

Master of Science in Sustainability Management

Circular Economy for Sustainability Professionals (SUMA PS5470)

Thursdays: 6 - 8PM

3 credits

Instructor: Stephanie Johnston, Adjunct Professor, sj2884@columbia.edu (917) 991 6032
Office Hours: Office hours are held by appointment in 2929 Broadway 5th floor. To schedule an appointment, please contact me by email.
Response Policy: Students can expect me to respond to emails within 48 hours during workweek and weekends. For urgent queries students may text me and I will respond or call ASAP.

Facilitator/Teaching Assistant, if applicable: Soujanya Nagaraja, sn2754@columbia.edu
Office Hours: Wed 3 -5.30pm
Response Policy: Students should contact me by email and expect a response within 24 hours. I will be available on campus during workweek only. In case of urgent queries students can text me on (267) 226 4116 and I will respond ASAP.

Course Overview

Today, we operate in a “linear” (take, make, dispose) economy that is defined by a reliance on large quantities of cheap materials and energy that are typically “finite” in nature. This approach is proving unsustainable, and presents problems that include the degradation of natural systems, economic and structural waste, as well as “supply” risks, as our planet reaches its physical limits.

Against a backdrop of population growth, these problems are only set to get worse. Yet at the same time, an unprecedented alignment of technological and societal factors is enabling the transition to a new model possible at scale.

A circular economy is an alternative economic model, that is restorative by design, and rather than relying on a constant throughput of newly extracted resources and non-renewable energy, aims to keep materials, products and components constantly at their highest utility and value.

This elective course will delve into both the theory and practical applications of a circular economy. Achieving perfect circularity (which would theoretically be a state of complete systemic regeneration and restoration, optimized resource utility and zero waste) represents potentially transformative system change and will involve a fundamental re-think of many of our structures, systems and processes in the economy at large. At the same time, its value creation potential for businesses, households and the environment alike, is potentially extremely significant. For example, manufacturers can reclaim substantial value from the products they develop by introducing take-back schemes to reclaim components and resources for re-use or recycling, as opposed to allowing them to go to waste as would typically be the case in a linear system.

We will explore the theoretical underpinnings of a circular economy, including the need for systems thinking (taking relevant learnings from biomimicry and industrial ecology). We will look to circular design principles and explore their use in different industries. We will pose the question of which stakeholders can help to facilitate this transition to circularity, and what enablers, in the form of policy and financing, will need to be in place to allow it to progress.

The exploration of new and emerging business models will form a significant part of this class. From sharing models to “product as a service” models, these new ways of doing business provide inherent opportunities and incentives for businesses to re-think how they can create value while simultaneously optimizing resource use and remaining at the competitive edge.

The course will explore real-life examples of circular economic thinking in specific industries, such as the fashion and industry, as well as looking at its application in a geographic context through the lens of cities, and examining standalone infrastructure, such as waste management.

The class will comprise a series of lectures, supported by case-study based assignments that will help to familiarize students

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with the challenges that apply to circular economic thinking in different geographical, industry and economic contexts. An important aspect of the course will be learning how to link systems thinking with effective stakeholder engagement to facilitate change.

This class will be ideal for graduate students and young professionals who have a good basic understanding of economic principles and are keen to explore an alternative approach to traditional sustainability, which has increasingly become focused on using less resources, without addressing the more systemic flaws we face in our economy.

Upon completion of this class, students will possess sufficient knowledge to discuss the merits of a circular economy and its applications with potential employers. This course will benefit anyone with an interest in a career in sustainability, particularly (but not exclusively) in the corporate and non-profit sectors, in operations, design, strategy or communications.

Learning Objectives

While elements of circular economy thinking have been around for some time, as an approach it has recently gained significant momentum. It is a rapidly evolving area, particularly when it comes to implementation. For that reason, the goal is not necessarily to learn about the circular economy as it applies to all industries or to understand every aspect of its successful application. Instead the course aims to provide students with firm knowledge of the underlying principles and approaches, as well as allowing them to practice a systems-focused mindset applied to a number of potential applications. During the course, students will:

- Identify critical aspects of circular economy terminology and vocabulary and learn to speak authoritatively about the merits and challenges of this approach
- Develop the skills to assess and evaluate opportunities for the use of circular economy thinking and approaches
- Apply systems thinking and circular design approaches to a range of real-world challenges
- Evaluate systems in a way that identifies their biological and technical materials/components
- Establish the key enablers and barriers for circular economy implementation in general, and as they relate to financing, policy, stakeholder management, business models and industry/application specifics
- Define ways to begin implementation and measure progress and success in circular economy
- Construct a response to a specific sustainability challenge that employs what they have learned about circular economy

