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Bioeconomy data analysis and statistics
SYLLABUS

Study subject No: **5.2.**

Responsible Unit: **Latvia University of Life Sciences and Technologies (LBTU)**

Credits and distribution of academic hours*:

	Credits ECTS	Contact hours		Independent study hours	Total hours
		Lectures	Practical works or seminars		
JAMK	2,5	12	11	52	75
LBTU	2,5	12	10	53	75
Total	**5**	**24**	**21**	**105**	**150**

** 1 ECTS = 30 hours (9 contact hours and 21 independent hours);*
1 academic hour = 40 minutes;
Theoretical lectures not less than 50% of contact hours.

Course developers:
Latvia University of Life Sciences and Technologies (LBTU), **Prof. Pēteris Rivža**
JAMK University of Applied Sciences (JAMK), **Tarja Stenman M.Sc. Environmental science, Senior Lecturer**

Notes: General study course for the master programme Bioeconomy.

Prior knowledge: none.

Annotation: The course is designed so that students gain understanding of the effects of the climate change to humans and environment, they are also able to get the newest research information of the climate change. Students will learn the basics of the footprints and life cycle assessment and they will also gain a critical understanding of the calculating methods. This course gives knowledge within multivariate statistics, both in theory and applications that are used in bioeconomy.

The aim: The main aim of this study course is that of familiarizing the students with the theoretical and practical framework underlying the analysis of any data set that involves more than one variable. Student will understand the effects of the climate change to humans and environment.

The course provides a deeper knowledge within multivariate statistics, both in theory and applications that are used in bioeconomy fields. This course is meant to prepare participants for using quantitative research methods in their master's thesis.

Student will get knowledge of the freshwater resources in global and risks of that. Student can apply research information for his/her assignments and will understand the calculating methods of the carbon footprint, water footprint and ecological footprint. Student will also understand the basics of the life cycle assessment.

Description of the organization and tasks of students' independent work: *Student must do small practices and take part to discussions during lectures, two tests and one project work. Project work are presented in the class.*

Learning outcomes (knowledge, skills and competences)

Learning outcomes	Assessment methods	Levels of achievement		
		Satisfactory	Average	High
KNOWLEDGE				
Student can evaluate the effects of the climate change to humans and environment. Student can evaluate the risks for the global freshwater system.	Discussions in the class and tests	Student will know the effects of the climate change to humans and environment. Student will know the risks for the global freshwater system.	Student will understand the effects of the climate change to humans and environment. Student will understand the risks for the global freshwater system.	Student can evaluate the effects of the climate change to humans and environment. Student can evaluate the risks for the global freshwater system.
The student can orientate in Multivariate Data Analysis methods and their application possibilities.	Discussions in the class and tests	The student will know the basic Multivariate Data Analysis methods.	The student will understand when and how to apply specific Multivariate Data Analysis techniques in order to analyse.	The student can estimate and interpret results from Multivariate Data Analysis (interpret software output) in bioeconomy research.
SKILLS				
Professional skills				
Student can evaluate the calculating methods of the footprints.	Testing calculators and discussions in the class	Student will know the calculating methods.	Student will understand the calculating methods.	Student can evaluate the calculating methods of the footprints
The student can evaluate the implementation of multifactor analysis methods in various computer programs.	Testing computer programmes and discussions in the class	Student will know the use computer programmes of Multivariate Data Analysis.	Student will understand the calculating process of Multivariate Data Analysis.	Student can evaluate the calculating methods of the Multivariate Data Analysis.
Soft skills				
Student can consider the different aspects and opinions and can make constructive discussions.	Discussions in the class	Student will know the different aspects and opinions and try to make discussions.	Student will understand the different aspects and opinions and can make discussions.	Student can consider the different aspects and opinions and can make constructive discussions.
COMPETENCE				
Student can apply to practice and evaluate footprints and life cycle assessment in critical way.	Project work and presentation	Student can apply to practice and evaluate footprints and life cycle assessment.	Student can apply to practice and evaluate footprints and life cycle assessment in diversely way.	Student can apply to practice and evaluate footprints and life cycle assessment in critical way.

Initiative, systematic thinking, collaboration	Independent research (project) work and presentation	Ability to make a research design and plan and organise a research study.	Ability to critically assess and present the results of the research.	Ability to creatively find a non-standard solution to a problem.

Requirements for awarding credit points: *The student has to pass two tests and carry out and present project work. The student has to be also active in the class.*

Knowledge assessment and prerequisites for taking a test or examination
The final mark in the course is based on activity during lectures (10%), two tests (10% each) and project work (20%).

