truthful cheap talk: Why operational flexibility may lead to truthful communication. *Management Science* 65: 1624—1641.

This paper shows that operational flexibility interacting with informational uncertainty may lead to truthful information exchange in equilibrium even when the communication is nonbinding and unverifiable, i.e., “cheap talk.” We consider a model consisting of a manufacturer releasing a new product with uncertain release date and demand, and a retailer who must determine the allocation of limited capacity between a preexisting third-party product and the manufacturer's new product that may or may not be released on time. The manufacturer has a private forecast about the likelihood of the product release and/or about the demand, which he shares (either truthfully or not) with the retailer. We show that under the “traditional” supply chain structure (one-time opportunity to order) no truthful equilibrium can emerge. However, if (1) the supply chain structure allows for postponement, i.e., the ability to delay orders at a certain cost by the retailer, and (2) the manufacturer has informational uncertainty about the retailer's capacity, then truthful information exchange may emerge in equilibrium, where the manufacturer transmits his true forecast and the retailer treats the transmission as truthful. The genesis of this effect is preference reversal, where the manufacturer is not sure which way to distort the forecast to best motivate the retailer to wait for the new product. Thus, we show that a truth-revealing mechanism can emerge from a relatively rich setup featuring two-sided information asymmetry interacting with postponement.

Topic Lo3: Torabi, S. A.; Hassini, E.; & Jeihoonian, M. (2015). Fulfillment source allocation, inventory transshipment, and customer order transfer in e-tailing. *Transportation Research Part E* 79: 128—144.

We consider an inventory fulfillment-allocation and transshipment problem in an e-tailing environment. For a typical e-tailer, each customer demand is fulfilled from the closest fulfillment center if there are enough inventories. Otherwise, the e-tailer would transship stock from a nearby facility or transfer the customer order so it is fulfilled from another facility, depending on the economics of transportation. We develop a mixed-integer programming model to help e-tailers optimally fulfill customer orders while minimizing logistics costs. We propose a Benders decomposition-based approach to efficiently find optimal solutions. Our computational results demonstrate the importance of considering inventory transshipments in online deliveries.

Topic Lo4: Campbell, A. M. & Savelsbergh, M. W. P. (2005). Decision support for consumer direct grocery initiatives. *Transportation Science* 39: 313—327.

Many companies with consumer direct service models, especially grocery delivery services, have found that home delivery poses an enormous logistical challenge due to the unpredictability of demand coupled with strict delivery windows and low profit margin products. These systems have proven difficult to manage effectively and could benefit from new technology, particularly to manage the interaction between order capture and order delivery. In this article, we define routing and scheduling problems that incorporate important features of this emerging business model and propose algorithms, based on insertion heuristics, for their solution. In the proposed home delivery problem, the company decides which deliveries to accept or reject as well as the time slot for the accepted deliveries so as to maximize expected profits. Computational experiments reveal the importance of an approach that integrates order capture with order delivery and demonstrates the quality and value of the proposed algorithms.

Topic Lo5: Paul, J.; Agatz, N.; Spliet, R.; & de Koster, R. (2019). Shared capacity routing problem – An omni-channel retail study. *European Journal of Operational Research* 273: 731—739.

More and more retailers allow customers to order goods online and then pick them up in a store. In this setting, these orders are typically served from a dedicated warehouse. This often means that the stores are visited by different vehicles to replenish the store inventory and to supply the pick-up points. Motivated by a collaboration with an omni-channel grocery retailer in the Netherlands, we study how to best share capacity between the routes associated with these different sales channels. As operational constraints prevent jointly planning the routes, we consider the replenishment routes as fixed when planning the routes to serve the pick-up orders. An order can be transferred to the replenishment route, if capacity allows. We consider the problem of deciding which customer orders to transfer and which to deliver directly such that the total costs are minimized. We present an exact and a heuristic approach to solve this problem. Computational experiments on both real-world and artificial instances show that substantial savings can be achieved by sharing vehicle capacity across different channels.

Topic Lo6: Hübner, A. & Ostermeier, M. (2018). A multi-compartment vehicle routing problem with loading and unloading costs. *Transportation Science* 53: 282—300.

