Business School
Chair of Supply Chain Management
Prof. Dr. Moritz Fleischmann

UNIVERSITY
OF MANNHEIM
Business School

OPM 701 – Research Seminar Supply Chain Management
HWS 2024

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 Supply Chain Management.

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 their findings in a written report (about 20 pages) as well as in a presentation (20 min + 20 min discussion).

3. A **kick-off meeting** for all participants will be held on **Thursday, 16 May, 10:15** in room **O 129.** General guidelines for conducting a scientific literature review will be discussed and the deliverables of the seminar will be explained in detail.

4. The written reports must be **submitted** electronically and as a hard copy in two-fold by **Tuesday 5 November**.

5. The **presentations** will be held as a blocked session, most probably on **14 and 15 November** (subject to change; exact times and room to be announced).

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

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

8. There is a joint application process for all seminars offered by the chairs of the Area Operations Management. In the HWS 2024, this includes the following seminars:

   - OPM 701: Research Seminar Supply Chain Management (Chair of Supply Chain Management), **labeled with 'L'**
   - OPM 760: Project Seminar Operations Analytics (Chair of Production Management), **labeled with 'P'**
   - OPM 761: Research Seminar Production Management (Chair of Production Management), **labeled with 'P'**
   - OPM 781: Research Seminar Service Operations (Chair of Service Operations Management), **labeled with 'S'**
   - OPM 791: Research Seminar Procurement (Chair of Procurement), **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.

9. Applications are open within the period from **26 April** to **10 May**. Students have to join the ILIAS group **Seminar Application Area Operations** ([link](#)) and complete the **application form** there.

10. Additionally, students applying for a topic of OPM 701 must send an e-mail to scm@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 must send documents to them as well.

11. For any questions concerning the seminar, feel free to contact Katrin Waßmuth at katrin.wassmuth@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: **Alvarez-Palau, E. J., Calvet-Liñán, L., Viu-Roig, M., Gandouz, M., & Juan, A. A. (2022). Economic profitability of last-mile food delivery services: Lessons from Barcelona.** *Research in Transportation Business & Management*, **45, 100659.**

During the last years, the number of digital platforms offering allegedly environmental sustainable last-mile logistics services has been increasing fast all over the world. Their size and geographical spread are growing leaps and bounds. Some studies suggest that they are still operating at losses and relying on venture capital to carry on growing. In this paper we employ real-life data gathered from the largest food delivery platforms (Just Eat, Glovo, and Deliveroo) operating in the city of Barcelona (Spain) to analyse the profitability of these business models. We develop a Monte Carlo simulation model with several scenarios to estimate how many orders are needed to reach economic profitability. Using this simulation model, a second model based on multiple linear regression is built to investigate the relationship between 'the minimum number of orders required to reach profitability' and several independent variables, such as the share of the total purchase order or the delivery time-distance. The potential use of this tool for managers is discussed, and several lines of future research on the economical profitability of food delivery operations are highlighted.

Topic L02: **Benjaafar, S., Ding, J.-Y., Kong, G., & Taylor, T. (2022). Labor Welfare in On-Demand Service Platforms.** *Manufacturing & Service Operations Management*, **24(1), 110-124.**

Problem definition: An on-demand service platform relies on independent workers (agents) who decide how much time, if any, to devote to the platform. Some labor advocates have argued that an expansion of the labor pool hurts agents—by reducing the wage and agent utilization (i.e., the fraction of time an agent is busy serving customers). Motivated by concern for agent welfare, regulators are considering measures that reduce the labor pool size or that impose a floor on the nominal wage or effective wage (i.e., the product of the nominal wage and agent utilization). Are agents indeed hurt by an expansion in the labor pool size? Which type of wage-floor regulation is preferable? Are consumers hurt by the imposition of a wage floor? Academic/practical relevance: Because independent agents work without the traditional protections intended to ensure the welfare of employees, the welfare of those agents is an important concern. Methodology: We employ an equilibrium model that accounts for the interaction among price, wage, labor supply, customer delay, and demand. Results: Average labor welfare increases and then decreases in the labor pool size; that is, agents are harmed by an expansion in the labor pool size if and only if the labor pool size is sufficiently large. The effective wage floor is superior to the nominal wage floor in terms of labor welfare maximization. More generally, the two types of wage floors have structurally different effects on labor welfare, with a floor on the nominal wage only beneficial to agents if it is sufficiently small. Contrary to the conventional view that consumers are hurt by an effective wage floor (because they face a higher price, due to upward pressure on the wage, and longer delay, due to upward pressure on agent utilization), consumers actually benefit. Managerial implications: Regulators, labor advocates, platform managers, and agents benefit from understanding the forces that create and destroy labor welfare.

