# Introduction to the Master Courses of the Chair of Production Management

**Analytics and Production Management Focus**

Prof. Dr. Raik Stolletz

AACSB ACCREDITED EFMD EQUIS ACCREDITED ASSOCIATION OF MBAS ACCREDITED

University of Mannheim, Fall Term 2023

# Chair of Production Management: Chair Holder

## Prof. Dr. Raik Stolletz

- Studies of Mathematics, Business Administration, and Computer Science (TU Berlin, 1999)
- Dr. rer. pol. in Business Administration (TU Clausthal, 2002)
- Habilitation in Business Administration (University of Hannover, 2009)
- Associate Professor for Operations Management (Technical University of Denmark, 2009/2010)
- Chair Holder of Production Management (since December 2010)

TECHNISCHE UNIVERSITÄT BERLIN

TU Clausthal

Leibniz Universität Hannover

DTU Technical University of Denmark

UNIVERSITY OF MANNHEIM

# Team

Prof. Dr. Raik Stolletz

Daniela Fichtenmeyer-Hüßler (Office)

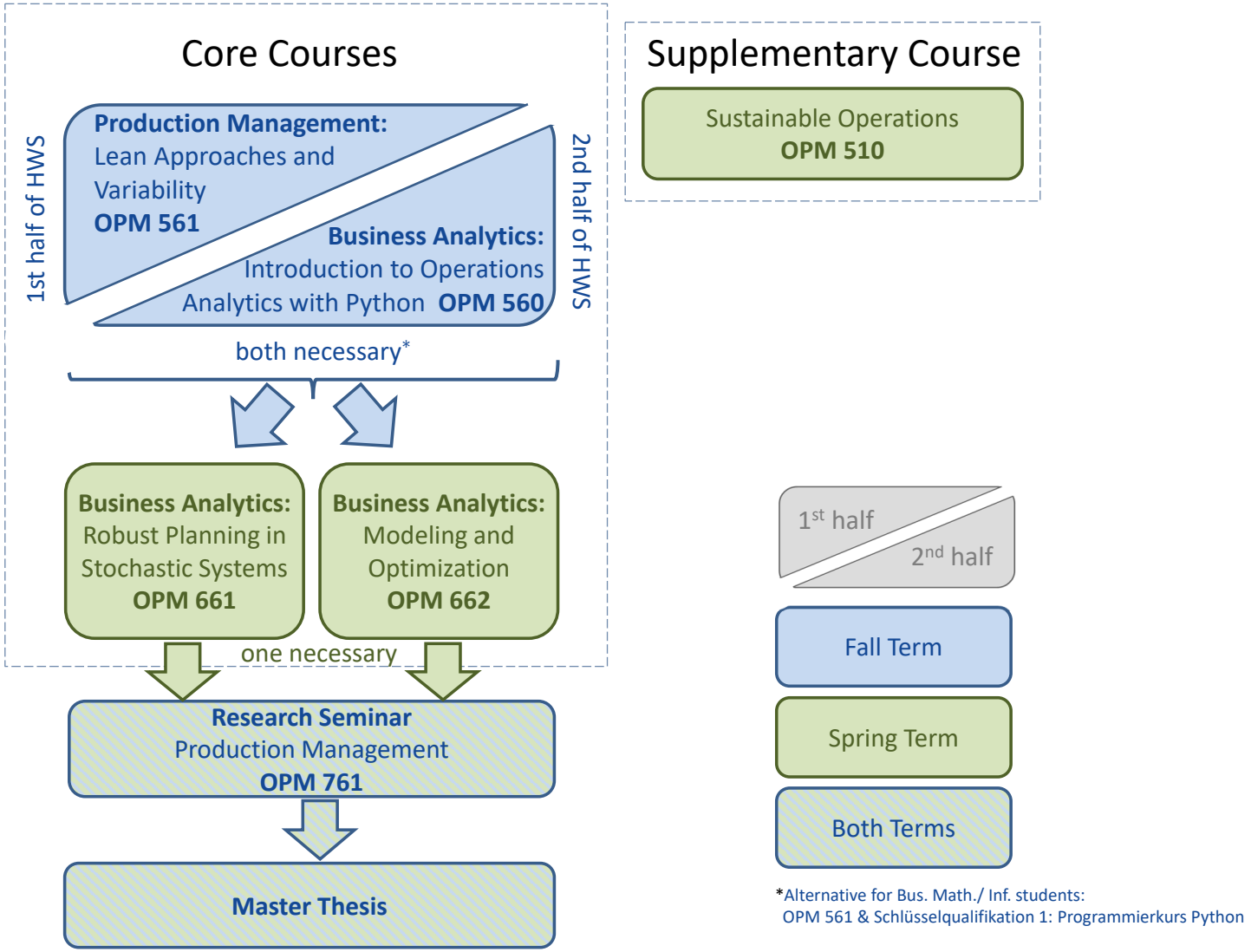
Mohammad Zenouzzadeh

Ömer Özümerzifon

Tim Weber

https://www.bwl.uni-mannheim.de/en/stolletz/

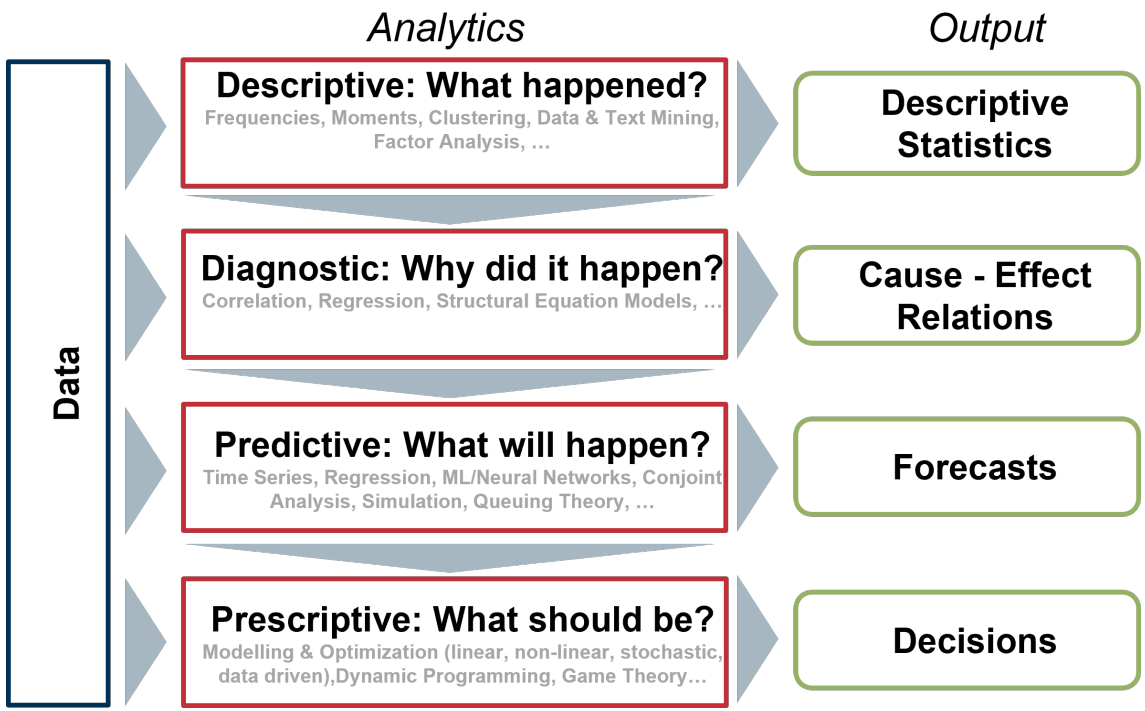
# Course Program - Master (M.Sc.)



