OPM 761 – Research Seminar Production Management

Fall Term 2026

The goal of this seminar is to introduce the participants to conduct scientific research. Thereby, it prepares the students for the writing of their Master's thesis. The seminar is geared towards students intending to write their thesis at the Chair of Production Management.

Participants will explore one of the topics listed below. They will review and critically assess the corresponding scientific literature and present their findings in a written report (18 to 22 pages) as well as in an in-class presentation (15 - 20 min + 20 min discussion). Each participant is also expected to critically assess the presentations of the other students in the ensuing discussion.

Applications will be accepted from **May 10th, 2026** until **May 22nd, 2026**. Admission to the seminar will be confirmed by e-mail at latest on May 29th, 2026 and must be reconfirmed by the participant at the kick-off meeting.

The **Kick-off meeting** will be held on **June 9th, 2026** between 10:15 and 11:45 (CET). During this meeting, an introduction to scientific writing and presentations for term papers will be given.

A brief session on introduction to Overleaf and LaTeXwill also be offered. The time and date of this session will be decided in the Kick-off meeting among the interested students.

The **written reports** have to be submitted by Monday, **October 6th, 2026** in the following formats:

- Two-fold hard copy version.
- Electronic version including a copy of the references cited in the report and auxiliary information (tables, data, programming code, etc.).

The **presentations** will be held as a blocked session during between **26th and 30th October 2026**. Attendance at all presentations is mandatory.

The final grade for the seminar is composed of the following components: Written report (50%) and presentation (50%).

There is a joint application process for all seminars offered by the chairs of the Area Operations Management. In the fall term 2026, this includes the following seminars:

- **OPM 701:** Research Seminar Supply Chain Management
  Chair of Logistics and Supply Chain Management, Prof. Dr. Moritz Fleischmann
  (Topics labeled with "L"),
- **OPM 760:** Project Seminar Operations Analytics,
  Chair of Production Management, Prof. Dr. Raik Stolletz
  (Topics labeled with "P"),
- **OPM 761:** Research Seminar Production Management,
  Chair of Production Management, Prof. Dr. Raik Stolletz
  (Topics labeled with "P"),

- **OPM 781:** Research Seminar Service Operations Management
  Chair of Service Operations Management, Prof. Dr. Cornelia Schön
  (Topics labeled with “S”),
- **OPM 791:** Research Seminar Procurement
  Endowed Chair of Procurement, Prof. Dr. Christoph Bode
  (Topics labeled with “B”).

Detailed information on the seminar topics and the link to the online registration tool are available on the home pages of the respective chairs. In their applications, students can indicate up to five preferred topics from all seminars.

In addition, applicants for OPM 761 must send an email with (1) CV, (2) official B.Sc. and M.Sc. grades overviews, and (3) the list of courses in the Area Operations that you are currently enrolled in to opm761@uni-mannheim.de. For any further question concerning the seminar please also contact the chair via opm761@uni-mannheim.de.

P7 – Optimizing Berth Allocation in Ports: Models and Multi-Objective Solutions

Objectives: Efficient berth allocation is a critical task in container terminal operations, where arriving vessels must be assigned to berthing positions and service times along a quay. Poor allocation decisions lead to increased waiting times, congestion, and higher operational costs. The Berth Allocation Problem (BeAP) is therefore a key optimization problem in maritime logistics. In practice, berth allocation often involves multiple conflicting objectives. Port operators aim to minimize vessel waiting times and service delays while also considering additional aspects such as environmental impact, fairness among vessels, and operational preferences (e.g., daytime berthing). These requirements give rise to the Multi-objective Berth Allocation Problem (MOBeAP), which is computationally challenging due to its combinatorial structure and the presence of conflicting objectives.

The goal of this research seminar is to provide a comprehensive overview of multi-objective optimization models and solution approaches for the MOBeAP. The existing literature should be systematically reviewed and compared by analyzing modeling choices (e.g., discrete vs. continuous berth representation), objective functions, and constraints. Furthermore, the trade-offs inherent in solving such problems, particularly how different approaches balance these competing objectives, should be discussed. Key focus here is the different formulations of the multi-objective problem. Finally, managerial insights derived from the literature on the MOBeAP should be identified and discussed.

