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 course will delve into both the theory and practical applications of a circular economy. Achieving perfect circularity 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 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.
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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.

This course can be used to meet the Area 5: General and Financial Management requirement for the M.S. in Sustainability Management Program.

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:

L1: Identify critical aspects of circular economy terminology and vocabulary and learn to speak authoritatively about the merits and challenges of this approach
L2: Apply systems thinking and circular design approaches to a range of real-world challenges
L3: Use the biological and technical materials/components to evaluate systems with the aim to keep materials, products and components constantly at their highest utility and value.
L4: Using case studies, 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
L5: Define ways to begin implementation and measure progress and success in circular economy
L6: Construct a response to a specific sustainability challenge that employs what they have learned about circular economy
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Readings

**Required readings**

- 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
- **Circular Fibres Initiative** [report is due in Fall 2017 – estimated reading length = 60 pages] Available here
  - 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)
  - 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)
  - Chapter 2: p45-67 (22 pages)
  - Chapter 3, p68-91 (23 pages)
  - Chapter 4, Waste Equals Food, p92-117 (25 pages)
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- Vlaanderen, Tessa. “Growing the Remanufacturing Industry: A Stakeholder Guide” [report is due in December 2017 – estimated reading length = 60 pages]

  - Introduction & Chapter 1-3, p7-61 (54 pages)
  - Chapter 4, Through the Macroscope, 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)

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**Recommended readings**

- Ellen MacArthur Foundation Educational Resources: [https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-educational-resources/schools-of-thought](https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-educational-resources/schools-of-thought)
  - Chapter 3, Towards a Regenerative Food System, p49-61 (12 pages)
  - 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)
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.
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Course Requirements (Assignments)
In total, there are 10 assignments for this class.

Term Project (L2, L5, L6)

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 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. (L1, L3, L4) 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. (L1, L3, L4) 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

<table>
<thead>
<tr>
<th>ASSIGNMENT</th>
<th>% Weight</th>
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<tbody>
<tr>
<td>Attendance and class participation</td>
<td>10%</td>
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<tr>
<td>Term project</td>
<td>45%</td>
</tr>
<tr>
<td>4 x POV writing assignments</td>
<td>20%</td>
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<tr>
<td>5 x Case study assignments</td>
<td>25%</td>
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</table>

The final grade will be calculated as described below:

FINAL GRADING SCALE

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points</th>
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<tr>
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<tr>
<td>A</td>
<td>93–97</td>
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<tr>
<td>A-</td>
<td>90–92</td>
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<td>B+</td>
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<td>B</td>
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<td>C-</td>
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<td>D</td>
<td>60–69</td>
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<tr>
<td>F</td>
<td>59 and below</td>
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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 email to: stephanieajohnston@gmail.com

I will respond to each submitted deliverable by email and 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.

Course Schedule/Course Calendar
# Master of Science in Sustainability Management

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics and Activities</th>
<th>Readings (due on this day)</th>
<th>Assignments</th>
</tr>
</thead>
</table>
| 1/18 | **A Circular Economy: Why?**  
*Topics*  
- 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  
*Activities*  
- Introductions  
- Course overview  
- Lecture  
- Discussion  

*Required:*  

*Recommended:*  
- Ellen MacArthur Foundation Educational Resource: [https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-educational-resources/schools-of-thought](https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-educational-resources/schools-of-thought)  

| 1/25 | **A Circular Economy: What?**  
*Topics*  
- The Fourth Industrial Revolution and the role of digital  
- Systems thinking and mapping  
- Complexity science  
- Education and mindsets  
*Activities*  
- Lecture  
- Group workshop  

*Required:*  

*Assignment #1:* Point-of-view. (Due 1/25)
### Business Models

**Topics**
- Business Models for a circular economy
- Servicization
- Financial system limitations

**Activities**
- Lecture
- Group workshop

**Required:**

**Recommended:**
- 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)

### Design

**Topics**

**Required:**

**Assignment #2:**
Point-of-view. (Due 2/1)

**Assignment #3:**
Case Study.
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- Schools of thought (recap)
- “Design for” – different approaches and their considerations
- Material selection
- Human-centered design

Activities
- Lecture
- Group workshop

2/15 Implementation & Measurement

Topics
- Approaches to implementation and measurement incl. tools to get started, prioritization, guidance and measurement
- Life Cycle Assessment

