

Cradle to cradle and circular economy

Professor: Ilija Sazdovski

Office hours: 24

Course Type: Selective

Credits: 3 ECTS

Term: Second

Course Description

Alarming reports published by the United Nations warned of the massive increase in resource extraction that tripled since 1970, and according to their projections, the resource usage will increase by 70% more by 2050. This increase in resource consumption is resulting in tremendous environmental impacts, a consequence of the present linear economic model.

The circular economy is a relatively new concept introduced to overcome the limitations of the traditional linear economic model that has proved to be inefficient in terms of material use and environmental protection.

A growing body of scientific literature aims at providing adequate metrics in order to improve the comparison between the two economic paradigms or systems serving the same function. One of the key limitations of the circular economy concept is the lack of a unique definition and commonly accepted indicators for circularity. Moreover, there are a plethora of different approaches utilizing or introducing new variables that are not defined in previously developed conceptual frameworks of the circular economy. Some authors even predict a collapse of the approach because of such wide interpretations of circularity as a concept.

The main aim of the course is the understanding of the urgency of changing the present linear economic model, as well as the key principle and philosophical approaches for the circular future.

Objectives (resultados de aprendizaje) and competences

The main objective for the students participating in this course is to differentiate the linear from the circular economic model. They will understand the main policy package in the European Union toward transforming the economy using the circularity paradigm.

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The students will obtain the basic skills for circularity assessments and learn how to identify the non-linear flow of the materials in the technosphere in multiple utilization circles.

They will be introduced to the historical development of the concept of circular economy, its main principles, and different definitions based on the scope of assessment. Also, they will get the basic knowledge of new philosophical approaches for the future such as the “Cradle to Cradle” concept, through theoretical approach and practical examples.

During the study visit, they will recognize the size of linearity of our system, and the urgent need for an efficient circular system for our economy and the materials we use.

To achieve the course objectives that will equip the students with necessary future skills, the following work plan will be conducted:

Week 1: January 16th, 2023

Topics: Introduction of the course;

Introduction of principles of circularity, limits of the linear economic model, key steps towards a circular economy, and practical examples.

Week 2: January 23rd, 2023

Topics: Theoretical basis

Circularity matrix based on robustness: micro-scale (product, company), mezzo-scale (industrial systems), and macro-scale (city, regional, national, or beyond);

Comparison of different circularity definitions and circularity indicators.

Material Circularity Indicator vs. other circularity indicators used. Practical aspects of calculations.

Homework for the student's group work:

The students will have to design a packaging product, with the maximal potential of circularity. Free accessible tools for assessment of circularity will be used.

Week 3: January 30th, 2023

Topics: Circular properties of the materials, difference between the fossil and bio-based materials, circular losses in open-loop multiple recycling processes. Material flow in real circumstances. Combination of lifecycle variables with circularity principles.

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Week 4: February 2nd, 2023

Topics: European Policy towards circular economy transformation.

Homework for the students: The students will be divided into groups to perform a literature review of the European policies to identify possible replications and unique approaches toward the transformation of the linear system.

Week 5: February 9th, 2023

Topics: Cradle to Cradle, a new philosophical concept of the future.

Week 6: February 16th, 2023

Topics: Practical implementation of the Cradle to Cradle concept, certification, and best examples.

Week 7: February 23rd, 2023

Topics: Understanding of the scope and size of the linear economic model that we use.

Study visit to the Ecoparc Del Mediterrani S.A. and TERSA (Tractament i Selecció de Residus, S.A.)” Barcelona, Spain

Week 8: December 2nd

Topics: Group work presentations: Designing a circular product.

Preparatory activities for the test.

Methodology

The course comprises eight 3-hour sessions, which combine theory lectures and student active participation in the classes.

During the course, the students will be assigned to a group work exercise and different homework assignments where the practical application of learned concepts will be applied. Activities will require both individual and group work.

A study visit will be organized to one of the biggest incinerator facilities in Spain.

Evaluation criteria

Three elements concur in the final mark:

- **Final exam (50%).** The final exam is used to assess the individual level of knowledge and understanding of each student. It will include questions covering topics from all the classes. This item counts for 50% of the final mark. To pass the exam the minimum grade is 5.

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Note: This document is for informational purposes only. Course contents and faculty may change.

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- **Group work and homework presentation (30%).** Students will apply their knowledge to real-life situations during the development of the homework and the group work exercise. They are expected to use the topics they learned to use during the classes.
- **Class attendance and active participation (20%).** Attendance in every session is expected and recorded using an attendance sheet. It is your responsibility to comply with this measure. Class attendance is compulsory and will be considered in your final grades; punctuality is a must. Note that unexcused absences reduce your score on the "attendance and participation" element of your final grade. Two or more unexcused absences will result in an automatic score of zero and, in all likelihood, a fail mark for the course as a whole.

Attended all the sessions + actively and consistently participated in the class discussions during the entire course period	20
Attended all the sessions + actively and consistently participated in most of the class discussions	15-19
No more than one unexpected absence + often participated in the class discussions	10-14
No more than one unexpected absence + participated in some class discussions	5-10
No more than one unexpected absence + limited or no participation in class discussions	1-5
Otherwise	0

Other evaluation criteria to take into consideration:

- **Retake**

Students who fail the course during the regular evaluation will be allowed ONE re-take of the examination/evaluation. Students that pass any Retake exam should get a 5 by default as a final grade for the course. If the course is again failed after the retake, students will have to register again for the course the following year.

- **No-show**

In case of a justified no-show to an exam, the student must inform the corresponding faculty member and the director(s) of the program so that they study the possibility of rescheduling the exam (one possibility being during the "Retake" period). In the meantime, the student will get an "incomplete", which will be replaced by the actual grade after the final exam is taken. The "incomplete" will not be reflected on the student's Academic Transcript.

- **Plagiarism**

Plagiarism is to use another's work and present it as one's own without acknowledging the sources in the correct way. All essays, reports, or projects handed in by a student must be original work completed by the student. By enrolling at any

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UPF BSM Master of Science and signing the “Honor Code,” students acknowledge that they understand the schools’ policy on plagiarism and certify that all course assignments will be their own work, except where indicated by correct referencing. Failing to do so may result in an automatic expulsion from the program.

Bio of Professor

Ilija Sazdovski is finalizing his Ph.D. thesis in the field of circular aspects of materials, directed by Dr. Pere Fullana-i-Palmer at the UNESCO Chair in Life Cycle and Climate Change ESCI-UPF. His thesis aims to propose methodological improvements to the life cycle assessment methodology by involving the principles of the circular economy. He developed theoretical aspects of two circularity indicators, which can be utilized in fast-moving products such as packaging, through involving time in the life cycle principles. He is skilled in laboratory testing of fossil-based and bio-based plastic materials in multiple recycling processes aiming to identify circular qualitative properties.

Between 2012 and 2018, he was part of the Scientific Advisory Board of the Conference for Sustainable Development of Energy, Water and Environmental Systems. He holds a B.Sc. in mathematics and physics and M.Sc. in ecological economics.

He is an experienced researcher and he is authoring numerous technical reports, strategies, and conference and scientific papers.

Reading Materials/ Bibliography/Resources

No textbook is required for this course. All the required materials will be provided. Any readings, notes, handouts, datasets, or additional course material will be available through the course website.