

Circular Economy Supply Chains

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Circular Economy Supply Chains: From Chains to Systems

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Contents

| | |
|--|------|
| List of Figures and Tables | ix |
| About the Editors | xiii |
| About the Contributors | xv |
| Acknowledgements | xxi |
| 1: Introduction to Circular Economy Requirements: From Supply Chains to Value Systems | |
| Chapter 1 Introduction to Circular Economy Supply Chains: From Supply Chains to Value Systems <i>Lydia Bals, Wendy L. Tate and Lisa M. Ellram</i> | 3 |
| Chapter 2 Industrial Symbiosis: Novel Supply Networks for the Circular Economy <i>Weslynn S. Ashton, Marian R. Chertow and Shahana Althaf</i> | 29 |
| Chapter 3 No Rest for the Complex: Information Flows, Adaptation, and Emergence in Circular Supply Systems <i>Elizabeth M. Miller</i> | 49 |
| 2: The Role of Production (Actor: Producers) | |
| Chapter 4 Shaping the Transition from Linear to Circular Supply Chains <i>Jennifer Rogan, Frank Fürstenberg and Andreas Wieland</i> | 69 |
| Chapter 5 Circular Business Models: A Network Approach to Promote Circularity and Value Co-Creation from the Producer's Perspective <i>Katharina Spraul and Stephanie Stumpf</i> | 89 |

**3: The Role and Types of (Reverse) Logistics
(Actors: Scavengers and Decomposers)**

| | |
|---|-----|
| Chapter 6 The Effects of Recycling Locations on Closed-loop Supply Chain Performance <i>Petchprakai Sirilertsuwan</i> | 111 |
|---|-----|

| | |
|---|-----|
| Chapter 7 Stakeholder Theory and Supply Chains in the Circular Economy <i>Muhammad Umair Shah and James H. Bookbinder</i> | 129 |
|---|-----|

**4: The Role and Types of Business and Retail Consumers
(Actor: Consumers)**

| | |
|---|-----|
| Chapter 8 From End-of-the-road to Critical Node: The Role of End-user “Consumers” in Shaping Circular Supply Chain Management <i>Ben Hazen, Ilenia Confente, Daniel Pellathy and Ivan Russo</i> | 151 |
|---|-----|

| | |
|---|-----|
| Chapter 9 Secondary Markets: Enabling the Circular Economy <i>Dale Rogers, Haozhe Chen and Zac Rogers</i> | 167 |
|---|-----|

**5: The Role of Information and Financial Flows
(Main Actor: Decomposers)**

| | |
|---|-----|
| Chapter 10 Blockchain Technology and the Circular Economy: An Exploration <i>Mahtab Kouhizadeh, Qingyun Zhu, Lojain Alkhuzaïm and Joseph Sarkis</i> | 189 |
|---|-----|

| | |
|--|-----|
| Chapter 11 Toward Sustainability: A Review of Analytical Models for Circular Supply Chains <i>M. Ali Ülkü, Dawne M. Skinner and Gonca Yildirim</i> | 215 |
|--|-----|

6: The Role of the Business Context (Policymakers, NGOs, etc.)

| | |
|--|-----|
| Chapter 12 Determinants of Circular Economy and Sustainable Development of European Countries <i>Tihana Škrinjaric</i> | 239 |
|--|-----|

| | |
|--|-----|
| Chapter 13 Waste Not, Want Not: The Regulatory Barriers of Upcycling Frass <i>Carla Kornelia Sminck and Rikke Dorothea Huulgaard</i> | 271 |
|--|-----|