Topic L03: Serrano-Hernandez, A., de la Torre, R., Cadarso, L., & Faulin, J. (2021). Urban e-grocery distribution design in Pamplona (Spain). Applying an agent-based simulation model with horizontal cooperation scenarios. *Algorithms*, **14(1), 20.**

E-commerce has boosted in the last decades because of the achievements of the information and telecommunications technology along with the changes in the society life-style. More recently, the groceries online purchase (or e-grocery), has also prevailed as a way of making the weekly shopping, particularly, the one including fresh vegetables and fruit. Furthermore, this type of virtual shopping in supermarkets is gaining importance as the most efficient delivery system in cost and time. Thus, we have evaluated in this study the influence of the cooperation-based policies on costs and service quality among different supermarkets in Pamplona, Spain. Concerning methodology, first of all, we carried out a survey in Pamplona having the purpose of modelling the demand patterns about e-grocery. Second, we have developed an agent-based simulation model for generating scenarios in non-cooperative, limited cooperation, and full cooperation settings, considering the real data obtained from the survey analysis. At this manner, Vehicle Routing Problems (VRP) and Multi Depot VRPs (MDVRP) are dynamically generated and solved within the simulation framework using a biased-randomization algorithm. Finally, the results show significant reductions in distance driven and lead times when employing horizontal cooperation in e-grocery distribution.

Topic L04: Ulmer, M. W., Goodson, J. C., & Thomas, B. W. (2024). Optimal Service Time Windows. *Transportation Science*, **Forthcoming.**

Because customers must usually arrange their schedules to be present for home services, they desire an accurate estimate of when the service will take place. However, even when firms quote large service time windows, they are often missed, leading to customer dissatisfaction. Wide time windows and frequent failures occur because time windows must be communicated to customers in the face of several uncertainties: future customer requests are unknown, final service plans are not yet determined, and when fulfillment is outsourced to a third party, the firm has limited control over routing procedures and eventual fulfillment times. Even when routing is performed in-house, time windows often do not receive explicit consideration. In this paper, we show how companies can communicate reliable and narrow time windows to customers in the face of arrival time uncertainty when time window decisions are decoupled from routing procedures. Under assumptions on the shape of arrival time distributions, our main result characterizes the optimal policy, identifying structure that reduces a high-dimensional stochastic nonlinear optimization problem to a root-finding problem in one dimension. The result inspires a practice-ready heuristic for the more general case. Relative to the industry standard of communicating uniform time windows to all customers, and to other policies applied in practice, our method of quoting customer-specific time windows yields a substantial increase in customer convenience without sacrificing reliability of service. Our results show that time windows should be tailored to individual customers, time window sizes should be proportional to the service level, larger time windows should be assigned to earlier requests and smaller time windows to later requests, larger time windows should be assigned to customers further from the depot of operation and smaller time windows to closer customers, high quality time windows can be identified even with limited data, and cost savings afforded by routing efficiency should be measured against potential losses to customer convenience.

Topic L05: Chomachaei, F., Gal-Or, E., Letizia, P., & Roma, P. (2024). The economic viability of the sharing economy business model and its environmental impact. *European Journal of Operational Research*, **315(3), 1197-1209.**

The sharing economy refers to a business model where access to products or services is shared among consumers through an online platform. This model has recently received much attention to determine whether it is economically viable and environmentally friendly. The main trade-off is this: a decrease in production volume possibly favoring the environment while reducing the manufacturer's profits versus an increase in product usage potentially harmful to the environment while enhancing the manufacturer's profits from increased margins. Furthermore, the sharing economy may prod the manufacturer to either elevate product efficiency so as to justify a higher selling price or to reduce it with the intent of cutting production costs. Given these arguments, we investigate both economic and environmental impacts of the sharing economy business model for comparison with the traditional models of pure sales and servicing. We find that the manufacturer may prefer peer-to-peer product-sharing over pure sales or hybrid servicing under two sets of conditions: (1) either consumers are sufficiently heterogeneous in their product usage needs, while concurrently the size of high-usage consumers being relatively small, or consumers are sufficiently homogeneous in their product usage needs, while concurrently consumer segments with different usage needs being similar in size, and (2) the marginal cost of production (per unit of efficiency) and the manufacturer's ability to pool consumers' needs are both sufficiently low. The sharing economy can also environmentally outperform traditional business models, especially for products where environmental impact accrues mostly at production/disposal than at usage. As a result, the sharing economy can yield a win–win outcome as to manufacturer's profits and environmental impact.