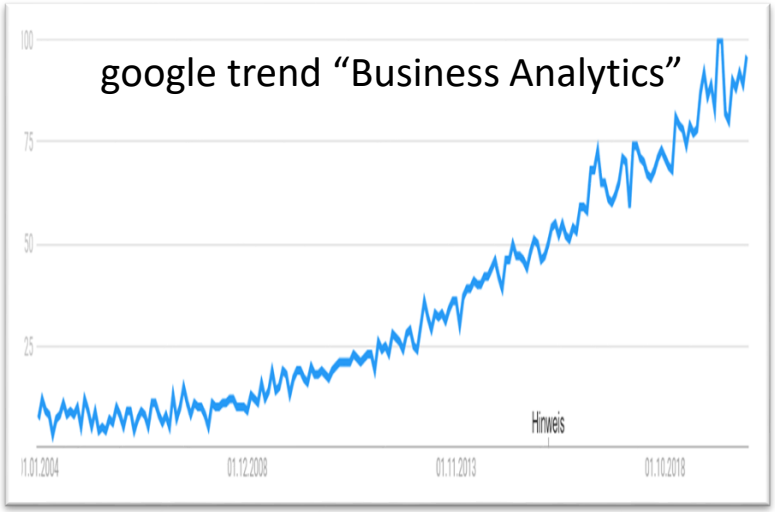

*Alternative for Bus. Math./ Inf. students:
OPM 561 & Schlüsselqualifikation 1: Programmierkurs Python

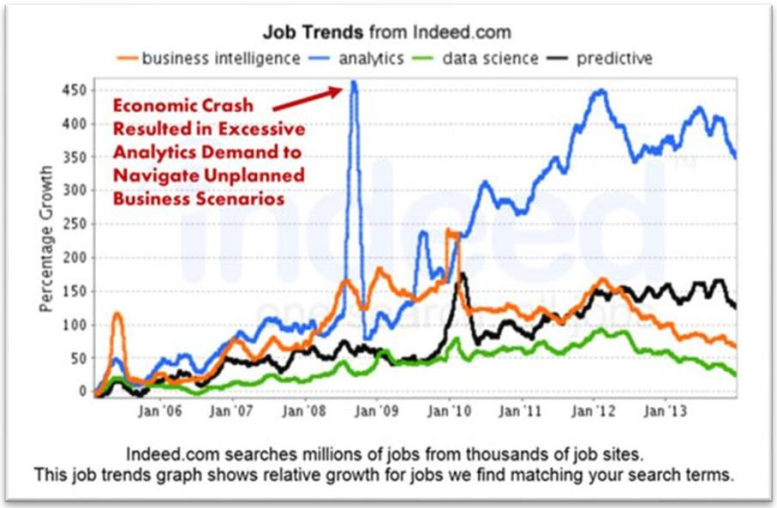
# Analytics-oriented Approach

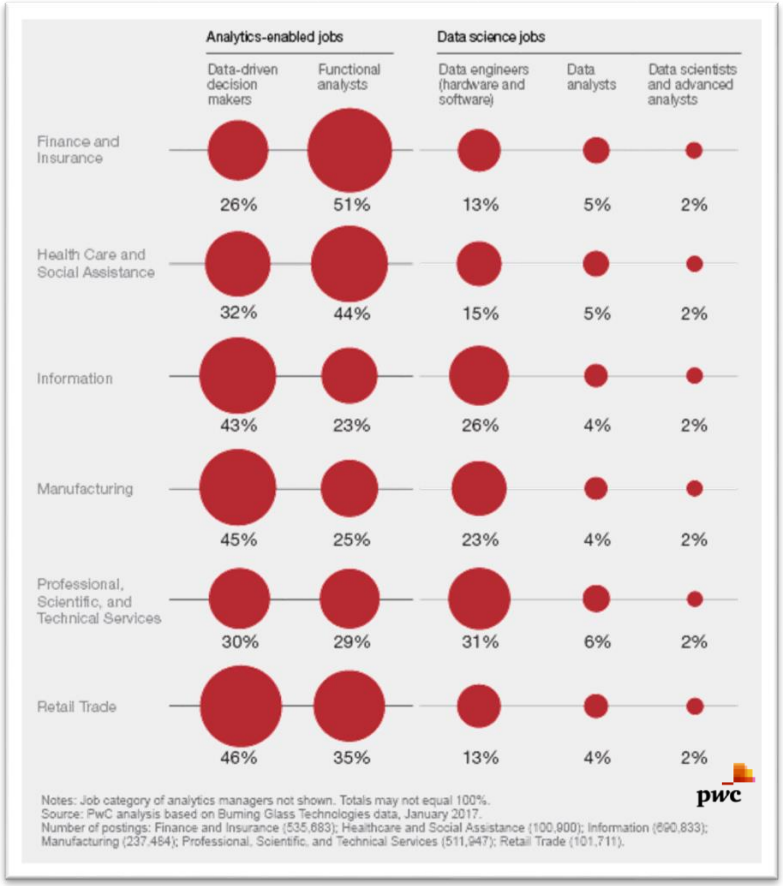
- Address complexities of **managerial decision making** by means of analytics
- Wide range of **advanced analytical methods**
- Combination of **methodological expertise** and **intimate domain knowledge** in relevant areas of operations management
- Focus on how to **generate value** from data by enabling **better decisions**