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Readings

Required readings

- Acaroglu, Leyla: Tools for Systems Thinkers: The 6 Fundamental Concepts of Systems Thinking ([Available on medium.com](#)), 2017. Web. (3 pages)
- Benyus, Janine. *Biomimicry*. (Harper Perennial, 2002). Print. Chapter 1, p1-10 (10 pages)
- Benyus, Janine: Video. Biomimicry in action, TED Talk, (2009). [Available here](#). (20 min)
- Brown, Tim: Design & the circular economy – Circular Design Guide. [Available here](#).
- BSI. “Executive Briefing: BS 8001 – a Guide”. (BSI, 2017). Web. (6 pages) [Available here](#)
- Circle Economy, Fabric TNO and Gemeente Amsterdam, “Circular Amsterdam: A vision and action agenda for the city and metropolitan area”, 2016. Web. (47 pages) [Available here](#)
- Ellen MacArthur Foundation, “A New Textiles Economy: Redesigning Fashion’s Future” Ellen MacArthur Foundation. 2017. Web. p36-117 (81 pages). [Available here](#).
- Circulate News (Ellen MacArthur Foundation), “Journey to the Circular City”. Web. (5 pages). [Available here](#).
- DG Environment Consortium. “Scoping study to identify potential circular economy actions, priority sectors, material flows & value chains”, August 2014. Web. Chapters 4-7, p15-72 (57 pages) [Available here](#).
- Ellen MacArthur Foundation, “Delivering the Circular Economy: A Toolkit for Policymakers” Ellen MacArthur Foundation. 2015. Web. p39-88 (49 pages)
- 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)
- Ellen MacArthur Foundation, “Achieving ‘Growth Within’” Ellen MacArthur Foundation. 2017. Web. p16-52 (36 pages)
- Ellen MacArthur Foundation, “The New Plastics Economy: Rethinking the Future of Plastics”. Ellen MacArthur Foundation. 2016. Web. (92 pages)
- Ellen MacArthur Foundation (in cooperation with Granta and LIFE). “Circularity Indicators. An Approach to Measuring Circularity: Project Overview”, May 2015. Web. (12 pages) [Available here](#).
- Ellen MacArthur Foundation. Video: Amsterdam – Exploring the Sharing City, DIF 2014. [Available here](#). (32min, 30 sec)
- Franconi, Ellen, Brett Bridgeland et al. *A New Dynamic 2: Effective Systems in a Circular Economy*. Ellen MacArthur Foundation Publishing, 2016. Print.
 - Chapter 3, Towards a Regenerative Food System, p49-61 (12 pages)
 - Chapter 5, The Circular Economy of Soil, p87-103 (16 pages)
 - Chapter 6, Remanufacturing and the Circular Economy, p107-127 (20 pages)
 - Chapter 8, Broader Lessons from Self-Organising Traffic Lights in City Transport Systems, p143-155 (12 pages)
 - Chapter 11: Circularity Indicators, p195-210 (15 pages)
 - Chapter 10: Cities as Flows in a Circular Economy, p177-193 (16 pages)
- Graedel, T.E. and Allenby, B.R. *Industrial Ecology* (Second Edition). New Jersey: Pearson Education, 2003. Print. Chapter 2, p17-24, and Chapter 22, p268-283, (23 pages)
- ING Economics Department. “Rethinking finance in a Circular Economy”, May 2015. Web. Section 4: p 34-52 (18 pages)
- Lovins, B, Amory, Michael Braungart et al. *A New Dynamic: Effective Business in A Circular Economy*. Ellen MacArthur Foundation Publishing, 2013. Print.
 - Chapter 5: A Farewell to Fossil Fuels: Answering the energy challenge, p61-74 (13 pages)
 - Chapter 8: Rebuilding Economic Vitality, Rev@ the World, by Sally Goerner and Randolph Voller, p112-128 (16 pages)
 - Chapter 10: Implementing a Circular and Performance Economy through Business Model Innovation, p143-156 (13 pages)
- McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things*. (North Point, 2002). Print.
 - Chapter 2: p45-67 (22 pages)
 - Chapter 3, p68-91 (23 pages)
 - Chapter 4, Waste Equals Food, p92-117 (25 pages)
- McDonough, William, and Michael Braungart. *The Upcycle: Beyond Sustainability – Designing for Abundance*. New York: North Point, 2013. Print. Chapter 2: Houston we have a solution, p53-83 (30 pages)

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- Ross, M. (Producer), & Morgan, A. (Director). (2015). Video documentary: *The True Cost*. United States: Life is My Movie Entertainment; Untold Creative LLC (1h 32 min): <https://truecostmovie.com/>
- Rutqvist, Jakob and Peter Lacy. *From Waste to Wealth: The Circular Economy Advantage* (Palgrave Macmillan, 2015). Print. Section II, pages 68-114 (46 pages)
- Stahel, W. Circular economy. *Nature* 53. Macmillan, 2016, p435-438 (3 pages) [Available here](#)
- The Ex'tax Project, "New Era. New Plan. Europe. A Fiscal Strategy for an Inclusive, Circular Economy." The Ex'Tax Project Foundation, 2016. Web. Chapter 3-5, p57-84 (27 pages) [Available here.](#)
- The Recycling Partnership. "The 2016 State of Curbside Report", January 2017. Web. (25 pages)
- Webster, Ken. *The Circular Economy: A Wealth of Flows*. Ellen MacArthur Foundation Publishing, 2015. Print.
 - Introduction & Chapter 1-3, p7-61 (54 pages)
 - Chapter 4, Through the Macroscopic, p63-87 (24 pages)
 - Chapter 5, p89-105 (16 pages)
 - Chapter 6, Social Capital, Markets and Money in a Circular Economy, p108-125 (17 pages)
 - Chapter 9, The Regenerative Biological Cycle at Scale, p159-173 (14 pages)
 - Chapter 10, p175-189 (14 pages)

