Valid from 2025.FS

Module description: Systems and Potential Analysis

Module Code	w.MA.XX.SYPA.23HS
ECTS Credits	6
Language of Instruction/Examination	English
Module Description	The search for cycle-compatible solutions in nature and the economy is preceded by cycle and systems thinking by players. Students learn to model, design, and assess complex socio-technical circular systems. Examples are taken from the fields of circular bioeconomy and packaging to illustrate the concept of the circular flow. Systems thinking allows different insights into how the world works and also provides the analytical perspective. Complex processes can be understood, measured, and steered. Students learn to assess existing systems and design circular solutions.
Organizational Unit	CCR Ltg.
Module Coordinator	Silvia Ulli-Beer
Program and Specialization	• Circular Economy Management
Legal Framework	Academic Regulations MSc in Circular Economy Management dated 02.06.2022, Appendix to the Academic Regulations for the degree program in Circular Economy Management, first adopted on 23.09.2022
Module Category	**Module Type** Compulsory Elective
Prerequisite Knowledge	Basics of approaches to system analysis and potential analysis (nice to have) A general understanding of tools for modelling systems (nice to have)
Contribution to Program Learning Objectives (by the concerned Module)	• Professional Competence • Methodological Competence • Social Competence • Self-Competence
Contribution to Program Learning Objectives	**Professional Competence** • Knowing and Understanding Content of Theoretical and Practical Relevance • Apply, Analyze, and Synthesize Content of Theoretical and Practical Relevance • Evaluate Content of Theoretical and Practical Relevance **Methodological Competence** • Problem-Solving & Critical Thinking • Scientific Methodology • Work Methods, Techniques, and Procedures • Information Literacy • Creativity & Innovation **Social Competence** • Written Communication • Oral Communication • Teamwork & Conflict Management • Intercultural Insight & Ability to Change Perspective **Self-Competence** • Self-Management & Self-Reflection • Ethical & Social Responsibility • Learning & Change

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Module Learning Objectives

Students...
- know and understand (complex) circular systems / concepts and their potential.
- learn to model complex systems that explain key performance metrics.
- are able to analyze (cycle) system variants and understand their effects on key performance metrics.
- are able to identify effects, interactions, and conflicting goals and outline possible solutions for selected circular design solutions for selected products.
- know and apply tools for modeling systems.
- carry out potential analyses.
- reflect the impact of circular design changes on the relevant existing business ecosystem. (Which players are involved and need to align their business models, what common resources may become helpful for a competitive solution?)
- can model possible futures of complex systems as scenarios.

Module Content

- Definition and structure of socio-technical circular system concepts (reduce, reuse, recycle, and remanufacting) of well-known cases such as glass recycling, PET recycling, cement recycling, WEEE recycling, renewable energy, and biogenic carbon bio fuels
- Approaches to system analysis and potential analysis: Formative scenario analysis (scenario trumpet), system dynamics modelling (causal loop diagrams), and simulation (small simulation models), including material flow analysis and business ecosystem analysis)
- Introducing and discussing recent research studies on system and potential analysis of circular systems
- Modeling and assessing complex circular systems (system boundary, elements, relationships between elements, and system behavior).
- Practical application of system and potential analysis to socio-technical systems (batteries, photovoltaics, heat recuperation from incineration plants, carbon capture, storage concepts, cascading the use of wood resources, and biogenic carbon and fuels)

Links to other modules

This module is linked to the following modules:
- w.MA.XX.REEWAM.23HS
- w.MA.XX.DAMO.23HS
- w.MA.XX.SCVC.23HS
- w.MA.XX.BMCE.23HS

Digital Learning Resources

- Teaching Materials
- Practice and Application Exercises (with Key)
- Case Studies (with Key)
- Multiple Choice Tests

Methods of Instruction

- Lecture
- Explorative Learning
- Exercises
- Case Studies

Social Settings Used:
- Individual Work
- Pair Work

Type of Instruction

	Classroom Instruction	Guided Self-Study	Autonomous Self-Study
Lecture	90 h	-	
Excercise	30 h	-	
Project Work	60 h	-	
Seminar	-	-	
Total	**180 h**	**0 h**	**0 h**

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Performance Assessment

End-of-module exam	Form	Length (min.)	Weighting
Written exam	open book	60	40.00
Permitted Resources	Free choice calculator	With dictionary	

Others	Assessment	Format	Length (min.)	Weighting
Written Assignment	Grade	Partnerarbeit	0	40.00
Talk/oral presentation	Grade	Partnerarbeit	15	20.00

Classroom Attendance Requirement

50%

Compulsory Reading

- Rittershaus, Renner & Aryan (2023). A conceptual methodology to screen and adopt circular business models in small and medium scale enterprises (SMEs): A case study on child safety seats as a product service system. Journal of Cleaner Production, https://doi.org/10.1016/j.jclepro.2023.136083.
- Alamerew & Brissoud (2020). Modelling reverse supply chain through system dynamics for realizing the transition towards the circular economy: A case study on electric vehicle batteries. Journal of Cleaner Production, https://doi.org/10.1016/j.jclepro.2020.120025.

Recommended Reading

Comments