7: Lessons Learned in the Move to a Circular Economy

| | |
|--|-----|
| Chapter 14 Learning to Implement the Circular Economy in the Agri-food Sector: A Multilevel Perspective <i>Joe Miemczyk, Valentina Carbone and Mickey Howard</i> | 283 |
| Chapter 15 Blanc de Gris, an Urban Mushroom Farm: Lessons from the Emergence of a Circular Business Model <i>Laura-Yi Lévesque, Emmanuel Raufflet and Linda Rouleau</i> | 303 |
| Chapter 16 Circular Tourism: A Destination Approach <i>Mette Alberg Mosgaard, Søren Kerndrup and Martin Lehmann</i> | 313 |
| Chapter 17 Circular Public Procurement: A Case Study of Workwear and Laundry Services <i>Rikke Dorothea Huulgaard, Heidi Simone Kristensen, Arne Remmen and Carla Kornelia Smink</i> | 329 |
| Chapter 18 Examples of Innovative Circular Economy Business Models (CBMs) from the Clothing and Textile Industry <i>Savu Rovanto and Anu Bask</i> | 343 |
| Chapter 19 Osklen Case Study: The Hurdles of Sustainable and Circular Fashion in Brazil <i>Leonardo Marques</i> | 357 |
| Index | 367 |

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List of Figures and Tables

Figures

| | | |
|-----------|--|-----|
| Fig. 2.1. | Industrial Symbiosis Network at The Plant, Chicago, USA, in 2017. | 35 |
| Fig. 2.2. | The Percentage of Local Industrial Demand for Materials That Could Be Met Through Industrial Symbiosis in Mysore, India. Each Color Represents a Different By-product. | 38 |
| Fig. 4.1. | Simplified Butterfly Diagram: The Circular Economy Concept. | 71 |
| Fig. 4.2. | Simplified Representation of the Adaptive Cycle and Cross-level Linkages in a Panarchy. | 72 |
| Fig. 5.1. | Circular Business Model Canvas. | 92 |
| Fig. 5.2. | Overview of the Research Process. | 95 |
| Fig. 5.3. | Coding Structure. | 98 |
| Fig. 5.4. | Framework to Design OBMs for a Circular Economy. | 102 |
| Fig. 6.1. | Comparison between Cost and CO ₂ e of Different R-R Supply Chains and Important Cost and CO ₂ e Factors. | 117 |
| Fig. 6.2. | Result Examples of R-R Supply Chain Costs for Each Sorting Facility Location After Varying Used Garment Prices and Gross Profit Percentages Delivering Similar Result Patterns for 25, 50, 74, 100, and 125 Gross Profit Percentages. | 119 |
| Fig. 6.3. | Result Examples of R-R Supply Chain CO ₂ e for Each Sorting Facility Location After Varying CO ₂ e of Water Freight and Heat Energy Delivering Similar Result Patterns for 0.00001, 0.000017, 0.00002, and 0.000033 Water Freight kgCO ₂ e/kg.km. | 120 |
| Fig. 9.1. | Secondary Market Channels in the United States (2020). | 171 |
| Fig. 9.2. | Returns to Secondary Market Flow. | 172 |
| Fig. 9.3. | Size and Growth of the US Secondary Market (\$). | 173 |
| Fig. 9.4. | Retail Store Openings and Closings in the United States (2015–2020). | 174 |
| Fig. 9.5. | Stock Price Chart for Traditional and Secondary Market Retail Chains. | 176 |
| Fig. 9.6. | Changes in Firm Usage of Secondary Markets. | 180 |
| Fig. 9.7. | Secondary Market Usage and Inventory Management. | 180 |
| Fig. 9.8. | Patagonia Apparel Repair Center, Reno, Nevada. | 182 |
| Fig. 9.9. | Number of Nordstrom and Nordstrom Rack Stores. | 182 |

