

Course Syllabus – DRAFT

ISEN 463 *Circular Economy*

Northwestern University

Course Synopsis: This class will cover the core principles of a circular economy. It will use systems thinking to understand the technological, economic and policy implications of circular economies. It will focus on real-world applications, testing the feasibility of circular systems and analyzing their design.

Course Goals: Students will develop a solid foundation in:

- **Systems Thinking and Circular Design:** This paradigm underlies much of the development of CEs and is an effective professional tool. Through this course, students will develop the necessary skills to be able to integrate a systems-based perspective in their analyses of situations. Systems Thinking will be cultivated through case studies and analysis projects.
- **Material Flows:** A basic understanding of the technological aspects of a circular economy are essential to its design. This course will impart an understanding of topics such as the biological cycle, energy flows and industrial ecology. Through the medium of case studies, it will also explore properties of common materials such as metals, rubber and plastic—focusing on the manner in which these properties can aid the integration into a circular system.
- **Business Models:** A circular economy requires new and changed business models to function. We will analyze models of financing and running a circular system. We will also look at the bigger picture, exploring how global supply chains can scale up to faster implement and accommodate circular economies.
- **Incentivizing and Measuring the Circular Economy:** Policy considerations are important to the success of a circular economy. This course will consider the practicalities of delivering a circular economy, addressing the key incentives of all stakeholders involved. It will also consider the available tools to measure the impact and circularity of such systems.

Grading/Assessment:

Grading will be based on the following rubric:

Component	Weight	Details	Due
Quizzes	20%	Conventional in class quizzes based on the content. These will be declared beforehand and will focus on the theoretical frameworks explored in class. Questions may include definitions, analyses, etc	Week #4, Week #7
Case Study Assignments	40%	There will be four case studies assigned. Students will read the case materials and then submit 3-4 pages of written, individual analysis in MS Word to answer the assigned case questions (usually 2-3 questions). Topics	Week #3 Week #6 Week #8 Week #9

		<p>will vary but may include circular potential, design and implementation or assessment of solutions. The case will be distributed during the first class of the week to be submitted by 8am on the day of the second class that week. The second class will often be used to discuss the case.</p> <p>An example case might be Karma, the Swedish food-waste management company. Case questions could include:</p> <ol style="list-style-type: none"> 1. What is Karma’s business model? What are its shortcomings and what are the positive externalities it produces? 2. How does Karma account for packaging waste produced by its operations? Does this detract from Karma’s circularity? What are the negative environmental effects of Karma’s model? 	
Final Presentation	40%	<p>Final presentations will be applications of the material covered in class—groups will have to identify an industry with potential for circular disruption, design a circular solution and consider the aspects of its implementation.</p> <p>The final project will be done in groups of 3-4 students. Students will be expected to deliver:</p> <ol style="list-style-type: none"> 1. 10-minute Elevator Pitch of Solution (Powerpoint Presentation in Class) 2. A written, 10 page paper submitted at 8am on the morning of the last class. <p>Students will be assessed in the following ways:</p> <ol style="list-style-type: none"> 1. <u>Peer Ratings</u>: Group members will rate each other’s contributions. (5%) 2. <u>In-Class Presentation</u>: The group will receive a team grade base on the clarity of the message and the quality of presentation (10%) 3. <u>Written Project</u>: The instructor will provide a grade to the group based on the assessment of the issue / opportunity for a circular solution, the quality of the recommendation/solution and the depth of implementation planning and risk assessment. Further details on expectations for the project will be shared when teams are formed (25%) <p>All students will be expected to be involved and engaged in presentations of others. Failure attend or show respect</p>	Week #10



		during the presentation of the others could result in a reduction in the team grade on the final project.	
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Grading Policy:

Grades will be assigned based on all the work you have completed during the semester following the traditional practice of A=90-100, B=80-89, C=70-79, D=60-69, F<60.

Course Readings:

Required readings are outlined below.

1. Webster, K. *Circular Economy: A Wealth of Flows*. Ellen MacArthur Foundation, 2nd Edition, 2016.
2. McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things*. New York: North Point, 2002. Chapter 2: p45-67 (22 pages)
3. Raworth, K. *Doughnut Economics. Seven Ways to Think Like a 21st-Century Economist*. Random House, 2017. Print.
4. Ellen MacArthur Foundation, "Delivering the Circular Economy: A Toolkit for Policymakers" Ellen MacArthur Foundation. 2015.
5. A. Tukker, et al, "The Impacts of Household Consumption and Options for Change," *Journal of Industrial Ecology*, Vol. 14: 13-39, 2010.