# The Analytics Job Market



# OPM 561 - Production Management: Lean Approaches and Variability

## Key topics:

### Capacity planning in Operations Management

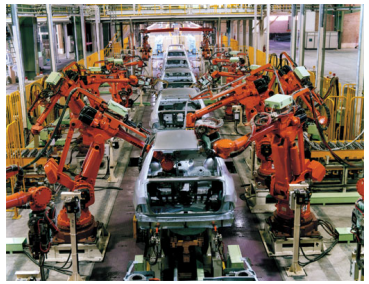
- Introduction to stochastic variability
- Design of production lines

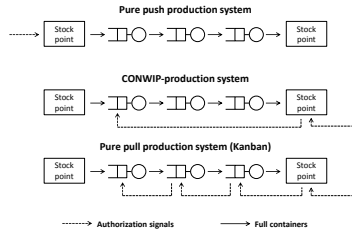
### Lean Management & Industry 4.0

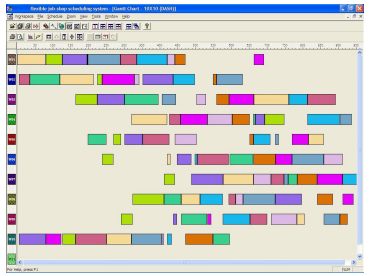
- Lean Philosophy
- Industry 4.0: Technologies and planning approaches

### Operations Planning and Optimization

- Scheduling & Lot sizing





## Grading: (4 ECTS)

- Written exam (60 min.)
- **Exam date: Midterm (probably 23.10.2023)**

## Dates/course structure: **(1st half of semester only)**

- Lecture: Wed B2 (O 145), 06.09.-18.10.2023
- Exercise: Mon B4 (O 145), 11.09.-23.10.2023
- Lecturer: Prof. Dr. Raik Stolletz

# OPM 561 - Course Structure

## I Introduction

- Variability in Operations Management

## II Capacity planning in Operations Management

- Introduction to stochastic variability
- Design of flow production & transfer lines

## III Lean Management

- Principles of lean management and implementation of lean systems

## IV Scheduling Applications

- Job shop scheduling
- Lot sizing

## V Industry 4.0

# OPM 560 - Business Analytics: Introduction to Operations Analytics with Python

## Key topics:

- Introduction to programming: Basics of Python
- Hands-on implementation: Predictive & descriptive analytics models from OPM 561
- Managerial insights: Sensitivity analysis for capacity and operations decisions

**Recommended:** OPM 561

**Grading:** (6 ECTS)

- 70 % Assignments (individual and in groups)
- 30 % Programming Exam


**Dates/course structure:** **(2nd half of semester, after OPM 561 exam)**

- Lecture with integrated exercises:
  Mon B4 & Wed B2 (O 145), 25.10.-06.12.2023
- Exercise (Not mandatory, support assignments):
  Tue B3 and/or B4 (O 048), 31.10.-05.12.2023
- Lecturer: Prof. Dr. Raik Stolletz, Mohammad Zenouzzadeh, Ömer Özümerzifon