x List of Tables and Figures

| | | |
|-----------------|---|-----|
| Fig. 10.1. | Reverse Logistics Processes. | 195 |
| Fig. 11.1. | Linear, Sustainable, and Circular Supply Chains. | 218 |
| Fig. 11.2. | Publication Trends on CE, SSC, and Quant CE-SSC, and Their Distribution Over Research Areas. | 219 |
| Fig. 11.3. | SUTs and IO Tables for Three Regions, A, B, C. | 228 |
| Fig. 11.4. | SSCA and CSC Canvas. | 231 |
| Fig. 12.1. | Clustering of Countries Based on Efficiency Scores and Variables From Table 12.5, Year 2010. | 261 |
| Fig. 12.2. | Clustering of Countries Based on Efficiency Scores and Variables From Table 12.5, Year 2014. | 262 |
| Fig. 12.3. | Clustering of Countries Based on Efficiency Scores and Variables From Table 12.5, Year 2017. | 263 |
| Fig. 13.1. | Conventional Management Practice of Food Losses. | 272 |
| Fig. 13.2. | Insect Industry's Potential Contribution to the Circular Economy. | 276 |
| Fig. 14.1. | Circular Economy Capability Maturity Model. | 285 |
| Fig. 16.1. | Map of Northern Jutland, Denmark. | 318 |
| Fig. 16.2. | Circular Economy Tourism in a Destination Approach at Slettestrand, Denmark. | 324 |
| Fig. 17.1. | Linking CE and PP. | 332 |
| Fig. 19.1. | Osklen's Circular Fashion Supply Network: A Biomimicry Lens. | 361 |
| Appendix A19.1. | Sustainability and Circular Economy Communication at Osklen's Windows. | 363 |

Tables

| | | |
|------------|--|-----|
| Table 1.1. | Overview of Edited Book. | 6 |
| Table 1.2. | Main Findings and Practical Implications. | 12 |
| Table 1.3. | Future Research Suggestions. | 21 |
| Table 3.1. | Key Information Flows on Local Supply Networks, Extended Supply Systems, and Biosphere Impacts That Can Contribute to the Emergence of Circular Supply Systems. | 59 |
| Table 4.1. | Reorganization: How the Apparel Sector Is Creating New Combinations of Resources in the Transition From a Linear to a Circular Economy. | 79 |
| Table 5.1. | Exemplary Quotes According to Established Themes. | 99 |
| Table 6.1. | Reverse Logistics Data From Sending Used Garments From Sorting Facilities to Recycling Locations. | 115 |
| Table 6.2. | Supply Chain Cost and CO ₂ e With Recycled Fiber for Three Markets Under Two Computational Scopes. | 122 |
| Table 7.1. | Literature Review (2015–2020). | 134 |
| Table 8.1. | Overview of Circular SCM Loops – Definitions and Ideas to Integrate Consumers. | 156 |
| Table 9.1. | Percentage Change of Stock Price 2009–2021. | 177 |

| | | |
|-------------|--|-----|
| Table 10.1. | CE Performance Measurements. | 198 |
| Table 10.2. | Blockchain for CE Performance Measurement. | 200 |
| Table 11.1. | CLSC Decision Levels. | 223 |
| Table 11.2. | Parameters and Decision Variables for MIP Formulation. | 230 |
| Table 12.1. | Data Description, DEA. | 250 |
| Table 12.2. | Super Efficiency Scores and Rankings. | 254 |
| Table 12.3. | Super Efficiency Scores and Rankings, Without Malta and Luxembourg. | 256 |
| Table 12.4. | Additional Variables for the Panel Regression. | 260 |
| Table 12.5. | Panel Data Estimation Results. | 261 |
| Table 13.1. | Classification of Insect Frass and Their Treatment (Based on IPIFF, 2019). | 274 |
| Table 14.1. | Circular Economy Levels of Maturity in Agri-Food. | 297 |
| Table 15.1. | Generic Challenges of Circular Entrepreneurs. | 310 |
| Table 16.1. | The Destination Approach to Circular Tourism. | 320 |
| Table 16.2. | Tourism Initiatives in Network. | 322 |
| Table 17.1. | The Content of the Guide on Sustainable Procurement of Workwear and Laundry Services. | 335 |
| Table 18.1. | Groups and Examples of Illustrative Cases. | 345 |

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Introduction to Circular Economy Requirements: From Supply Chains to Value Systems

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Chapter 1

Introduction to Circular Economy Supply Chains: From Supply Chains to Value Systems