Recommended readings

- Benyus, Janine. *Biomimicry*. (Harper Perennial, 2002). Print. (297 pages)
- Circulate News. *Future of Cities: A New Approach to Urban Space*. [Available here.](#)
- Despeisse, M., Baumers, M et al. "Unlocking value for a circular economy through 3D printing: A research agenda", February 2017. Elsevier. *Technological Forecasting and Social Change* Volume 115, pages 75-84 (10 pages).
- Ellen MacArthur Foundation, "Achieving 'Growth Within'" Ellen MacArthur Foundation. 2017. Web. Chapters 3 & 4, p70-92 (22 pages)
- Ellen MacArthur Foundation (in cooperation with Granta and LIFE). "Circularity Indicators. An Approach to Measuring Circularity: Methodology", May 2015. Web. (98 pages) [Available here.](#)
- Ellen MacArthur Foundation, "Delivering the Circular Economy: A Toolkit for Policymakers" Ellen MacArthur Foundation. 2015. Web. p91-146 - Denmark case study (55 pages)
- Ellen MacArthur Foundation Educational Resources: <https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-educational-resources/schools-of-thought>
- Ellen MacArthur Foundation, "Intelligent Assets: Unlocking the Circular Economy Potential" Ellen MacArthur Foundation. 2016. Web. p28-63 (35 pages)
- Ellen MacArthur Foundation, "The New Plastics Economy: Catalysing Action" Ellen MacArthur Foundation. 2017. Web. (49 pages)
- Ellen MacArthur Foundation, "Towards the Circular Economy Vol. 2: Opportunities for the Consumer Goods Sector" Ellen MacArthur Foundation. 2013. Web. (101 pages)
- Ellen MacArthur Foundation, "Towards the Circular Economy Vol. 3: Accelerating the Scale-Up Across Global Supply Chains" Ellen MacArthur Foundation. 2014. Web. Chapters 1, 2, 3 & 4, p11-64 (53 pages)
- Ellen MacArthur Foundation, "Urban Biocycles" Ellen MacArthur Foundation. 2017. Web. (36 pages)
- Franconi, Ellen, Brett Bridgeland et al. *A New Dynamic 2: Effective Systems in a Circular Economy*. Ellen MacArthur Foundation Publishing, 2016. Print.
 - Chapter 4, Ecosystems as a Unifying Model for Cities and Industry, p63-85 (22 pages)
 - Chapter 9, Challenges and Capabilities for Scaling up Circular Economy Business Models – A Change Management Perspective, p157-175 (18 pages)
- Glattfelder, James B. Video: TEDx, Zurich, 2012. "Who Controls the World?" [Available here.](#) (14min, 10sec)
- Graedel, T.E. and Allenby, B.R. *Industrial Ecology* (Second Edition). New Jersey: Pearson Education, 2003. Print. 183-227 (43 pages)
- Gullingsrud, Annie. *Fashion Fibers: Designing for Sustainability*. (Bloomsbury, 2017). Print. (293 pages)
- London Waste and Recycling Board (LWRAB), "London's Circular Economy Route Map", 2017. Web (60 pages) [Available here](#)

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- 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)
 - Chapter 9: White Goods/Washing Machines – Business Case Study, p129-142 (13 pages)
- McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things*. (North Point, 2002). Print. (193 pages)
- McDonough, William, and Michael Braungart. *The Upcycle: Beyond Sustainability – Designing for Abundance*. New York: North Point, 2013. Print. (217 pages)
- Raworth, K. *Doughnut Economics. Seven Ways to Think Like a 21st-Century Economist*. Random House, 2017. Print. (250 pages)
- Schenck, Rita C. “LCA for Mere Mortals. A Primer on Life Cycle Assessment” (IERE, 2000). Web. (103 pages) [Available here](#)
- The Ex’tax Project, “New Era. New Plan. Europe. A Fiscal Strategy for an Inclusive, Circular Economy. The Ex’Tax Project Foundation, 2016. Web. (196 pages) – *of particular interest are chapters 7 & 8* [Available here](#).
- Vlaanderen, Tessa. “Vlaanderen, Tessa. “Growing the Remanufacturing Industry: A Stakeholder Guide” [report is due to be published in January 2018 – estimated reading length = 44 pages]
- Working Group FinanCE. “Money Makes the World Go Round (and will it help to make the economy circular as well?)”, March 2016. Web. Sections 2 & 3, p35-68 (33 pages) [Available here](#).

Resources

Course Specific Tools

I recommend exploring the following resources to provide additional information and examples:

<https://www.weforum.org/agenda/2016/04/8-videos-that-explain-the-circular-economy/>

<https://www.circulardesignguide.com/>

<https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-general-resources-map/key-for-general-resources-map>

<http://circulatenews.org/>

Columbia University Library

Columbia’s extensive library system ranks in the top five academic libraries in the nation, with many of its services and resources available online: <http://library.columbia.edu/>.