# OPM 560: Course Structure

## I Get started with Python

- Simple types and operators
- Branching programs and conditional statements
- While loops, for loops and ranges
- Python data structure (list, dict, etc.)
- Functions

## II Descriptive Analytics

- Read and write datasets
- Univariate and Bivariate analyses
- Quantify & visualize variability in datasets

## III Predictive Analytics

- Analyzing functions and sensitivities
- Digital twins and random numbers

## IV Prescriptive Analysis

- Implementation of Optimization models
- Design of numerical studies

# OPM 661 - Business Analytics: Robust Planning in Stochastic Systems

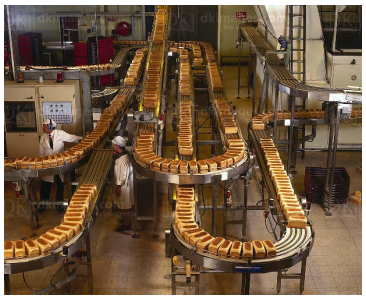
## Key topics:

### Methodological foundations of stochastic systems

- Stochastic processes and Markov chains
- Simulation and key performance measures

### Implementation of predictive analytics approaches

- Performance analysis under stochastic variability
- Optimization concepts under uncertainty



**Prerequisites:** OPM 561 and OPM 560
(Alternative for Bus. Math./Inf. students: OPM 561 & Schlüsselqualifikation 1: Programmierkurs Python)

**Grading:** (8 ECTS)

- 70 % Assignments and presentations (individual and in groups) and 30 % written (45 min)/oral exam

## Dates/course structure:

- Lecture with integrated exercise & non-mandatory exercise session (support assignments)
- Planned next offering: Spring 2024

# OPM 661 - Course Structure

## I Introduction to performance evaluation and simulation

- Queueing systems, decisions, and applications
- Performance measures and simulation of queueing systems

## II Performance analysis of Markovian queueing systems

- Analysis of stochastic processes and Markov chains
- Performance analysis and economies of scale

## III Impact of variability in queueing

- Queueing systems with general distributions
- Time-dependent analysis of queueing systems

## IV Optimization and queueing

- Optimization concepts and approaches
- Robust planning with scenarios

## V Practical insights

- Predictive and prescriptive analytics with Python
- Guest lecture

# OPM 662 - Business Analytics: Modeling and Optimization

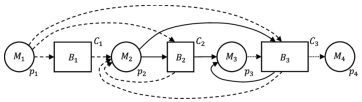
## Key topics:

**Mathematical optimization models**

- Operations planning and workforce optimization
- Production system design

**Implementation of prescriptive analytics approaches**

- Optimization and algorithmic solution methods
- Robustness and fairness in optimization approaches
- Managerial insights and numerical studies




Minimize:

$$\sum_{m=\underline{M}+1}^{\overline{M}} z_m$$

Subject to:

$$\sum_{i=1}^{I} t_i(x_{im} + y_{im}) \leq C \cdot z_m \qquad m = \underline{M}+1, \ldots, M$$

$$\sum_{m=1}^{M} (x_{im} + y_{im}) = 1 \qquad i = 1, \ldots, I$$

$$\sum_{m=1}^{M} (M - m + 1)(x_{rm} - x_{sm}) \geq 0 \qquad \forall\, (r,s) \in P$$

$$\sum_{m=1}^{M} (M - m + 1)(y_{sm} - y_{rm}) \geq 0 \qquad \forall\, (r,s) \in P$$


## Prerequisites: OPM 561 and OPM 560

(Alternative for Bus. Math./Inf. students: OPM 561 & Schlüsselqualifikation 1: Programmierkurs Python)

## Grading: (8 ECTS)

- 70 % Assignments and presentations (individual and in groups) and 30 % written (45 min)/oral exam

## Dates/course structure:

- Lecture with integrated exercise & non-mandatory exercise session (support assignments)
- Planned next offering: Spring 2024

