Module Name: Data Analysis and Monitoring

Module Code	w.MA.XX.DAMO.23HS
Module Description	Data-driven decision-making is crucial when dealing with circular economy issues/applications. Statistical and visualization techniques are therefore required to extract valuable information from data and transmit it to stakeholders. In this module, students are taught a scientific approach to data handling with the help of statistical methods. These will be implemented in the programming language "R". Students will learn how to interpret and present the outcomes of their data analyses. The module will also provide students with methods to handle data of variable quality and featuring uncertainty, monitor processes, and carry out plausibility checks on the outcomes of data analyses. By working in groups on typical case studies, students will consolidate their understanding of the potential and limitations of the analysis and the monitoring tools presented.
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
ECTS	6
Organizational Unit	W Center for Corporate Responsibility CCR
Module Coordinator	Patrick Laube (laup)
Deputy Module Coordinator	Maike Scherrer (scek)
Prerequisite Knowledge	Students: • understand basic concepts of statistics (types of data, sample vs population, sampling techniques, parameters, and variables). • have previous basic knowledge of (any) programming language.
Contribution to Program Learning Goals (Affected by 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
Module Learning Objectives	Students... § sample and pre-process datasets to apply statistical methods to them. § choose and apply the proper statistical methods according to the given research or applied question. § appreciate the potential and the limitations of typical data analysis techniques in the field/context of circular economy. § present, visualize, and interpret statistical outputs in the programming language R. § handle datasets with variable data quality and uncertainty and apply monitoring strategies

Module Content	§ Repetition of simple statistical methods (comparison of two samples, ANOVA…).
	§ Regression techniques (linear, multiple, non-linear).
	§ Advanced applications of inductive and multivariate statistics.
	§ Data visualization and implementation of statistical methods in R.
	§ Data preparation and data (pre-) processing.
	§ Basic and advanced visualizations (histogram, boxplot, barplot, plot, piechart, levelplots).
	§ Handling variable data qualities and uncertainty and apply monitoring strategies.
	§ Cluster analysis and data classification approaches.
	§ Spatio-temporal data science (handling of spatiotemporal datasets, approaching geostatistics).
	§ Overview of open access data, data sharing platforms, version control systems (Git).
	§ Group project work: Students apply statistical methods to a dataset of their choice to answer a research or applied question related to the circular economy.

Links to other modules	The content of this module is linked to the following modules: w.MA.XX.FOSANR.23HS
	w.MA.XX.REEWAM.23HS
	w.MA.XX.SYPA.23HS

Methods of Instruction	§ Lecture	**Social Settings Used:**
	§ Interactive Instruction	§ Individual Work
	§ Case Studies	§ Group Work
	§ Exercises	
	§ Project Work	

| Digital Resources | § Teaching Materials |
| | § Case Studies (with Key) |

Type of Instruction	**Classroom Instruction**	**Guided Self-Study**	**Autonomous Self-Study**
Lecture	28 h	86 h	
Excercise	28 h	-	
Project Work	38 h	-	
Seminar	-	-	
Total	**94 h**	**86 h**	**0 h**

Performance Assessment

End-of-module exam	**Form**		**Length (min.)**	**Weighting**
Written exam	Closed book		90	75,00 %
Permitted Resources	No calculator		With dictionary	

Others		**Assessment**	**Length (min.)**	**Weighting**
Project work		Grade	-	25,00 %

Students are not allowed to revise and resubmit performance assessment tasks.

Classroom Attendance Requirement	Mandatory Attendance: None
Language of Instruction/Examination	English
Compulsory Reading	-
Recommended Reading	-
Comments	-