The Columbia University Libraries offer many services to faculty including direct contact with librarians who will build custom queries and set up custom databases for your course. They also work one on one with students and consult with faculty to build research projects for courses. Many faculty services are available via CUL/IS such as subject guides (<http://library.columbia.edu/subject-guides.html>), the digital collections (<http://library.columbia.edu/find/digital-collections.html>) and how to request an appointment with a librarian to review library, archival, print and electronic resources, including primary sources, to customize resources for their course (<https://library.columbia.edu/find/request/reference/consultation.html>)

SPS Academic Resources

The Office of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: <http://sps.columbia.edu/student-life-and-alumni-relations/academic-resources>.

Course Requirements (Assignments)

In total, there are 10 assignments for this class.

During the course of the semester, you will complete a term project in groups of approximately four, producing a term project report and delivering a summary oral presentation. Over the course of the semester, in your group, you will explore what

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mobility/the transport system could look like in New York City in the near future, by applying a circular economy lens. You will demonstrate having achieved the learning goals for the course by including the following in your report, summarized in an engaging way in your presentation:

- Background research
 - Context on mobility/transport in NYC
 - Explore reasons why NYC mobility/transport may be suited for circular disruption, and barriers faced
 - Explore, document/describe (as appropriate) the mobility system in NYC as it stands, recognizing the existing networks, enablers, active businesses, key stakeholders/communities and supply chain.
- Circular approach and implementation
 - Re-imagine the mobility system, in terms of design and business model constructs
 - Draw on best practice/examples to demonstrate feasibility
 - Identify key enablers and potential barriers to achieving this.
 - Suggest an approach to implementation and measurement of success for your newly imagined system and provide a rationale for this

Your student peers will assign points, from 0-100 based on the following evaluation criteria, and average scores will be used for peer evaluation points:

- Individual grade (from your group) to reflect your performance during work on the term project (25%)
- Individual grade (from the other students) for presentation delivery style (25%)
- Group grade (from the other students) for presentation content (25%)
- Group grade (from the other students) for presentation style and layout (25%)

The remaining deliverables consist of nine writing assignments. Each assignment is due at the beginning of class on Thursday of that week (e.g., Assignment #1 is due at the beginning of class on 1/18; assignment #2 is due at the beginning of class on 1/25 etc.)

- Four assignments are Point-of-View (POV) writing assignments. You will be asked to share your point-of-view, in one page or less, on specific class topics and/or weekly readings. These assignments are designed to provide you with the opportunity to internalize each week's class topic. Your work will be evaluated individually.
- Five assignments are Case Study assignments. You will be asked to use specific tools and/or reading material to conduct a straightforward analysis of a situation and present your findings and/or suggested solutions to a specific dilemma. These assignments are designed to test your understanding of key concepts. Your work will be evaluated individually. Case studies will include an answer to the dilemma, rationale to support that answer and evidence, calculations, logic and assumptions behind the rationale where relevant. Case study deliverables should be no more than 3 pages in length, including any appendices.

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Evaluation/Grading

100 Points Total divided as follows:

- 1) Attendance and class participation (10 Points)
 - Attendance (1 point removed for each unexcused absence up to 5)
 - Active participation in class – up to 5 points are available for presenting, posing questions, and suggesting answers to questions.
- 2) Term project (45 points)
 - 30 points for the report content and coverage
 - 10 points for the summary presentation, including content and style/layout
 - 5 points for peer evaluation
- 3) Point-of-View writing assignments (5 points each for total of 20 points)
 - 2 points for providing a summary of the key points from article/topic discussion
 - 2 points for expressing the strengths and weaknesses of the position as well as a taking a clear stance
 - 1 point for presenting within the length limits
- 4) Case Study assignments (5 points each for total of 25 points)
 - 2 points for answering the dilemma presented
 - 2 points for using calculations, data and/or cited evidence to support the answer
 - 1 point for presenting within the length limits

ASSIGNMENT	% Weight
Attendance and class participation	10%
Term project	45%
4 x POV writing assignments	20%
5 x Case study assignments	25%

The final grade will be calculated as described below:

FINAL GRADING SCALE

Grade	Points
A+	98–100
A	93–97
A-	90–92
B+	87–89
B	83–86
B-	80–82
C+	77–79
C	73–76
C-	70–72
D	60–69
F	59 and below

Course Policies

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Participation and Attendance

I expect you to come to class on time and thoroughly prepared. I will keep track of attendance and look forward to an interesting, lively and confidential discussion. If you miss an experience in class, you miss an important learning moment and the class misses your contribution. Absences will affect your grade.

Late work

There are 10 deliverables. The nine writing assignments will be due at the beginning of class each Thursday via Canvas.

It is your responsibility to ensure that I receive your submission. There will be a 25% reduction in score for deliverables submitted up to a day late. No points will be awarded to any deliverable submitted over 24 hours after the due date/time. Teams will present their term projects to the class at the end of the semester, and the term project report will be due at the time of the presentations.

School Policies

Copyright Policy

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <http://health.columbia.edu/services/ods/support>.