Prerequisites: Knowledge in optimization models (e.g., OPM 561, 662)

Basic Paper: Bierwirth and Meisel (2010, 2015)

> **Abstract**: Due to the variety of technical equipments and terminal layouts, research has produced a multitude of optimization models for seaside operations planning in container terminals. To provide a support in modeling problem characteristics and in suggesting applicable algorithms this paper reviews the relevant literature. For this purpose new classification schemes for berth allocation problems and quay crane scheduling problems are developed. Particular focus is put on integrated solution approaches which receive increasing importance for the terminal management.

P8 – From Amazon Prime to Same-Day Delivery: Who Gets Served First?

Objectives: Many production and service systems must handle heterogeneous demand classes that differ in urgency, profitability, or service requirements. Examples include spare parts logistics with critical vs. non-critical components, healthcare systems with emergency vs. elective patients, or make-to-order manufacturing with premium vs. standard customers. When capacity is scarce, firms must decide how much capacity to provide and how to allocate it across different demand classes. These mechanisms should aim to balance efficiency, fairness, and profitability under uncertainty. Two key operational levers in such systems are capacity reservation and prioritization policies. Capacity reservation/buffer refers to dedicating a portion of capacity exclusively to high-priority demand, while prioritization policies dynamically determine the order in which jobs are processed (e.g., priority queues, threshold policies, or state-dependent rules).

The goal of this seminar thesis is to provide a structured overview of the literature on capacity allocation and prioritization in multi-class stochastic service systems. The student should identify and classify different modelling approaches specifically, the influence of system characteristics (e.g. demand uncertainty, service time variability and time sensitivity) affect prioritization policies. The thesis should conclude with managerial insights that support the selection of appropriate priority policies in practical settings.

Prerequisites: Knowledge in variability and stochastic systems (e.g. OPM 561)

Basic Papers: Chen et al. (2025); Jiang et al. (2020)

> **Abstract**: We study service systems with parallel servers and random customer arrivals and focus on the waiting cost of customers. Using a Markov decision process (MDP) modelling approach, we analytically characterize the structures of the optimal dynamic server assignment policies for two important systems, one consisting of multiple homogeneous servers and two classes of customers and the other consisting of two heterogeneous servers and multiple classes of customers. Based on the obtained results, we propose a threshold-type heuristic policy for the generalized system consisting of multiple heterogeneous servers and multiple classes of customers. . .

P9 – Priority Rules for Order Scheduling under Tight Deadlines: Heuristics vs. Optimal Policies

Objectives: In many production and fulfillment systems, orders must be processed under strict time constraints. Examples include make-to-order manufacturing, spare parts logistics with service-level agreements, and e-commerce fulfillment with same-day or next-day delivery promises. In such environments, firms must decide how to dynamically schedule jobs when capacity is limited and deadlines are tight. A central operational challenge is the choice of priority rules for order scheduling. Classical heuristics such as earliest due date (EDD) or shortest processing time (SPT) are widely used in practice due to their simplicity and robustness. However, these heuristics may be suboptimal in stochastic and highly congested systems, where uncertainty in processing times, arrivals, and deadlines plays a critical role.

The goal of this seminar paper is to provide a structured overview of the literature on scheduling policies under tight deadlines, with a particular focus on the comparison between heuristic priority rules and optimal (or near-optimal) policies. Specifically, the student should identify how system characteristics influence the performance of different prioritization rules and their impact on service levels. The discussion of relevant managerial insights should highlight under which conditions simple heuristics remain effective and when more advanced scheduling approaches are required.

