

cleophas

Discipline: [Methods]

1. Language: English

2. Title: Simulation Modelling for Business Research

3. Lecturer: Prof. Dr. Catherine Cleophas, CAU Kiel, email: cleophas@bwl.uni-kiel.de

4. Date and Location

7-10 October 2019

Kiel

5. Course Description

5.1 Abstract and Learning Objectives

Business research increasingly considers wicked problems and complex dynamic systems. Analytical models of such problems and systems quickly become untraceable and unsolvable. Given increasing computational power, simulation models provide an alternative tool. They can fuel studies tracing the long-term evolution of systems and comparing the outcomes of alternative scenarios. However, successfully applying simulation modelling for business research requires expertise on applicable simulation paradigms, approaches to model validation and the analysis of stochastic results.

5.2 Content

Participants gain theoretical background knowledge in the following areas:

- system dynamic, discrete event-based and agent-based simulation paradigms
- analysis of stochastic simulation results
- the role of simulation validation and calibration
- challenges of computational efficiency

They also gain hands-on experience in applying these concepts to case scenarios in

- implementing simulation models in Arena and Net Logo
- data analysis and visualization with Excel

5.3 Schedule (including start and end time)

Date	Sessions
Day 1: 10:00-17:00	Introductory lectures on modeling, simulation paradigms, stochastic simulation and first application examples.
	Exercises on abstract modeling, participants introduce their own project topics.
Day 2: 9:00 – 17:00	Lectures considering detailed aspects of system dynamics, discrete-event-based and agent-based simulation. Challenges of computational efficiency and result analysis.
	Exercises with Netlogo and Arena.
Day 3: 9:00 – 17:00	Lectures on simulation validation and calibration as well as on combining simulation and data analytics, selected case studies.
	Work on project topics supported by lecturer, capped by intermediate presentation.
Day 4: 9:00 – 15:00	Work on project topics supported by lecturer, capped by final presentation.

5.4 Course format

This course focuses on providing both a theoretical background in simulation modelling as well as first expertise in applying these concepts using relevant software packages. Each day will consist of lectures focusing on theoretical concepts followed by exercise sessions focusing on relevant problems. In a series of project sessions, participants will work alone or in teams to apply the knowledge gained to a project of their own choice. Accordingly, participants are encouraged to bring in their own application problems.

During project sessions, the participants can work on the respective projects in a self-organized fashion. Each project session offers the opportunity to discuss aspects and challenges of the project with the instructor.

Several sessions will be dedicated to first discussing the project topics (5 minutes per group), intermediate results (20 minutes), and finally the conclusion of the project (20 minutes).

The course is aimed at PhD-students from all disciplines of business and economics. By bringing together participants with different methodological backgrounds and problem domains, we will experience the whole spectrum of simulation modelling.

6. Preparation and Literature

6.1 Prerequisites

- Previous experience with Microsoft Office, particularly Excel, recommended.
- Standard university knowledge of statistical concepts.
- Programming experience is helpful, but not required.
- No previous knowledge of simulation modelling is required.

6.2 Essential Reading Material

- Robinson, S. (2005). Discrete-event simulation: from the pioneers to the present, what next? *Journal of the Operational Research Society*, 56(6), 619-629.
- Tako, A. A., & Robinson, S. (2012). The application of discrete event simulation and system dynamics in the logistics and supply chain context. *Decision Support Systems*, 52(4), 802-815.
- Chan, W. K. V., Son, Y. J., & Macal, C. M. (2010, December). Agent-based simulation tutorial-simulation of emergent behavior and differences between agent-based simulation and discrete-event simulation. *Proceedings of the 2010 Winter Simulation Conference (WSC)*, (pp. 135-150). IEEE.
- Sargent, Robert G. "Verification and validation of simulation models." *Journal of Simulation* 7, no. 1 (2013): 12-24.

6.3 Additional Reading Material

- Law: *Simulation Modeling and Analysis* (2014)
- Gilbert & Troitzsch: *Simulation for the Social Scientist* (2005)
- Ghosh: *Dynamic Systems for Everyone: Understanding How Our World Works* (2015)

6.4 To prepare

- Download and install software:
 - o Netlogo: <https://ccl.northwestern.edu/netlogo/>
 - o Arena (Student Version): <https://www.arenasimulation.com/academic/students>
- Consider your own research project, analyzing the potential for computational experiments, required data, and different approaches to simulation you may take. What are potential risks and benefits from employing a simulation-based approach?

7. Administration

7.1 Max. number of participants

The number of participants is limited to 20.

7.2 Assignments

We will work through exercises on Day 1 and 2 and consider own projects on Day 3 and 4.

7.3 Exam

The final grade will be based on class participation during the lectures and exercises (50%) and the students' intermediate and final presentations (50%).

7.4 Credits

The course is eligible for 6 ECTS.

8. Working Hours

Aufteilung der Arbeitsstunden / Working Hours	Stunden
Vorarbeiten:	60 h
Aktive Mitarbeit:	30 h
Vorbereitung der Präsentation:	30 h
Nachbereitung:	60 h
SUMME	180 h
ECTS: 6	