# OPM 662: Course Structure

## I Applications of optimization models

- Aggregated production planning
- Lot sizing and detailed scheduling
- Workforce planning

## II Business Analytics approaches

- Mathematical modeling
- Heuristic solutions for large-scale problems
- Scenario approaches for robust planning

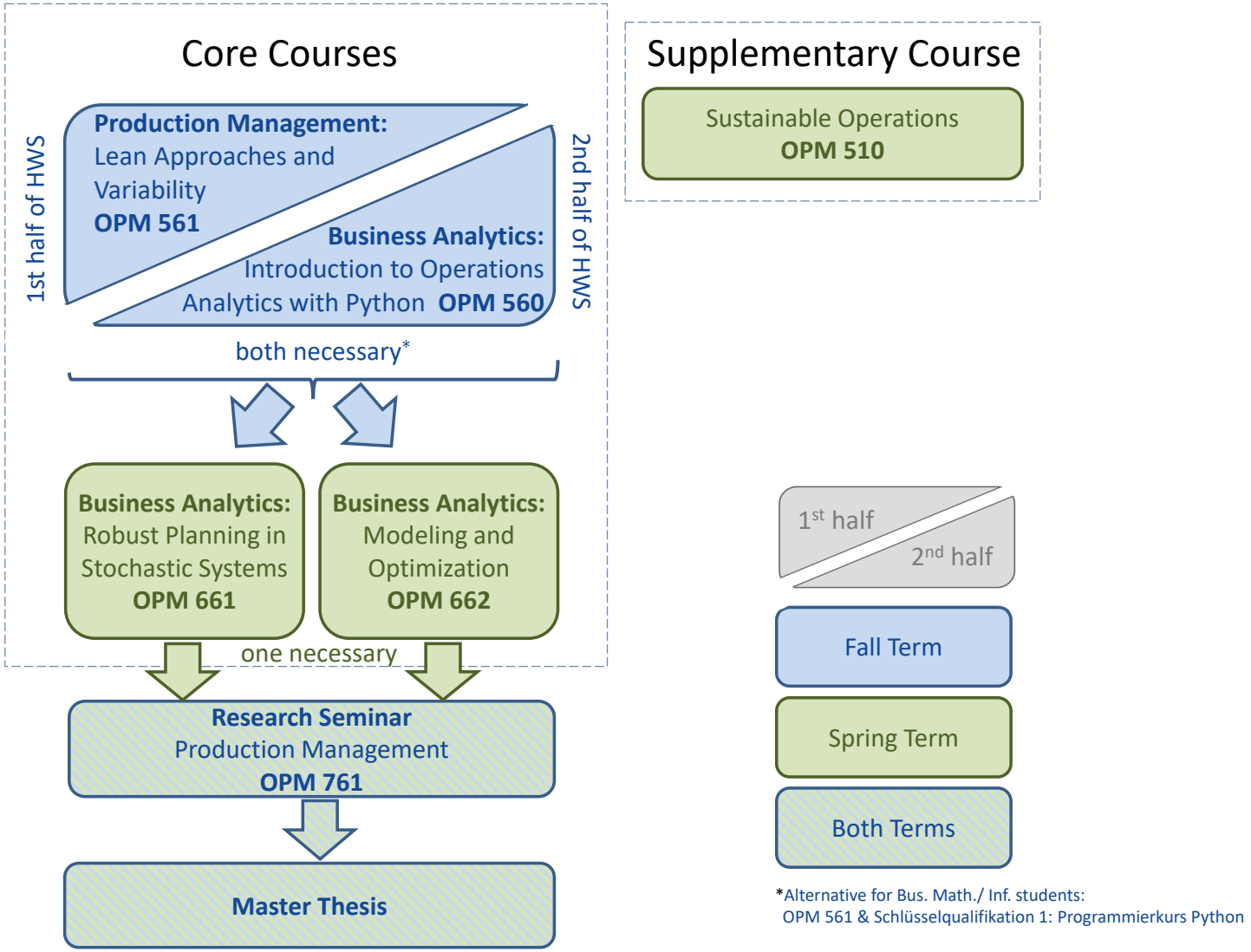
## III Managerial insights and numerical studies