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Course Schedule/Course Calendar

Date	Topics and Activities	Readings (due on this day)	Assignments
1/18	<p>A Circular Economy: Why? <i>Topics</i></p> <ul style="list-style-type: none"> • Course introduction, requirements and objectives for the class • Overview of the key principles of Circular Economy (background, rationale, basic theory, schools of thought) • Megatrends, imperatives and enablers • Term project <p><i>Activities</i></p> <ul style="list-style-type: none"> • Introductions • Course overview • Lecture • Discussion 	<p><i>Required:</i></p> <ul style="list-style-type: none"> ▪ 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) ▪ Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Introduction & Chapter 1-3, p7-61 (54 pages) ▪ McDonough, William, and Michael Braungart. <i>Cradle to Cradle: Remaking the Way We Make Things</i>. New York: North Point, 2002. Print. Chapter 2: p45-67 (22 pages) <p><i>Recommended:</i></p> <ul style="list-style-type: none"> ▪ Ellen MacArthur Foundation Educational Resource: https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-educational-resources/schools-of-thought ▪ Lovins, B, Amory, Michael Braungart et al. <i>A New Dynamic: Effective Business in A Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2013. Print. Chapter 2, A Concise Guide to the Circular Economy, p19-28 (9 pages) ▪ Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 3: Accelerating the Scale-Up Across Global Supply Chains” Ellen MacArthur Foundation. 2014. Web. Chapters 1 & 2, p11-36 (25 pages) ▪ Ellen MacArthur Foundation, “Intelligent Assets: Unlocking the Circular Economy Potential” Ellen MacArthur Foundation. 2016. Web. p28-63 (35 pages) 	<p>Personal bio (Due 1/18)</p>
1/25	<p>A Circular Economy: What? <i>Topics</i></p> <ul style="list-style-type: none"> • Rethinking existing economic systems and constructs • Systems thinking and mapping • Complexity science • Education and mindsets 	<p><i>Required:</i></p> <ul style="list-style-type: none"> ▪ Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 4, Through the Macroscope, p63-87 (24 pages) ▪ Acaroglu, Leyla: Tools for Systems Thinkers: The 6 Fundamental Concepts of Systems Thinking (Available on medium.com), 2017. Web. (3 pages) ▪ Franconi, Ellen, Brett Bridgeland et al. <i>A New</i> 	<p>Assignment #1: Point-of-view. (Due 1/25)</p>

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	<p><i>Activities</i></p> <ul style="list-style-type: none"> Lecture 	<p><i>Dynamic 2: Effective Systems in a Circular Economy.</i> Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 8, Broader Lessons from Self-Organising Traffic Lights in City Transport Systems, p143-155 (12 pages)</p> <ul style="list-style-type: none"> Webster, Ken. <i>The Circular Economy: A Wealth of Flows.</i> Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 10, p175-189 (14 pages) <p><i>Recommended:</i></p> <ul style="list-style-type: none"> Raworth, K. <i>Doughnut Economics. Seven Ways to Think Like a 21st-Century Economist.</i> Random House, 2017. Print. (250 pages) Lovins, B, Amory, Michael Braungart et al. <i>A New Dynamic: Effective Business in A Circular Economy.</i> Ellen MacArthur Foundation Publishing, 2013. Print. Chapter 8: Rebuilding Economic Vitality, Rev@ the World, by Sally Goerner and Randolph Voller, p112-128 (16 pages) Video: James B. Glattfelder. TEDx, Zurich, 2012. "Who Controls the World? Available here. (14min, 10sec) 	
2/1	<p>Business Models</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> Business Models for a circular economy Servicization Financial system limitations <p><i>Activities</i></p> <ul style="list-style-type: none"> Lecture Group workshop 	<p><i>Required:</i></p> <ul style="list-style-type: none"> Webster, Ken. <i>The Circular Economy: A Wealth of Flows.</i> Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 5, p89-105 (16 pages) Lovins, B, Amory, Michael Braungart et al. <i>A New Dynamic: Effective Business in A Circular Economy.</i> Ellen MacArthur Foundation Publishing, 2013. Print. Chapter 10: Implementing a Circular and Performance Economy through Business Model Innovation, p143-156 (13 pages) Rutqvist, Jakob and Peter Lacy. <i>From Waste to Wealth: The Circular Economy Advantage</i> (Palgrave Macmillan, 2015). Print. Section II, pages 68-114 (46 pages) ING Economics Department. "Rethinking finance in a Circular Economy", May 2015. Web. Section 4: p 34-52 (18 pages) <p><i>Recommended:</i></p> <ul style="list-style-type: none"> Ellen MacArthur Foundation, "Towards the Circular Economy Vol. 3: Accelerating the Scale-Up Across Global Supply Chains" Ellen MacArthur Foundation. 2014. Web. Chapters 3 & 4, p37-64 (27 pages) 	Assignment #2: Point-of-view. (Due 2/1)