Lydia Bals, Wendy L. Tate and Lisa M. Ellram

Abstract

A circular economy perspective embraces a systemic, cradle-to-cradle notion that everything is designed to be reused as long as possible and then recaptured and repurposed when reuse is no longer possible. Designing for a circular economy ecosystem requires a holistic, integrative viewpoint, spanning all aspects of design and development and considering many supply chain actors, far beyond that of traditional supply chains. This edited book adopts a biomimetic lens, highlighting the need for cross-industry flows and need for different actors (beyond producers and consumers) in circular value cycles. Enablers such as incentives and/or legislation are also discussed. While biomimicry provides the structure for organizing this book, individual chapters build on other theoretical lenses and concepts, such as stakeholder theory, etc. The intent is to move beyond a dyadic (buyer–supplier) view, embracing a holistic network or ecosystem view, to consider a cross-industry system perspective, where there is a diversity of actors (covering four actor groups: producers, consumers, scavengers, and decomposers) needed for a working ecosystem. This edited book offers a comprehensive overview of system components and actors, including how the circular economy adds value, the role of producers and consumers, the spectrum of recovery possibilities to return products back to the consumption supply chain, and the essential role of information management.

Keywords: Circular economy; circular systems; biomimicry; value systems; circular flows; ecosystem view

Introduction

While most US companies say they are planning to transition to a circular economy (Peters, 2019), this transition is challenging for many reasons including products that are difficult to disassemble (Soufani & Loch, 2021). A circular economy is based on the foundational principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems (MacArthur Foundation, 2019). Circular economy is a sustainable and flexible way to grow without exhausting primary materials, based on longevity of products and servitization (Esposito, Tse, & Soufani, 2017). Waste is reduced by closed-loop recycling and reuse, also known as the “cradle-to-cradle” model (McDonough & Braungart, 2010). This goes beyond recycling, moving to a new way of thinking about growth without dramatically expanding resource consumption (Esposito et al., 2017; European Commission, 2018).

The efficient and effective use of finite resources leads to improved sustainability and enables further value creation (De Angelis, Howard, & Miemczyk, 2018). In 2017, the EU created a Circular Economy Finance Support Platform that illustrates various possibilities of funding for circular economy projects through 2027 (European Commission, 2021). In the 2019 budgetary period, for example, about 9.6 billion euros were directed toward circular economy projects (European Commission, 2019). It is estimated that a total of around EUR 320 billion is needed between now and 2025 to implement projects that put the European economy on the path to transition (MacArthur Foundation, 2017). In the circular economy, product ownership is transformed to purchasing a service, and the financial model shifted to leasing rather than ownership (De Angelis et al., 2018) which enables efficient reverse logistics and remanufacturing (Esposito et al., 2017). These characteristics make collaboration within the circular framework boundaries important (De Angelis et al., 2018). Although leasing and access primarily refer to nonbiological products (e.g., carpets or electronic devices), it is important to note that both flows – for technical materials and biological mass – are part of the cradle-to-cradle concept (McDonough & Braungart, 2010) and also in scope of this book. Industrial ecology researchers propose that networks of industries can be designed analogous to food webs to reach a sustainable and efficient state (e.g., Frosch, 1992; Frosch & Gallopoulos, 1989), enabling “closed-loops” (Korhonen, 2001a, 2001b).

This book covers all four biomimetic roles: producers, consumers, scavengers, and decomposers and provides additional insights such as information infrastructure, to bridge the current linear material usage patterns in today’s supply chains toward circular systems. In the business world, scavengers can be represented by reverse logistics companies and overstock/salvage retailers, and decomposers represented by recyclers and waste treatment companies. Unlike natural ecosystems, current economic systems are characterized by an abundance of producers and consumers in a linear material usage pattern. Looking at circularity with the lens of biomimicry in natural ecosystems, there is a balance between producers, consumers, scavengers, and decomposers (Babbitt, Gaustad, Fisher,

Chen, & Liu, 2018; Geng & Côté, 2002). Current publications at the intersection of circular economy and supply chain management research often lack a systemic perspective. Supply chain literature often still frames the world in dyads instead of “networks” or “systems”. In order to move beyond limited-scope recycling solutions that still result in value degradation and waste, a systemic perspective is needed that embraces cross-industry flows and an expansive spectrum of actors (e.g., taking care of the reverse logistics) than in traditional supply chains, establishing circular value cycles.