- Design of numerical studies
- Sensitivity analysis
- Interpretation of solutions

## IV Practical insights

- Business Analytics tool for modeling and optimization
- Guest lecture by business analytics professionals

# Course Program - Master (M.Sc.)

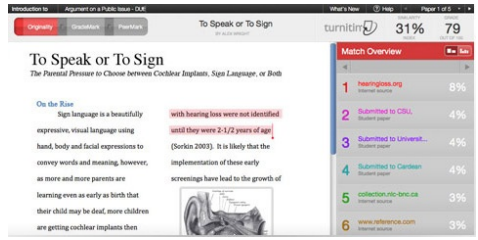



*Alternative for Bus. Math./ Inf. students:
OPM 561 & Schlüsselqualifikation 1: Programmierkurs Python

# OPM 761 - Research Seminar Production Management

## Key topics:

- Implementation of predictive or prescriptive analytics approaches
- Literature reviews analytics models or approaches
- Paper discussion



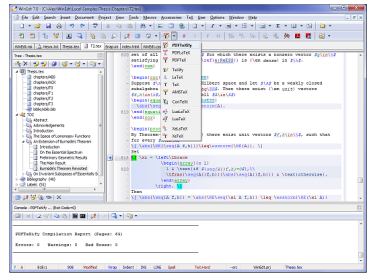

**Prerequisites:** At least one of the OPM 66x courses (parallel attendance possible)

**Grading:** (6 ECTS)

- Seminar thesis (18-22 pages) (60%),
- Presentation (30%) and discussion (10%)

## Dates/course structure:

- Application together with other OPM chairs (at the end of previous semester)
- Kick-Off, individual meetings with supervisor
- Introduction to literature research, scientific writing & presentations



# Master's Thesis (OPM 762)

## Types of topics:

- Implementation and extensions of predictive or prescriptive analytics approaches
- Literature reviews analytics models or approaches
- Collaboration with companies

## Prerequisites: Research seminar

## Duration:

- Four months
- Start possible any time

## Application:

- Motivation letter
- Further information and sample topics:
  See Homepage:

www.bwl.uni-mannheim.de/en/stolletz/teaching/master/masters-thesis/

# Example Study Plan: Specialist - Analytics & Production

## Example study plan: Analytics & Production Management Focus I

**1st Semester** - Fall

| Course Title | ECTS |
|---|---|
| **OPM 561 - Production Management: Lean Approaches and Variability** | 4 |
| **OPM 560 - Business Analytics: Introduction to Operations Analytics with Python** | 6 |
| OPM 501 - Logistics Management | 6 |
| CC 501 - Decision Analysis | 6 |
| *Additional **analytics-oriented** courses* | *8* |

**30 ECTS**

**2nd Semester** - Spring

| Course Title | ECTS |
|---|---|
| **OPM 661 - Business Analytics: Robust Planning in Stochastic Systems** | 8 |
| **OPM 662 - Business Analytics: Modeling and Optimization** | 8 |
| OPM 581 - Service Operations Management | 6 |
| CC 504 - Corporate Social Responsibility | 4 |
| *Additional **analytics-oriented** courses* | *4* |

**30 ECTS**

***Analytics-oriented courses***

| Course Title | ECTS |
|---|---|
| **Area Operations:**<br>• OPM 502 - Inventory Management<br>• OPM 582 - Case Studies in Operations Management<br>• OPM 601 - Supply Chain Management<br>• OPM 691 - Supply Risk Management<br>• OPM 591 Strategic Procurement<br>• OPM 692 - Strategic Sourcing<br>• … | <br>6<br>6<br>6<br>4<br>6<br>6 |
| **Other Areas:**<br>• ACC&TAX, FIN, IS, MAN, MKT | |
| **Electives (other School):**<br>• Computer Science<br>• Mathematics | |