Prerequisites: Knowledge in variability and stochastic systems (e.g. OPM 561)

Basic Papers: Chen et al. (2025); Lawrence and Sewell (1997)

> **Abstract**: Problem definition: Appointment scheduling problems under uncertainty encounter a fundamental trade-off between cost minimization and customer waiting times. Most existing studies address this trade-off using a weighted sum approach, which puts little emphasis on individual waiting times and thus, customer satisfaction. In contrast, we study how to minimize total cost while providing waiting time guarantees to all customers. Methodology/results: Given box uncertainty sets for service times and no-shows, we introduce the robust appointment scheduling problem with waiting time guarantees…

P10 – Optimizing Lot Size under Rework Policies in Tool Manufacturing

Objectives: In manufacturing systems such as tool production, semiconductor, textile, and chemical industries, rework requirements are common, as production processes are rarely perfect and a certain proportion of the produced items exhibit low quality. Variability in machine performance, material properties, and human operations often results in imperfect products that must be reworked, rejected, or sold at a reduced value. The decisions regarding qualification, rejection, or rework are typically based on inspection reports generated by quality control departments. Moreover, inspection and quality assurance activities consume additional time and resources, thereby affecting overall productivity and inventory levels. Traditional Economic Order Quantity (EOQ) and Economic Production Quantity (EPQ) models, however, overlook these imperfections by assuming that all produced items are of perfect quality and that inspection activities have no time or cost implications.

The objective of this seminar thesis is to review and critically analyze the literature on lot-sizing models that incorporate imperfect production, rework, and inspection. The thesis should classify existing models according to their underlying assumptions, decision variables, and cost structures, and examine how rework and inspection affect optimal lot sizes, total costs, and, more broadly, the overall decision-making process and numerical insights. The concluding section should offer a critical assessment of the current state of research and highlight potential future directions, such as stochastic model extensions or applications within modern Industry 4.0 environments.

Prerequisites: Knowledge in optimization models (e.g., OPM 561, 662)

Basic Papers: Ullah and Kang (2014)

Abstract: The economic order quantity and economic production quantity models are the most commonly used inventory models in production environments for the calculation of optimum lot size. However, these models are based on the unrealistic assumption that every process produces good quality products every time. Moreover, the impact of inspection is neglected in all extended inventory control models involving work in process inventory. By taking both imperfect production and lot size inspection into consideration, this paper presents a more realistic approach for the modelling of optimum lot size and total cost with a focus on the work in process inventory. A mathematical model is derived for optimum lot size based on the minimisation of the average cost. Our approach incorporates the effect of rework, rejects and inspection on work in process inventory. The significant effect of imperfect production and inspection on optimum lot size is evaluated via numerical examples. In comparison to existing models, the proposed model is a more generalised and flexible form of inventory model for independent demands.

P11 – Balancing Speed and Costs in Service Systems

Objectives: Queueing systems are analyzed in a multitude of context: Call centers, traffic, airports, healthcare, restaurants, and customer services in general. One lever for the performance of such a system is the service rate, i.e., how many customers per time unit can be served. The service rate can be increased by, e.g., speeding up services, simplifying processes, and on the other hand reduced by additional up- and cross-selling, or by putting more diligence into the service. A higher service rate decreases congestion, and thus waiting. However, a higher service rate can come with other costs. E.g., in the so-called quality-speed trade-off literature it can also lower the value of the service provided to the customer. Depending on the business application, literature assumes different components in the objective function, such as waiting costs, revenues depending on the service rate, costs in the service rate, etc.

The goal of this seminar thesis is to provide a detailed overview, classification, and comparison of different objective functions in the queueing literature with decisions on the service rate. The underlying motivation of the objective functions should be explained. Moreover, the optimization problems should be classified with respect to the dimensions of the variability cube (Stolletz and Tan, 2024). Relevant applications and managerial insights, as well as structural similarities and differences between the considered objective functions should be identified. A critical assessment of the literature concludes this thesis.