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		<ul style="list-style-type: none"> ▪ Working Group FinanCE. “Money Makes the World Go Round (and will it help to make the economy circular as well?)”, March 2016. Web. Sections 2 & 3, p35-68 (33 pages) ▪ Lovins, B, Amory, Michael Braungart et al. <i>A New Dynamic: Effective Business in A Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2013. Print. Chapter 9: White Goods/Washing Machines – Business Case Study, p129-142 (13 pages) 	
2/8	<p>Design</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> • Schools of thought (recap) • “Design for” – different approaches and their considerations • Material selection • Human-centered design <p><i>Activities</i></p> <ul style="list-style-type: none"> • Lecture • Group workshop 	<p><i>Required:</i></p> <ul style="list-style-type: none"> • Tim Brown: Design & the circular economy – Circular Design Guide. Available here. • McDonough, William, and Michael Braungart. <i>Cradle to Cradle: Remaking the Way We Make Things</i>. (North Point, 2002). Print. Chapter 3, p68-91 (23 pages) • McDonough, William, and Michael Braungart. <i>The Upcycle: Beyond Sustainability – Designing for Abundance</i>. New York: North Point, 2013. Print. Chapter 2: Houston we have a solution, p53-83 (30 pages) • Benyus, Janine. <i>Biomimicry</i>. (Harper Perennial, 2002). Print. Chapter 1, p1-10 (10 pages) • Video: Janine Benyus. Biomimicry in action, TED Talk, (2009). Available here. (20 min) <p><i>Recommended:</i></p> <ul style="list-style-type: none"> • McDonough, William, and Michael Braungart. <i>Cradle to Cradle: Remaking the Way We Make Things</i>. (North Point, 2002). Print. (193 pages) • McDonough, William, and Michael Braungart. <i>The Upcycle: Beyond Sustainability – Designing for Abundance</i>. New York: North Point, 2013. Print. (217 pages) • Benyus, Janine. <i>Biomimicry</i>. (Harper Perennial, 2002). Print. (297 pages) 	Assignment #3: Case Study. (Due 2/8)
2/15	<p>Policy Considerations</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> • Approaches and interventions • Municipal, regional, national, supranational and international considerations • Fiscal policy as a case study <p><i>Activities</i></p>	<p><i>Required:</i></p> <ul style="list-style-type: none"> • Ellen MacArthur Foundation, “Delivering the Circular Economy: A Toolkit for Policymakers” Ellen MacArthur Foundation. 2015. Web. p39-88 (49 pages) • DG Environment Consortium. “Scoping study to identify potential circular economy actions, priority sectors, material flows & value chains”, August 2014. Web. Chapters 4-7, p15-72 (57 pages) Available here. • The Ex’tax Project, “New Era. New Plan. 	N/A

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	<ul style="list-style-type: none"> Lecture Discussions Group case study workshop 	<p>Europe. A Fiscal Strategy for an Inclusive, Circular Economy.” The Ex’Tax Project Foundation, 2016. Web. Chapter 3-5, p57-84 (27 pages) Available here.</p> <p><i>Recommended:</i></p> <ul style="list-style-type: none"> Ellen MacArthur Foundation, “Delivering the Circular Economy: A Toolkit for Policymakers” Ellen MacArthur Foundation. 2017. Web. p91-146 - Denmark case study (55 pages) The Ex’tax Project, “New Era. New Plan. Europe. A Fiscal Strategy for an Inclusive, Circular Economy.” The Ex’Tax Project Foundation, 2016. Web. (196 pages) – <i>of particular interest in addition to chapters 3-5 are chapters 7 & 8</i> 	
2/22	<p>Flows (Part I)</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> The concepts of capitals and flows Money as information Material flows <p><i>Activities</i></p> <ul style="list-style-type: none"> Lecture Discussions Group case study workshop 	<p><i>Required:</i></p> <ul style="list-style-type: none"> Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 6, Social Capital, Markets and Money in a Circular Economy, p108-125 (17 pages) Lovins, B, Amory, Michael Braungart et al. <i>A New Dynamic: Effective Business in A Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2013. Print. Chapter 5, A Farewell to Fossil Fuels: Answering the energy challenge, p61-74 (13 pages) Stahel, W. Circular economy. <i>Nature</i> 53. Macmillan, 2016, p435-438 (3 pages) Available here <p><i>Recommended:</i></p> <ul style="list-style-type: none"> Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 4, Ecosystems as a Unifying Model for Cities and Industry, p63-85 (22 pages) 	Assignment #4: Case Study. (Due 2/22)
3/1	<p>Flows (Part II)</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> Biological cycle/nutrients Organics Bio-based materials 	<p><i>Required:</i></p> <ul style="list-style-type: none"> Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 9, The Regenerative Biological Cycle at Scale, p159-173 (14 pages) McDonough, William, and Michael Braungart. <i>Cradle to Cradle: Remaking the Way We Make Things</i>. (North Point, 2002). Print. Chapter 4, 	N/A