**3rd Semester** - Fall

| Course Title | ECTS |
|---|---|
| **OPM 761 - Research Seminar Production Management (Prof. Dr. Raik Stolletz)** | 6 |
| CC 502 - Applied Econometrics or CC 503 - Empirical Methods | 6 |
| OPM 682 - Revenue Management | 6 |
| BE 510 - Business Economics I | 6 |
| *Additional **analytics-oriented** courses* | *6* |

**30 ECTS**

**4th Semester** - Spring

| Course Title | ECTS |
|---|---|
| BE 511 - Business Economics II | 6 |
| **Master Thesis** | 24 |

**30 ECTS**

**Σ = 120 ECTS**

# Example Study Plan: Specialist - Analytics & Production (Exchange Sem.)

## Example study plan: Analytics & Production Management Focus II (with exchange semester)

**1st Semester** - Fall

| Course Title | ECTS |
|---|---|
| **OPM 561 - Production Management: Lean Approaches and Variability** | 4 |
| **OPM 560 - Business Analytics: Introduction to Operations Analytics with Python** | 6 |
| CC 501 - Decision Analysis | 6 |
| OPM 501 - Logistics Management | 6 |
| BE 510 - Business Economics I | 6 |

**28 ECTS**

**2nd Semester** - Spring

| Course Title | ECTS |
|---|---|
| **OPM 662 - Business Analytics: Modeling and Optimization** OR **OPM 661 - Business Analytics: Robust Planning in Stochastic Systems** | 8 |
| BE 511 - Business Economics II | 6 |
| OPM 581 - Service Operations Management | 6 |
| CC 503 - Empirical Methods | 6 |
| *Additional **analytics-oriented** courses* | *6* |

**32 ECTS**

**3rd Semester** - Fall (**Exchange Semester**)

| Course Title | ECTS |
|---|---|
| Courses about Operations Management, Analytics, Management Science, Operations Research | 26 |
| Corporate Social Responsibility (replacing CC 504) | 4 |

**30 ECTS**

Vice versa

**4th Semester** - Spring

| Course Title | ECTS |
|---|---|
| **OPM 761 - Research Seminar Production Management (Prof. Dr. Raik Stolletz)** | 6 |
| **Master Thesis** | 24 |

**30 ECTS**

**Σ = 120 ECTS**

# Example Study Plan: Specialist - Analytics & Production (Exchange Sem.)

## Example study plan: Analytics & Production Management Focus III (with exchange semester)

**1st Semester** - Fall

| Course Title | ECTS |
|---|---|
| **OPM 561 - Production Management: Lean Approaches and Variability** | 4 |
| **OPM 560 - Business Analytics: Introduction to Operations Analytics with Python** | 6 |
| CC 501 - Decision Analysis | 6 |
| OPM 501 - Logistics Management | 6 |
| BE 510 - Business Economics I | 6 |

**28 ECTS**

**2nd Semester** - Spring

| Course Title | ECTS |
|---|---|
| **OPM 662 - Business Analytics: Modeling and Optimization** | 8 |
| **OPM 661 - Business Analytics: Robust Planning in Stochastic Systems** | 8 |
| BE 511 - Business Economics II | 6 |
| OPM 581 - Service Operations Management | 6 |
| CC 504 - Corporate Social Responsibility | 4 |

**32 ECTS**

**3rd Semester** - Fall (**Exchange Semester**)

| Course Title | ECTS |
|---|---|
| Courses about Operations Management, Analytics, Management Science, Operations Research | 24 |
| Empirical Methods (replacing CC 503) | 6 |

**30 ECTS**

Vice versa

**4th Semester** - Spring

| Course Title | ECTS |
|---|---|
| **OPM 761 - Research Seminar Production Management (Prof. Dr. Raik Stolletz)** | 6 |
| **Master Thesis** | 24 |

**30 ECTS**

**Σ = 120 ECTS**

## General Introduction to the Chair

- General introduction to the teaching of the chair of Production Management
  - Wednesday, 06.09.2023, 10:15 - 11:45 (first Lecture of OPM 561)
  - Location: O 145

# See you in our courses!

In case of questions: prod@uni-mannheim.de