Prerequisites: Basic knowledge in stochastic modelling (e.g., OPM 561)

Basic Papers: Anand et al. (2011), Stolletz and Tan (2024)

> **Abstract**: In many services, the quality or value provided by the service increases with the time the service provider spends with the customer. However, longer service times also result in longer waits for customers. We term such services, in which the interaction between quality and speed is critical, as customer-intensive services. In a queueing framework, we parameterize the degree of customer intensity of the service. The service speed chosen by the service provider affects the quality of the service through its customer intensity. Customers queue for the service based on service quality, delay costs, and price. We study how a service provider facing such customers makes the optimal "quality–speed trade-off." Our results demonstrate that the customer intensity of the service is a critical driver of equilibrium price, service speed, demand, congestion in queues, and service provider revenues. Customer intensity leads to outcomes very different from those of traditional models of service rate competition. For instance, as the number of competing servers increases, the price increases, and the servers become slower.

P12 – Overview of Optimization Models in Call Center Staffing

Objectives: In many service systems, staffing drives both costs and service quality by ensuring that the right number of employees are available for various processes. A call center for example, might aim to minimize personnel cost while ensuring a certain service level. One example could be to consider the negative impacts on waiting time or customer abandonments.

The goal of this research seminar is to provide a comprehensive overview of utilized optimization models for time-dependent staffing in call centers. Existing literature should be critically assessed and compared by describing the utilized optimization models (objective, constraints, ...). Relevant trade-offs (e.g. balancing cost savings and lost sales) and managerial findings presented in literature should be presented and discussed.

Prerequisites: Knowledge in variability and optimization models (e.g. OPM 561)

Basic Paper: Defraeye and Van Nieuwenhuyse (2016); Stolletz and Tan (2024)

> **Abstract**: Many service systems display nonstationary demand: the number of customers fluctuates over time according to a stochastic—though to some extent predictable—pattern. To safeguard the performance of such systems, adequate personnel capacity planning (i.e., determining appropriate staffing levels and/or shift schedules) is often crucial. This paper provides a state-of-the-art literature review on staffing and scheduling approaches that account for nonstationary demand. Among references published during 1991–2013, it is possible to categorize relevant contributions according to system assumptions, performance evaluation characteristics, optimization approaches and real-life application contexts. Based on their findings, the authors develop recommendations for further research.

P13 – Impact of Customer Behavior on Call Center Capacity

Objectives: The interaction between a company and its customers has a significant impact on a company reputation. Therefore, call centers are of high importance as the first point of contact for customers. If a call center fails to provide satisfactory service or customers are faced with long waits, customers are likely to call again later (retrial calls). These issues negatively impact call centers' profits. Therefore, call center managers have to reduce retrials with efficient capacity decisions, without overshooting their operational costs.

The goal of this research seminar is to conduct a literature review about customer behavior in call centers, and their impact on call center capacity. The existing literature on empirical impatience and retrial behavior should be critically assessed and compared with respect to the assumptions about the statistical data set, the data analysis method, and the resulting managerial insights for optimal capacity decisions.

Prerequisites: Knowledge in variability and stochastic systems (e.g. OPM 561)

Basic Paper: Brown et al. (2005); Hu et al. (2022)

> **Abstract**:
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> A call center is a service network in which agents provide telephone-based services. Customers who seek these services are delayed in tele-queues. This article summarizes an analysis of a unique record of call center operations. The data comprise a complete operational history of a small banking call center, call by call, over a full year. Taking the perspective of queueing theory, we decompose the service process into three fundamental components: arrivals, customer patience, and service durations. Each component involves different basic mathematical structures and requires a different style of statistical analysis. Some of the key empirical results are sketched, along with descriptions of the varied techniques required. Several statistical techniques are developed for analysis of the basic components. One of these techniques is a test that a point process is a Poisson process. Another involves estimation of the mean function in a nonparametric regression with lognormal errors. A new graphical technique is introduced for nonparametric hazard rate estimation with censored data. Models are developed and implemented for forecasting of Poisson arrival rates. Finally, the article surveys how the characteristics deduced from the statistical analyses form the building blocks for theoretically interesting and practically useful mathematical models for call center operations.

References

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