This paper discusses a multi-compartment vehicle routing problem (MCVRP) that occurs in the context of grocery distribution. Different temperature-specific product segments (e.g., frozen or ambient) are transported from a retail warehouse to outlets. Different temperature-specific product segments can be transported together using multi-compartment vehicles. These trucks are technically able to have different temperature zones on the same truck by separating the capacity of a vehicle flexibly into a limited number of compartments. On one hand, this leads to a cost saving as different product segments ordered by one outlet can be delivered jointly using only one truck. This impacts the routing and the number of stops—i.e., the transportation costs and unloading costs. On the other hand, more than one shipping gate has to be approached at the warehouse to collect and load different product segments. As a consequence, the number of segments on each truck and therefore the number of compartments impact loading, transportation, and unloading costs.

An extended MCVRP with flexible compartments is presented to account for these loading and unloading costs. To solve the problem that arises, a large neighborhood search (LNS) tailored to the extended model is defined. The LNS includes problem-specific extensions in terms of the removal and reinsert operators as well as the termination criteria. It is tested using a case study with a retailer, benchmark data, and randomly generated data. Results are also compared to existing approaches. In line with the analyses performed for the model introduced, it is shown that the integration of loading and unloading costs into the model impacts routing considerably, and ultimately results in significant savings potential for retailers.

Topic Lo7: Soysal, M.; Bloemhof-Ruwaard, J. M.; & van der Vorst, J. G. A. J. (2014). Modelling food logistics networks with emission considerations: The case of an international beef supply chain. *International Journal of Production Economics* 152: 57—70.

Intrinsic characteristics of food products and processes along with growing sustainability concerns lead to the need for decision support tools that can integrate economic considerations with quality preservation and environmental protection in food supply chains. In this study, we develop a multi-objective linear programming (MOLP) model for a generic beef logistics network problem. The objectives of the model are (i) minimizing total logistics cost and (ii) minimizing total amount of greenhouse gas emissions from transportation operations. The model is solved with the ϵ -constraint method. This study breaks away from the literature on logistics network models by simultaneously considering transportation emissions (affected by road structure, vehicle and fuel types, weight loads of vehicles, traveled distances), return hauls and product perishability in a MOLP model. We present computational results and analysis based on an application of the model on a real-life international beef logistics chain operating in Nova Andradina, Mato Grosso do Sul, Brazil and exporting beef to the European Union. Trade-off relationships between multiple objectives are observed by the derived Pareto frontier that presents the cost of being sustainable from the point of reducing transportation

emissions. The results from the pie chart analysis indicate the importance of distances between actors in terms of environmental impact. Moreover, sensitivity analysis on practically important parameters shows that export ports' capacities put pressure on the logistics system; decreasing fuel efficiency due to the bad infrastructure has negative effects on cost and emissions; and green tax incentives result in economic and environmental improvement.

Topic Lo8: Helber, S.; Sahling, F.; & Schimmelpfeng, K. (2013). Dynamic capacitated lot sizing with random demand and dynamic safety stocks. *OR Spectrum* 35: 75—105.

We present a stochastic version of the single-level, multi-product dynamic lot-sizing problem subject to a capacity constraint. A production schedule has to be determined for random demand so that expected costs are minimized and a constraint based on a new backlog-oriented δ -service-level measure is met. This leads to a non-linear model that is approximated by two different linear models. In the first approximation, a scenario approach based on the random samples is used. In the second approximation model, the expected values of physical inventory and backlog as functions of the cumulated production are approximated by piecewise linear functions. Both models can be solved to determine efficient, robust and stable production schedules in the presence of uncertain and dynamic demand. They lead to dynamic safety stocks that are endogenously coordinated with the production quantities. A numerical analysis based on a set of (artificial) problem instances is used to evaluate the relative performance of the two different approximation approaches. We furthermore show under which conditions precise demand forecasts are particularly useful from a production-scheduling perspective.

Topic Log: Guajardo, J. A. & Cohen, M. A. (2018). Service differentiation and operating segments: A framework and an application to after-sales services. *Manufacturing & Service Operations Management* 20: 440—454.