Some additional suggested readings include:

1. Ellen MacArthur Foundation, "Towards the Circular Economy Vol. 1: Economic and Business Rationale for an Accelerated Transition" Ellen MacArthur Foundation. 2013. Web: p6-62 (56 pages)
2. Lovins, B, Amory, Michael Braungart et al. *A New Dynamic: Effective Business in A Circular Economy*. Ellen MacArthur Foundation Publishing, 2013. Print. Chapter 2, A Concise Guide to the Circular Economy, p19-28 (9 pages)
3. Ellen MacArthur Foundation, "Towards the Circular Economy Vol. 3: Accelerating the Scale-Up Across Global Supply Chains" Ellen MacArthur Foundation. 2014. Web.
4. Ellen MacArthur Foundation, "Intelligent Assets: Unlocking the Circular Economy Potential" Ellen MacArthur Foundation. 2016. Web. p28-63 (35 pages)
5. ING Economics Department. "Rethinking finance in a Circular Economy", May 2015. Web. Section 4: p 34-52 (18 pages)
1. Ellen MacArthur Foundation, "Towards the Circular Economy Vol. 3: Accelerating the Scale-Up Across Global Supply Chains" Ellen MacArthur Foundation. 2014.
2. Directorate General for Internal Policies, European Parliament. "Leasing Society: Study", November 2012.
3. Tim Brown: Design & the circular economy – Circular Design Guide.
4. DG Environment Consortium. "Scoping study to identify potential circular economy actions, priority sectors, material flows & value chains"
5. Kim, Daniel. *Introduction to Systems Thinking*, Pegasus Communications, 1999. Print.
6. Ellen MacArthur Foundation, "The New Plastics Economy: Rethinking the Future of Plastics"
7. Franconi, Ellen, Brett Bridgeland et al. *A New Dynamic 2: Effective Systems in a Circular Economy*
8. Ellen MacArthur Foundation (in cooperation with Granta and LIFE). "Circularity Indicators. An Approach to Measuring Circularity"
9. S. Carbonaro, "10 Principles of a New Consumer Paradigm," presented at the MIGROS/GDI 65th International Retail Conference, Ruschlikon/Zurich, 2015.
10. E. Franklin-Johnson, et al, "Resource Duration as a Managerial Indicator for Circular Economy Performance," *Journal of Cleaner Production* Vol 133: 589-598, 2016.

11. A. Minter, "The Burning Truth Behind an E Waste Dump in Africa," Smithsonian Magazine, January 13, 2016.

Websites:

At points you may be required to watch videos, read blogs, or explore websites outside of class. Below are some interesting resources on circular economies:

- <https://www.circulardesignguide.com>
- <http://www.symbiosis.dk/en/>
- <https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-general-resources-map/key-for-general->
- <https://thesystemsthinker.com>

CLASS OUTLINE

Weekly Topic	Description
<p>1: Intro to Circular Economy, Course Logistics</p>	<ul style="list-style-type: none"> • Introduction to course, its objectives and expectations of students • Measures of success: GDP vs. Human prosperity • What is a circular economy? • What is the economic rationale behind a circular economy? What are its theoretical foundations and current applications?
<p>2: Systems Thinking Paradigm</p>	<ul style="list-style-type: none"> • What is systems thinking? • Discuss the theoretical foundations of systems-level thinking and its application to circular economy concepts • Importance of systems approach & key tools • How / where systems thinking is applied in today's market <p><u>Supplemental Reading</u> http://biqthinking.io/why-is-systems-thinking-important-to-innovation/</p>
<p>3: Consumer Behavior and the Circular Economy</p>	<p>QUIZ #1: Circular Economy & Systems Thinking Basics</p> <ul style="list-style-type: none"> • General fundamentals of consumer behavior • Changing consumer norms in the US & beyond • Key drivers of change in consumer behavior • Role of consumers to influence circular economy: barriers and opportunities <p>CASE STUDY #1: Consumer Behavior</p>
<p>4: Circular Design and Possible Business Models</p>	<ul style="list-style-type: none"> • What is circular design? Where is it used today? • Applying systems thinking to circular design • Exploring possible business models in a circular economy • Integrating design and business models to get a more complete picture

