Supply Chain Dynamics (SCD)

Summer term 2024, version: 25/03/2024

Please note: This document reflects our planning before the term started; it will **not** be updated regularly. For short-term changes regarding rooms or times, see Campus. Changes regarding the content will be discussed in class and, if appropriate, communicated via Ilias.

Technicalities

One semester course, taught every second semester in the summer term

Six credit points; on average, four contact hours per week. Taught in English

Course coordinator and lecturer: Prof Dr Andreas Größler; tutorials: Julia Elter

Part of the MSc study programme in (technically oriented) business administration

Time and location

Classes: Mondays, 15:45–17:15 (M17.73), and Thursdays, 15:45–17:15 (M17.81). For topics and preparation, see the timetable below.

First class: Thursday, 11 April 2024, 15:45

Recommended requirements

Introductory bachelor-level course in operations management and/or supply chain management

Short description and learning goals

The course starts with discussing the nature of supply chains, particularly their dynamic aspects. Students acquire first-hand experience with the effects of dynamic behaviour. A major part of the course is devoted to learning a methodology for better understanding and controlling supply chains: system dynamics. It is used to analyse some real-world cases of dynamic supply chain issues.

After successfully finishing the course, students can:

- name and discuss sources and effects of dynamics in supply chains;
- develop simple supply chain models with system dynamics;
- understand and evaluate complex dynamic supply chain models.

Course design

Although officially split into lectures and tutorial sessions, all classes consist of theoretical and practical parts. Thus, the content will run over the two weekly sessions with teacher presentations, case study work, modelling exercises, and experiential learning elements. Students are expected to attend all sessions and actively engage in classroom discussions; they should study the required readings before class.

Course element	**Quantity**	**Time required**	**Total [h]**
Contact hours			
Interactive lectures	25	2 h	50
Self-study			
Required reading	424 pp.	94.5 h	94.5
Working on exercises	6	2 h	12
			106.5
Examination			
Homework assignment	1	23.5 h	23.5
Total			**180**

A forum has been opened in Ilias for regular communication between students and teachers, and amongst students.

Examination

The examination for this course will be carried out by three tests related to its three major parts (see timetable). The first part will be assessed by a **single-choice questionnaire** (20%). For the second part, students must submit the answer to a **modelling exercise** (40%). The last part will be evaluated by **writing short texts** to answer two to four over-arching questions (40%). Details for each test will be provided on Ilias, where the answers must be submitted. The periods in which these answers must be provided are indicated in the timetable below.

Regardless of these submission periods, you need to **register for the examination** on Campus between 14 May 2024 and 04 June 2024. NB: in case you want to withdraw from the examination, this also needs to be done by 04 June 2024.

Timetable

Week		**Date**	**Topic**	**Teacher**	**Required reading**
15	C1	Thu, 11/04	Introduction to and motivation for the course	AG	McKinsey (2020)
Dynamic phenomena in supply networks					
16	C2	Mon, 15/04	Supply chain management	AG	Kovács & Falagara Sigala (2021)

	C3	Thu, 18/04	Responsible supply chain management	AG	Wu&Pagell (2011)
17	C4	Mon, 22/04	Experience dynamics! The Beer Distribution Game	AG/JE	
	C5	Thu, 25/04	Beer Distribution Game: debriefing Systemic explanation of game outcomes	AG	Senge (1990), ch. 3
18	C6	Mon, 29/04	Operational causes of supply chain dynamics	AG	Lee et al. (1997)
	C7	Thu, 02/05	Behavioural causes of supply chain dynamics The case for modelling and simulation	AG	Sterman (2000), ch. 1
03/05/2024 – 09/05/2024: 1st assessment – single-choice questionnaire (20%, 1 week)					
System dynamics modelling and simulation					
19	C8	Mon, 06/05	An introduction to system dynamics	AG	Sterman (2000), chs. 6&7
20	C9	Mon, 13/05	Practice session: identifying stocks and flows, feedback loops	JE	
	C10	Thu, 16/05	Minimal structures to explain dynamic behaviour modes	AG	Sterman (2000), chs. 4&8
22	C11	Mon, 27/05	Practice session: getting to know Vensim – Explore an existing model*	JE	Kirkwood (2005)
23	C12	Mon, 03/06	Practice session: copying a model*	JE	
	C13	Thu, 06/06	Practice session: adding structure*	JE	
24	C14	Mon, 10/06	Practice session: correcting and improving a model*	JE	
	C15	Thu, 13/06	Practice session: modelling a “canned” verbal description*	JE	
25	C16	Mon, 17/06	Practice session: modelling a fuzzy problem*	JE	
	C17	Thu, 20/06	Practice session: modelling a personally chosen problem*	JE	

21/06/2024 – 04/07/2024: 2nd assignment – modelling exercise (40%, 2 weeks)					
Advanced topics in simulation modelling and applications					
26	C18	Mon, 24/06	Ageing chain models and business cycles	AG	Sterman (2000), ch. 17
	C19	Thu, 27/06	A comprehensive supply chain model	AG	Sterman (2000), ch. 18
27	C20	Mon, 01/07	Validity of system dynamics models and implementation issues	AG	Barlas (1996)
	C21	Thu, 04/07	The mathematics of dynamic systems	AG	Gandolfo (2009), chs. 11&12
28	C22	Mon, 08/07	Archetypal dynamic behaviour and modelling modules	AG	Senge (1990), app. 2
		Thu, 11/07	*Guest lecture*		
12/07/2024 – 25/07/2024: 3rd assignment – writing short texts (40%, 2 weeks)					
29	C23	Mon, 15/07	System dynamics in action: En-ROADS climate simulation	AG	Kapmeier et al. (2021)
	C24	Thu, 18/07	Summary: Modelling and simulation as research methods; Q&A	AG	Saltelli et al. (2020)

* For practice sessions: if available, bring your laptop/tablet with Vensim installed (see below)

References to readings

Barlas, Y. (1996): Formal aspects of model validity and validation in system dynamics. *System Dynamics Review*, 12(3), 183–210.

Gandolfo, G. (2009): Economic Dynamics, 4th ed., Springer.

Kapmeier, F., Greenspan, A. S., Jones, A. P., & Sterman, J. D. (2021): Science-based analysis for climate action: how HSBC Bank uses the En-ROADS climate policy simulation. *System Dynamics Review*, 37(4), 333–352.

Kirkwood, C.W. (2005): Vensim PLE Quick Reference and Tutorial, available at http://www.public.asu.edu/~kirkwood/sysdyn/SDRes.htm.

Kovács, G., & Falagara Sigala, I. (2021): Lessons learned from humanitarian logistics to manage supply chain disruptions. *Journal of Supply Chain Management*, 57(1), 41–49.

Lee, H. L., Padmanabhan, V., & Whang, S. (1997): Information distortion in a supply chain: the Bullwhip effect. *Management Science,* 43(4), 546–558.

McKinsey & Company (ed.) (2020): Demystifying modeling: How quantitative models can—and can't—explain the world.

Saltelli, A. et al. (2020): Five ways to ensure that models serve society: a manifesto. *Nature*, 582, 25 June, 482–484.

Senge, P.M. (1990): The Fifth Discipline – The Art and Practice of the Learning Organization, Currency Doubleday.

Sterman, J.D. (2000): Business Dynamics – System Thinking and Modeling for a Complex World, Irwin McGraw-Hill.

Wu, Z., & Pagell, M. (2011): Balancing priorities: Decision-making in sustainable supply chain management. *Journal of Operations Management*, 29, 577–590.

Software

Download and install Vensim PLE on your computer: http://vensim.com/free-download/. Bring the computer to all practice sessions.