** 10 percent are equal to one point on a 10-point marking scale (or 10 percent are equal to 0.5 point on a 5-point marking scale).*

Topic	Type of assessment	Percentage	Assessment deadline
Activity in lectures	Participation and activity in discussions	10	During the studies
Topics 1-6	Test	10	During the studies
Topics 7-12	Test	10	During the studies
Topic 13	Test	50	During the studies
Independent work about the footprints	Project work and presentation	20	During the studies
Total		100	x

The course contents

JAMK - Content:
- *Climate change*
- *Carbon footprint*
- *Water footprint*
- *Ecological footprint*
- *Life cycle assessment*

Learning outcomes
- *Footprints (carbon, water, ecological)*
- *Calculation methods*
- *Basics of the life cycle assessment*

LBTU - Content:
- *Analyses of variance*
- M*ultiple regression analysis*
- *Factor analysis*
- *Cluster analysis*
- *Time series data analysis and forecasting*

Learning outcomes
- *Ability to choose appropriate procedures for multivariate analysis*

- *Use the SPSS Statistical software platform or the R language to carry out analyses ???*
- *Interpret the output of such analyses*

1. Lectures

1. Freshwater.
2. Freshwater and sustainable development goals (SDG).
3. Water footprint.
4. Blue, green and grey water footprint.
5. Water and ecosystem services.
6. Wetlands.
7. Climate change and global warming.
8. Greenhouse gas emissions by country.
9. Carbon footprint.
10. Ecological footprint, part 1.
11. Ecological footprint, part 2.
12. Life cycle assessment.
13. Multivariate Data Analysis.
    - Variables and their measurement. Scales for measuring variables. Preparation of data for analysis.
    - Introduction to Multivariate Data Analysis
    - Multivariate analysis of variance and covariance
    - Discriminant analysis
    - Canonical correlation analysis
    - Multiple regression analysis
    - Principal component analysis
    - Factor analysis
    - Cluster analysis
    - Time series data analysis
    - Time series data forecasting
    - Choice of Multivariate Data Analysis methods in bioeconomy research.

2. Practicals

1. Student will calculate their own water footprint by using waterfootprint.org calculator.
2. Student will compare water footprints in different countries and different products.
3. Student will familiarise the Ramsar sites in their home country.
4. Student will look for the newest information of the climate change by IPCC.
5. Student will look for the information of the greenhouse gas emissions by country.
6. Student will test and compare different kind of calculators (carbon and ecological footprints).
7. Student will present their project work.
8. Working with multivariate data and its graphical display.
9. Understanding the role that partial correlation may play in multivariate contexts.
10. Using multiple regression analysis.
11. Using factor analysis.
12. Using cluster analysis.
13. Time series data analysis and forecasting.
14. Student will present their project work.

List of sources of training, methodological and scientific literature and information

Compulsory reading (books, scientific articles, online sources etc.):

1. United Nations: Goal 6 | Department of Economic and Social Affairs (un.org)
2. Water Footprint Network: https://waterfootprint.org/en/about-us/
3. Ramsar Convention: https://www.ramsar.org/
4. The Intergovernmental Panel on Climate Change: https://www.ipcc.ch/
5. Global Footprint Network: https://www.footprintnetwork.org/our-work/ecological-footprint/
6. Bryan F.J. Manly, Jorge A. Navarro Alberto *Multivariate Statistical Methods*: A Primer, Fourth Edition 4th Edition, 2016 , Chapman and Hall/CRC 269 Pages
7. Brian Everitt, Torsten Hothorn *An Introduction to Applied Multivariate Analysis with R (Use R!)* 2011th Edition
8. Tenko Raykov, George A. Marcoulides *An Introduction to Applied Multivariate Analysis* 2008 by Routledge 496 Pages (SPSS and SAS)
9. Pat Dugard, John Todman, Harry Staines *Approaching Multivariate Analysis, A Practical Introduction*, 2014, Routledge, 440 Pages (SPSS and SAS)
10. Applied Multivariate Statistics for the Social Sciences: Analyses with SAS and IBM's SPSS by Keenan A. Pituch & James P. Stevens, 2016, Taylor & Francis

Further reading:

1. Freshwater Information Platform: http://www.freshwaterplatform.eu/
2. SPSS Statistics for Dummies, 3rd Edition.pdf https://itbook.download/topic/f1604953eaaf43ce9f6033047f8a8556
3. Multivariate Analysis https://www.stat.auckland.ac.nz/~balemi/Multivariate%2520Analysis.ppt+&cd=1&hl=lv&ct=clnk&gl=lv

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