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	<p><i>Activities</i></p> <ul style="list-style-type: none"> • Lecture • Discussion 	<p>Waste Equals Food, p92-117 (25 pages)</p> <ul style="list-style-type: none"> ▪ Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 3, Towards a Regenerative Food System, p49-61 (12 pages) ▪ Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 5, The Circular Economy of Soil, p87-103 (16 pages) <p><i>Recommended:</i></p> <ul style="list-style-type: none"> ▪ McDonough, William, and Michael Braungart. <i>The Upcycle: Beyond Sustainability – Designing for Abundance</i>. New York: North Point, 2013. Chapter 3 & 4, p87-142 (55 pages) ▪ Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 2: Opportunities for the Consumer Goods Sector” Ellen MacArthur Foundation. 2013. Web. p38 and p41-53 (13 pages) ▪ Ellen MacArthur Foundation, “Achieving ‘Growth Within’” Ellen MacArthur Foundation. 2017. Web. Chapter 3, p70-80 (10 pages) ▪ Ellen MacArthur Foundation, “Urban Biocycles” Ellen MacArthur Foundation. 2017. Web. (36 pages) 	
<p>3/8</p>	<p>Flows (Part III)</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> • Technical cycle/nutrients • Industrial ecology and symbiosis • 3D printing • Plastics <p><i>Activities</i></p> <ul style="list-style-type: none"> • Materials – group exercise • Lecture • Discussion 	<p><i>Required:</i></p> <ul style="list-style-type: none"> ▪ Graedel, T.E. and Allenby, B.R. <i>Industrial Ecology</i> (Second Edition). New Jersey: Pearson Education, 2003. Print. Chapter 2, p17-24, and Chapter 22, p268-283, (23 pages) ▪ Ellen MacArthur Foundation, “The New Plastics Economy: Rethinking the Future of Plastics”. Ellen MacArthur Foundation. 2016. Web. (92 pages) <p><i>Recommended:</i></p> <ul style="list-style-type: none"> ▪ Despeisse, M., Baumers, M et al. “Unlocking value for a circular economy through 3D printing: A research agenda”, February 2017. Elsevier. <i>Technological Forecasting and Social Change</i> Volume 115, pages 75-84 (10 pages). ▪ Ellen MacArthur Foundation, “The New Plastics Economy: Catalysing Action” Ellen MacArthur Foundation. 2017. Web. (49 pages) 	<p>Assignment #5: Case Study. (Due 3/8)</p>

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<p>3/22</p>	<p>Flows (Part IV)</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> Reverse logistics, re-use, re-manufacturing Waste and recycling - challenges <p><i>Activities</i></p> <ul style="list-style-type: none"> Class Discussion/Q&A Lecture Group activity 	<p><i>Required:</i></p> <ul style="list-style-type: none"> Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 6, Remanufacturing and the Circular Economy, p107-127 (20 pages) The Recycling Partnership. “The 2016 State of Curbside Report”, January 2017. Web. (25 pages) <p><i>Recommended:</i></p> <ul style="list-style-type: none"> Vlaanderen, Tessa. “Vlaanderen, Tessa. “Growing the Remanufacturing Industry: A Stakeholder Guide” [report is due to launch in January 2018 – estimated reading length = 44 pages] Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 9, Challenges and Capabilities for Scaling up Circular Economy Business Models – A Change Management Perspective, p157-175 (18 pages) 	<p>Assignment #6: Case Study. (Due 3/22)</p>
<p>3/29</p>	<p>Implementation & Measurement</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> Approaches to implementation and measurement incl. tools to get started, prioritization, guidance and measurement Life Cycle Assessment <p><i>Activities</i></p> <ul style="list-style-type: none"> Lecture Guest facilitator: Annabelle Stamm, Senior Consultant, Quantis. (see bio below) 	<p><i>Required:</i></p> <ul style="list-style-type: none"> McDonough, William, and Michael Braungart. <i>The Upcycle: Beyond Sustainability – Designing for Abundance</i>. New York: North Point, 2013. Print. p66-81 (15 pages) Ellen MacArthur Foundation, “Achieving ‘Growth Within’” Ellen MacArthur Foundation. 2017. Web. p16-52 (36 pages) Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 11: Circularity Indicators, p195-210 (15 pages) Ellen MacArthur Foundation (in cooperation with Granta and LIFE). “Circularity Indicators. An Approach to Measuring Circularity: Project Overview”, May 2015. Web. (12 pages) Available here. BSI. “Executive Briefing: BS 8001 – a Guide”. (BSI, 2017). Web. (6 pages) Available here <p><i>Recommended:</i></p> <ul style="list-style-type: none"> Graedel, T.E. and Allenby, B.R. <i>Industrial Ecology</i> (Second Edition). New Jersey: Pearson Education, 2003. Print. 183-227 (43 pages) 	<p>N/A</p>

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		<ul style="list-style-type: none"> Schenck, Rita C. "LCA for Mere Mortals. A Primer on Life Cycle Assessment" (IERE, 2000). Web. (103 pages) Available here Ellen MacArthur Foundation (in cooperation with Granta and LIFE). "Circularity Indicators. An Approach to Measuring Circularity: Methodology", May 2015. Web. (98 pages) Available here. 	
4/5	<p>Applications: Consumer Packaged Goods (CPG)</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> Implementation within existing business infrastructure Relationship to traditional sustainability models Case studies <p><i>Activities</i></p> <ul style="list-style-type: none"> Lecture Discussion Guest lecture: Blanca Brambila, Sustainability & CSR Manager, HEINEKEN Mexico (see bio below) 	<p><i>Recommended:</i></p> <ul style="list-style-type: none"> Ellen MacArthur Foundation, "Towards the Circular Economy Vol. 2: Opportunities for the Consumer Goods Sector" Ellen MacArthur Foundation. 2013. Web. (101 pages) HEINEKEN N.V. (integrated) Annual Report 2017. Available here from mid-Feb 2018 (focus on the front section and sustainability reporting). 	Assignment #7 Point-of-view. (Due 4/5)
4/12	<p>Applications: Circular Cities</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> Cities as environments Urban Metabolism vs Urban Ecosystem approaches Roadmaps for cities <p><i>Activities</i></p> <ul style="list-style-type: none"> Lecture Discussion Guest lecture: Saami Kalule-Sabiti, Assistant Vice President at NYCEDC's Center for Urban Innovation (see bio below) 	<p><i>Required:</i></p> <ul style="list-style-type: none"> Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 10, Cities as Flows in a Circular Economy, p177-193 (16 pages) Video: Ellen MacArthur Foundation. Amsterdam – Exploring the Sharing City, DIF 2014. Available here. (32min, 30 sec) Circulate News (Ellen MacArthur Foundation), "Journey to the Circular City". Web. (5 pages). Available here. Circle Economy, Fabric TNO and Gemeente Amsterdam, "Circular Amsterdam: A vision and action agenda for the city and metropolitan area", 2016. Web. (47 pages) Available here <p><i>Recommended:</i></p> <ul style="list-style-type: none"> London Waste and Recycling Board (LWRAB), "London's Circular Economy Route Map", 2017. Web (60 pages) Available 	N/A