Activities
- Lecture
- Guest facilitator: Annabelle Stamm, Senior Consultant, Quantis. (see bio below)


McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things.* (North Point, 2002). Print. Chapter 3, p68-91 (23 pages)


Benyus, Janine. *Biomimicry.* (Harper Perennial, 2002). Print. Chapter 1, p1-10 (10 pages)


Recommended:
- McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things.* (North Point, 2002). Print. (193 pages)

Required:

Due 2/8

N/A
### Flows (Part I)

**Topics**
- From linear to feedback rich
- Rethinking existing economic systems and constructs
- Money as information
- Energy, material and information

**Activities**
- Lecture
- Discussions
- Group case study workshop

**Recommended:**

**Required:**

Assignment #4: Point-of-view. (Due 2/22)

### Flows (Part II)

**Topics**
- Biological cycle/nutrients
- Organics incl. food waste and production
- Bio-based materials
- Case studies

**Required:**
- McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make* N/A
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### Activities
- Lecture
- Discussion

### Flows (Part III)

#### Topics
- Technical cycle/nutrients
- Industrial ecology and symbiosis
- Plastics

#### Activities
- Materials – group exercise
- Lecture
- Discussion

### Required:

### Recommended:

### Assignment #5:
- Case Study. (Due 3/8)

### Flows (Part IV)

#### Topics
- Reverse logistics, re-use, re-manufacturing
- Waste and recycling - challenges

#### Activities
- Class Discussion/Q&A

### Required:
- Vlaanderen, Tessa. “Vlaanderen, Tessa. Growing the Remanufacturing Industry: A

### Assignment #6:
- Case Study. (Due 3/22)
# Master of Science in Sustainability Management

- Lecture
- Group activity

**Stakeholder Guide** [report is due in December 2017 – estimated reading length = 60 pages]

**Recommended:**

<table>
<thead>
<tr>
<th>Date</th>
<th>Policy Considerations</th>
<th>Required</th>
<th>N/A</th>
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<tr>
<td></td>
<td>Approaches and interventions</td>
<td>Recommended:</td>
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<table>
<thead>
<tr>
<th>Date</th>
<th>Applications: Circular Cities</th>
<th>Required</th>
<th>Assignment #7: Case Study. (Due 4/5)</th>
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<tbody>
<tr>
<td>4/5</td>
<td></td>
<td>Franconi, Ellen, Brett Bridgeland et al. <em>A New Dynamic 2: Effective Systems in a Circular Economy</em></td>
<td></td>
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</tbody>
</table>
## Master of Science in Sustainability Management

**Activities**
- Cities as environments
- Urban Metabolism vs Urban Ecosystem approaches
- Roadmaps for cities

**Guest lecture:**
Saami Kalule-Sabiti, Assistant Vice President at NYCEDC’s Center for Urban Innovation (see bio below)


- 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](https://truecostmovie.com/)

**Recommended:**

### Applications: Fashion & Textiles

**Topics**
- Industry basics
- The fashion & textiles system and supply chain
- Business models and opportunities
- Active industry project
- Case studies

**Activities**
- Lecture
- Discussion
- Group activities on supply chain and business model

**Required:**
- [Circular Fibres Initiative](https://circularfibres.com/) [first report is due in Fall 2017 – estimated reading length = 60 pages]

**Recommended:**

### Assignment #8:
Case Study. (Due 4/12)

### Applications: Consumer Packaged Goods (CPG)

**No required reading for this class**

**Assignment #9:**
Point-of-view.
### Master of Science in Sustainability Management

<table>
<thead>
<tr>
<th>Topics</th>
<th>Recommended:</th>
<th>(Due 4/26)</th>
</tr>
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</table>
(focus on the front section and sustainability reporting). |            |
| Relationship to traditional sustainability models | | |
| Case studies | | |
| Activities                  | Guest lecture: Blanca Brambila, Sustainability & CSR Manager, HEINEKEN Mexico (see bio below) |            |
| Lecture                    | | |
| Discussion                  | | |

#### 5/3 Review, recap and discussion

**Topics**
- To be agreed with class

**Activities**
- To be agreed with class

**No required reading for this class**

N/A
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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.