	<p>Announcement of groups for final project, review of final project objectives and output, discussion of potential topics. Select and submit topic to instructor by end of week</p>
<p>5: Flows in a circular economy (Energy, Material, Waste, Effluents)</p>	<ul style="list-style-type: none"> ● Define “flows” and outline major types of flows ● Explore the circular potential of specific common materials such as plastics, cloth, rubber and metals through case studies and research papers ● Review the role of waste as a resource in the circular economy ● Consider impacts of flows beyond raw materials such as transportation, energy ● How can various types of flows be measured and managed <p>CASE STUDY #2: Flow measurement</p>
<p>6: Policy Considerations</p>	<p>QUIZ #2: Defining, calculating and managing CE Flows</p> <ul style="list-style-type: none"> ● Introduction to the policy considerations and incentives for circular economies ● Consider the role of government, regulatory authorities and other stakeholders ● Review examples of success and failure in circular economy policies <p>CASE STUDY #3: Policy & Circular Economy</p>
<p>7: Implementation and Measurement</p>	<ul style="list-style-type: none"> ● How can we transition to circular models? ● Methods for implementing circular systems ● Best practices & learnings from case examples ● Measure circularity and quantitatively assess potential for a circular system <p>FINAL PROJECT OUTLINE DUE</p>
<p>8: Leading Markets for Circular: Fashion & Packaging</p>	<ul style="list-style-type: none"> ● Overview of industries & their progress in circular economy ● Review of fashion and plastics industries as opportunities for circular disruption ● Discussion of new business models (e.g. Thred Up, Rent the Runway, TRR) and assessment of modifications in traditional components such as textiles ● Evaluate evolutionary changes in packaging / plastics ● Assess more revolutionary changes in the packaging industry ● Analyze the business models of these industries and use the frameworks developed in class to analyze circular potential
<p>9: Circularity Across the Globe</p>	<ul style="list-style-type: none"> ● Assess the relative uptake of circular concepts on a global basis ● Discuss role of cities in moving to circular systems



	<ul style="list-style-type: none"> ● Identify breakthrough innovations and stakeholders that are driving change ● Consider the components necessary (economic, technical, policy) required to move to a circular model ● Review the potential global impact of moving from GDP to a human prosperity model using circular economy as a tool
<p>10: Final Presentations</p>	<p>Groups will present the 10-minute elevator pitches of their final presentations. They will field questions for 5 minutes. Grading rubric outlined above. Detailed project requirements will be shared on Week 3.</p>

OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE

1

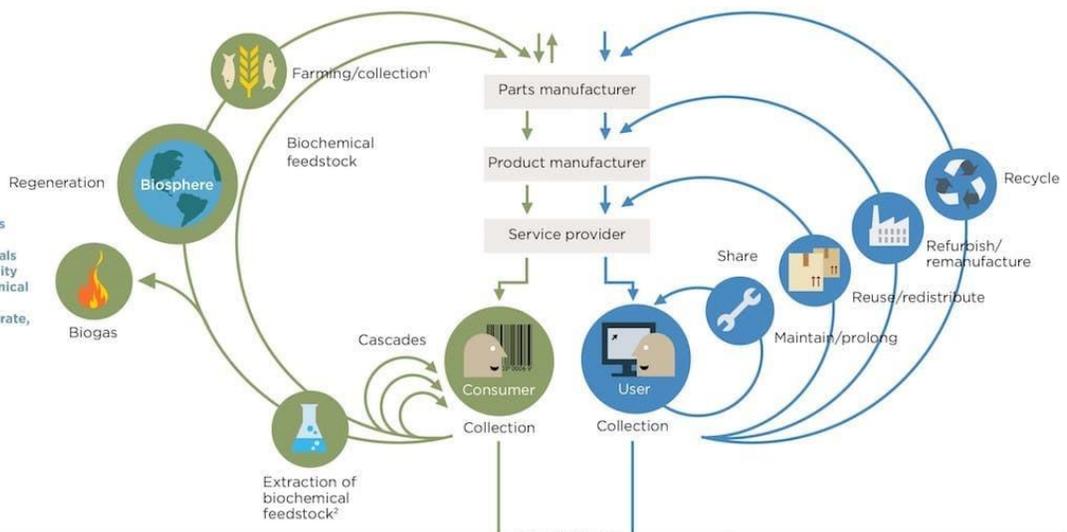
Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
 ReSOLVE levers: regenerate, virtualise, exchange



PRINCIPLE

2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
 ReSOLVE levers: regenerate, share, optimise, loop



PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities
 All ReSOLVE levers



1. Hunting and fishing
 2. Can take both post-harvest and post-consumer waste as an input
 Source: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

Source: Ellen MacArthur Foundation, 2019¹

¹ <https://www.ellenmacarthurfoundation.org/circular-economy/concept/infographic>