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		<p>here</p> <ul style="list-style-type: none"> ▪ Ellen MacArthur Foundation, “Achieving ‘Growth Within’” Ellen MacArthur Foundation. 2017. Web. Chapter 4, p82-92 (10 pages) ▪ Circulate News. Future of Cities: A New Approach to Urban Space. Available here. 	
4/19	<p>Applications: Fashion & Textiles</p> <p><i>Topics</i></p> <ul style="list-style-type: none"> • Industry basics • The fashion & textiles system and supply chain • Business models and opportunities • Active industry project • Case studies <p><i>Activities</i></p> <ul style="list-style-type: none"> • Lecture • Discussion • Group activities on supply chain and business model 	<p><i>Required:</i></p> <ul style="list-style-type: none"> ▪ Video documentary: Ross, M. (Producer), & Morgan, A. (Director). (2015). <i>The True Cost</i>. United States: Life is My Movie Entertainment; Untold Creative LLC (1h 32 min): https://truecostmovie.com/ ▪ Ellen MacArthur Foundation, “A New Textiles Economy: Redesigning Fashion’s Future” Ellen MacArthur Foundation. 2017. Web. p36-117 (81 pages). Available here. <p><i>Recommended:</i></p> <ul style="list-style-type: none"> ▪ Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 2: Opportunities for the Consumer Goods Sector” Ellen MacArthur Foundation. 2013. Web. p38 and p53-63 (11 pages) ▪ Gullingsrud, Annie. <i>Fashion Fibers: Designing for Sustainability</i>. (Bloomsbury, 2017). Print. (293 pages) 	Assignment #8: Case Study. (Due 4/19)
4/26	<p>Oral presentations</p> <p><i>May be an extended class to accommodate all presentations</i></p>	<ul style="list-style-type: none"> • <i>No required reading for this class</i> 	Assignment #9: Point-of-view. (Due 4/26)

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Biographies of participants

Saami Kalule-Sabiti is an economic development strategist and policymaker. In his role with the New York City Economic Development Corporation, he supports the development and execution of a diverse portfolio of initiatives that target emerging and high growth sectors; covering a wide range of topics including circular economy, clean-tech and renewable energy. He previously spent two years as Senior Project Manager within the Mayor's Office of Recovery and Resiliency, developing social and economic resiliency policy with a particular focus on labor issues and the integration of workforce development into the City's resiliency capital program. He is an alumnus of Columbia's Sustainability Management program; has studied biomimicry and previously spent 14 years as a television presenter working across Africa and Middle East, the United States and the UK.

Annabelle Stamm is a Senior Consultant with Quantis' US team with over a decade of professional experience working in sustainability consulting. Annabelle handles project management responsibilities helping clients identify and develop pathways for future success. She has a high level of expertise on topics such as corporate and product footprinting (LCA), circular economy, and translation of environmental metrics into business strategies and effective communication. Ms Stamm was on the technical advisory group for the Sustainable Purchasing Leadership Council, and is currently on the committee of the New York Area Sustainability Group. Quantis guides top organizations to define, shape and implement intelligent environmental sustainability solutions via resilient strategies, robust metrics, useful tools, and credible communications. Supporting diverse companies such as Unilever, Dell, Estee Lauder Companies, Diageo, WWF among others.

Blanca Brambila is a passionate sustainable economic development professional, with a bachelor degree in Marketing and a master's degree in Business Administration. In her role as Sustainability & Corporate Social Responsibility manager at HEINEKEN Mexico, she leads the S&CSR strategy for the biggest operation of HEINEKEN worldwide, focusing her efforts in assuring the company becomes the most sustainable company in the country, by achieving both environmental and social commitments, including public commitments in water and CO₂ emissions reductions, renewable energy sourcing and waste elimination, all within the perspective of the Circular Economy. She has led HEINEKEN Mexico's strategy to become the first operation company of the HEINEKEN group, and the first Mexico's based company, to become part of the CE100 program from the Ellen MacArthur Foundation; proposing a 3 year transition plan to the Circular Economy, based on a companywide self-assessment and the development of the capabilities of the ReSOLVE framework.