The decisions of whether and how to adopt service differentiation are at the core of a firm's service operations strategy. This paper proposes a framework for service differentiation that highlights the identification and use of operating segments as a central component in the delivery of differentiated services. The notion of operating segments and the general empirical methodology to identify them proposed in this paper integrally considers the consumer's preferences and operational capabilities required to fulfill the differentiated service offering. An application in the context of after-sales services for product-service bundles using data from a major manufacturer in the consumer electronics industry is presented, which illustrates how operational decisions need to be adjusted when multiple operating segments are defined to support a service differentiation strategy.

Topic L10: Mazahir, S; Verter, V.; Boyaci, T.; & Van Wassenhove, L. N. (2019). Did Europe move in the right direction on e-waste legislation? *Production and Operations Management* 28: 121—139.

This study presents an analytical framework of the product take back legislation in the context of product reuse. We characterize existing and proposed forms of E-waste legislation and compare their environmental and economic performance. Using stylized models, we analyze an OEM's decision about new and remanufactured product quantity in response to the legislative mechanism. We focus on the 2012 waste electrical and electronic equipment directive in Europe, where the policy makers intended to create additional incentives for the product reuse. Through a comparison to the Original 2002 version of the directive, we find that these incentives translate into improved environmental outcomes only for a limited set of products. We also study a proposed policy that advocates a separate target for the product reuse. Our analysis reveals that from an environmental standpoint, the Recast version is always dominated either by the Original policy or by the one that advocates a separate target for product reuse. We show that the benefits of a separate reuse target scheme can be fully replicated with the aid of fiscal levers. Our main message is that there cannot be a single best environmental policy that is suitable for all products. Therefore, the consideration of product attributes is essential in identification of the most appropriate policy tool. This can be done either by the implementation of different policies on each product category or by implementation of product-based target levels.

Topic L11: Wan, M.; H, Y.; Zhao, L.; Deng, T; & Fransoo, J. C. (2019). Demand estimation under multi-store multi-product substitution in high density traditional retail. *European Journal of Operational Research* 266: 99—111.

In large cities in emerging economies, traditional retail is present in a very high density, with multiple independently owned small stores in each city block. Consequently, when faced with a stockout, consumers may not only substitute with a different product in the same store, but also switch to a neighboring store. Suppliers may take advantage of this behavior by strategically supplying these stores in a coherent manner. We study this problem using consumer choice models. We build two consumer choice models for this consumer behavior. First, we build a Nested Logit model for the consumer choice process, where the consumer chooses the store at the first level and selects the product at the second level. Then, we consider an Exogenous Substitution model. In both models, a consumer may substitute at either the store level or the product level. Furthermore, we estimate the parameters of the two models using a Markov chain Monte Carlo algorithm in a Bayesian manner. We numerically find that the Nested Logit model outperforms the Exogenous Substitution model in estimating substitution probabilities. Further, the information on consumers' purchase records helps improve the estimation accuracies of both the first-choice probabilities and the substitution probabilities when the beginning inventory level is low. Finally, we show that explicitly including such substitution behavior in the inventory optimization process can significantly increase the expected profit.

Topic L12: Harsha, P.; Subramanian, S.; & Uichanco, J. (2019). Dynamic pricing of omnichannel inventories. *Manufacturing & Service Operations Management* 21: 47—65.

Omnichannel retail refers to a seamless integration of an e-commerce channel and a network of brick-and-mortar stores. An example is cross-channel fulfillment, which allows a store to fulfill online orders in any location. Another is price transparency, which allows customers to compare the online price with store prices. This paper studies a new and widespread problem resulting from omnichannel retail: price optimization in the presence of cross-channel interactions in demand and supply, where cross-channel fulfillment is exogenous. We propose two pricing policies that are based on the idea of “partitions” to the store inventory that approximate how this shared resource will be utilized. These policies are practical because they rely on solving computationally tractable mixed integer programs that can accept various business and pricing rules. In extensive simulation experiments, they achieve a small optimality gap relative to theoretical upper bounds on the optimal expected profit. The good observed performance of our pricing policies results from managing substitutive channel demands in accordance with partitions that rebalance inventory in the network. A proprietary implementation of the analytics is commercially available as part of the IBM Commerce markdown price solution. The system results in an estimated 13.7% increase in clearance-period revenue based on causal model analysis of the data from a pilot implementation for clearance pricing at a large U.S. retailer.