Topic L06: Dou, G., & Choi, T.-M. (2024). Compete or cooperate? Effects of channel relationships on government policies for sustainability. *European Journal of Operational Research*, **313(2), 718-732.**

The importance of sustainability has led governments worldwide to impose emission regulations on manufacturers. However, it is largely unknown how channel relationships between manufacturers (i.e., competitive or cooperative) affect government policies, such as the emission tax price. In this paper, we address this pertinent yet underexplored issue by building formal analytical models. In the context of different channel relationships and with the goal of increasing social welfare, we also explore whether providing positive incentives is more effective than imposing taxes. We show that although cooperation leads to better economic performance, competition may be the channel relationship that better improves sustainability and social welfare. We find that government incentives to promote green technology need not be effective in enhancing sustainability. If investment is needed to fund green technology, increasing taxes on greenhouse gas emissions (hereafter "emissions") can protect the environment only if the product's initial emission intensity is sufficiently high. We also reveal that the total emissions are not necessarily decreased when (i) the consumers are more environmentally aware and (ii) there is a reduction in emission-abatement costs. Finally, we generalize our model to the extended modeling cases with (i) N-manufacturer and (ii) market segments with a proportion of environmentally aware consumers. Our main conclusions remain valid in the extended cases. The practical relevance and real-world implications of these results are discussed.

Topic L07: Jiang, Z.-Z., Li, K., Tang, C. S., & Yang, S. A. (2024). Offering EV Battery Swapping as a Service: EV Manufacturers or Battery Producers? *Working Paper*.

To accelerate EV adoption and overcome the shortcomings of the traditional EV charging model (e.g., long charging time and lack of access to home chargers for urban residents), Battery as a Service (BaaS) has emerged as a promising alternative. Under the BaaS model, customers can purchase the vehicle body without owning the battery packs. By paying a battery service fee, customers can swap their depleted batteries with fully charged ones at battery-swapping stations. The BaaS model requires investment and operation of battery-swapping stations, prompting us to examine the relative advantages for EV manufacturers or battery producers to build and operate these battery-swapping stations. By constructing a game-theoretical model with one battery supplier and one vehicle manufacturer, we compare two BaaS operating models. First, in the "manufacturer-operated" model (Model-M), the vehicle manufacturer procures EV batteries from the supplier and invests and operates the battery swapping stations. Second, in the "supplier-operated" model (Model-S), the vehicle manufacturer sells battery-free EVs to customers while the supplier invests and operates the battery swapping stations. Our results reveal that Model-S can induce a higher number of battery swapping stations being built; however, Model-M always entices more customers to adopt EVs. Furthermore, Model-M leads to a higher profit for the manufacturer and the supply chain, and it is preferable by the supplier when the cost of building battery swapping stations is low or the cost of producing batteries is low. Finally, by extending the model to include two competing EV manufacturers, we highlight that the choice between Model-M and Model-S hinges on the degree of downstream competition: in a low-competition environment, it could still be socially optimal for the leading EV manufacturer to lead the BaaS effort under Model-M; However, as competition intensifies, the battery producer is in general in a better position to offer the EV BaaS. By identifying how different operational and economic factors affect the relative merits between the two BaaS operating models, our paper provides insights for industry leaders and policymakers when deciding who should lead the effort of investing and operating the BaaS model.

Topic L08: Cohen, M., Cui, S., Doetsch, S., Ernst, R., Huchzermeier, A., Kouvelis, P., Lee, H., Matsuo, H., & Tsay, A. A. (2022). Bespoke supply-chain resilience: The gap between theory and practice. *Journal of Operations Management*, 68(5), 515-531.

Recent research has documented that companies are pursuing a variety of strategies to enhance supply-chain resilience. This paper examines how managers actually think about resilience strategies, and then analyzes the relationship between operations, supply-chain characteristics, and the implemented strategies. We define a "Triple-P" framework that matches resilience strategies to supply-chain archetypes by examining Product, Partnership, and Process complexity based on interviews of senior supply-chain executives. These interviews revealed two major influencers of resilience strategy, that is, Homogeneity of internal supply-chain processes and Integration with other actors in their end-to-end supply chains. We found that the supply chains have different resilience requirements, have different ways to achieve resilience (which we conceptualize as "bespoke supply-chain resilience"), and face different obstacles to resilience. This study aims at initiating a dialogue between supply-chain scholars and practitioners to support more research for developing an effective supply-chain resilience strategy.

Topic L09: Wijnsma, S. C., Lauga, D. O., & Toktay, L. B. (2024). Treat, Dump, or Export? How Domestic and International Waste Management Policies Shape Waste Chain Outcomes. *Management Science*, **Forthcoming.**

Illegal or unwanted waste disposal methods such as dumping and export are prevalent in practice. To minimize the environmental harm of these methods, policymakers have implemented laws and regulations designed to combat them. Even so, violations are rampant as a high degree of heterogeneity between firms and proprietary information render monitoring imperfect. Decentralized waste disposal chains, a common form of interbusiness organization in this sector, compound this problem as firms also have limited information available on their waste chain partner, creating complex interactions between firm behavior and policy interventions. Against this background, we analyze the effects of domestic and international waste regulations targeting dumping and export, respectively, on firm incentives and compliance. We develop a two-tier waste chain with a producer that generates waste and an operator that treats it. The producer's waste quality and the treatment operator's efficiency can be private information. Either party can avoid compliance cost by violating regulations where the producer can arrange for export and the operator can dump locally. Our analysis reveals that primarily focusing on penalizing dumping by treatment operators can worsen environmental harm. Solely focusing on penalizing low-quality waste exports, a common intervention in practice, can also backfire. Instead, penalizing producers for downstream dumping should be given consideration. In addition, the asymmetry in export burden between waste quality levels should be reduced.

Topic L10: Denizel, M., Ferguson, M., & Souza, G. C. (2010). Multiperiod Remanufacturing Planning With Uncertain Quality of Inputs. *IEEE Transactions on Engineering Management*, **57(3), 394-404.**

In this paper, we consider production planning when inputs have different and uncertain quality levels, and there are capacity constraints. This situation is typical of most remanufacturing environments, where inputs are product returns (also called cores). Production (remanufacturing) cost increases as the quality level decreases, and any unused cores may be salvaged at a value that increases with their quality level. Decision variables include, for each period and under a certain probabilistic scenario, the amount of cores to grade, the amount to remanufacture for each quality level, and the amount of inventory to carry over for future periods for ungraded cores, graded cores, and finished remanufactured products. Our model is grounded with data collected at a major original equipment manufacturer that also remanufactures. We formulate the problem as a stochastic program; although it is a large linear program, it can be solved easily using Cplex. We provide a numeric study to generate insights into the nature of the solution.

Topic L11: **Tuna, A. K., & Swinney, R. (2023). Sustainability Implications of Supply Chain Responsiveness.** *Manufacturing & Service Operations Management*, **25(6), 2176-2194.**

Problem definition: A critical decision made by firms is whether to adopt a responsive supply chain (prioritizing speed) or an efficient supply chain (prioritizing cost). We consider the environmental implications of this choice, distinguishing between responsiveness achieved via three pathways: responsive offshore supply chains increase speed by using expedited production and distribution methods; responsive nearshore supply chains increase speed by reducing the physical distance between source and destination for all production; and hybrid nearshore supply chains produce in multiple locations simultaneously, increasing speed by reducing distance on some portion of production. Methodology/results: Using a model wherein responsiveness increases fixed and marginal costs, decreases leadtimes, and changes the per-unit environmental impact of production and distribution, we identify several results. First, all types of responsiveness can decrease environmental impact relative to an efficient supply chain, showing any form of responsiveness has potential to improve sustainability. Second, despite this, all types of responsiveness can also increase environmental impact relative to an efficient supply chain, particularly if demand variability is high. This is precisely when responsiveness is most profitable to the firm, indicating a tension between firm and environmental preferences. Third, a win-win outcome in which responsiveness both maximizes firm profit and minimizes environmental impact is most likely to occur when demand variability is high and unsatisfied customers substitute with a product that generates high environmental impact. Fourth, the firm may have incentive to choose a supply chain that does not minimize (and may maximize) environmental impact, especially at low-to-moderate demand variability. Managerial implications: While responsive supply chains can improve sustainability, they also generate the potential for misalignment of profit and environmental performance. We discuss the implications of this for firms and for policymakers seeking to encourage firms to use supply chains that generate the least environmental impact.

Topic L12: **Theodorou, E., & Spiliotis, E., Assimakopoulos, V. (2023). Optimizing inventory control through a data-driven and model-independent framework.** *EURO Journal on Transportation and Logistics*, **12, 100103.**

Machine learning has shown great potential in various domains, but its appearance in inventory control optimization settings remains rather limited. We propose a novel inventory cost minimization framework that exploits advanced decision-tree based models to approximate inventory performance at an item level, considering demand patterns and key replenishment policy parameters as input. The suggested approach enables data-driven approximations that are faster to perform compared to standard inventory simulations, while being flexible in terms of the methods used for forecasting demand or estimating inventory level, lost sales, and number of orders, among others. Moreover, such approximations can be based on knowledge extracted from different sets of items than the ones being optimized, thus providing more accurate proposals in cases where historical data are scarce or highly affected by stock-outs. The framework was evaluated using part of the M5 competition's data. Our results suggest that the proposed framework, and especially its transfer learning variant, can result in significant improvements, both in terms of total inventory cost and realized service level.