Current research lacks the broader perspective necessary to investigate a circular value system. A comprehensive view on such actors is essential to achieve integrated management of material and information flows as a central backbone to realize a circular economy with circular value cycles (Tate, Bals, Bals, & Foerstl, 2019). The biomimetic lens highlights the need for such cross-industry flows and for additional actors (beyond producers and consumers) in circular value cycles (Tate et al., 2019). Cross-industry flows can be enabled, for example, by a material database that allows tracking of materials over their entire lifecycle, with creation of a marketplace where companies across industries can source their inputs. In this book and more generally, enablers such as incentives and/or legislation are also of interest.

Structure Of Overall Book – The Biomimetic Lens

The objective of this book, which has been realized, was to attract submissions in all of the sections in [Table 1.1](#), to achieve a comprehensive overview and broad coverage of actors and preconditions for a circular economy. The biomimetic lens was applied to structure this book. Chapters did not have to necessarily focus on biomimicry; the chapters’ relation to the respective actor group (producers, etc.) or needed information infrastructure in the context of a circular economy was deemed sufficient. The originality and novelty lie in bringing these timely insights together in a systemic framework inspired by nature.

[Table 1.1](#) also shows the final chapters included per section with their titles and authors. The flow begins with broad early chapters with a system perspective, moving to specific roles of actors. Then, the role of information and financial flows and the role of contextual ramifications are introduced. The final section includes a number of cases from a variety of industries, illustrating examples of circular economy ambassadors in practice. [Table 1.1](#) also provides an overview regarding the main foci and approaches/methodologies of the included chapters.

[Table 1.2](#) provides a summary of the main findings and practical implications of each chapter. As initially envisioned, many of the chapters highlight the importance – either directly in the biomimetic terminology or indirectly – of the roles of scavengers and decomposers in order to move toward a circular business ecosystem.

Table 1.1. Overview of Edited Book.

| Book Section/Focus | Chapter | Authors | Chapter Title | Main Focus | Approach/Methodology |
|--|---------|-------------------------|--|--|--|
| 1: Introduction to Circular Economy Requirements: From Supply Chains to Value Systems | 1 | Bals, Tate, Ellram | Introduction to Circular Economy Supply Chains – from Supply Chains to Value Systems | | |
| Chapters highlight related insights from biomimetic research and chapters with focus on cross-industry value systems | 2 | Ashton, Chertow, Althaf | Industrial Symbiosis: Novel Supply Networks for the Circular Economy | Industrial ecology of circular economy | Offers an understanding of how industrial symbiosis can contribute to building robust supply networks for resource sharing in different contexts. In particular, it explores the conditions and circumstances in which industrial symbiosis could play a pivotal role for increasing circularity and sustainability in diverse value networks, as well as the benefits and challenges in implementing industrial symbiosis across different contexts |
| | 3 | Miller | No Rest for the Complex: Information Flows, Adaptation, and Emergence in Circular Supply Systems | Information flows and emergence of circular supply systems | Sets out to build on complex adaptive systems (CAS) theory and circular economy research to conceptualize how information flows between actors can facilitate the emergence of a circular supply system |

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|---|-------------------------------|---|---|---|
| 2: The Role of Production (Actor: Producers) Chapters with focus on product design, production methods. | 4 Rogan, Fürstenberg, Wieland | Shaping the Transition from Linear to Circular Supply Chains Circular Business Models: A Network Approach to Promote Circularity and Value Co-Creation from the Producer's Perspective | Adaptive cycle and system change Circular and open-business models | Employs case examples to illustrate the ways that supply chain management is reimagined in the shift to a circular economic system Builds on a grounded theory approach and proposes a new framework for companies that combine insights about open-business models with circularity |
| 3: The Role and Types of (Reverse) Logistics (Actors: Scavengers and Decomposers) Chapters with focus on recovery and resale of used goods, material recovery, transportation | 6 Sirilertsuwan | The Effects of Recycling Locations on Closed-loop Supply Chain Performance | Cost and carbon dioxide equivalent factors | Uses exploratory data analysis to analyze results from simulations based on empirical data and market rates relating to textile and clothing CLSCs |
| 7 | Shah, Bookbinder | Stakeholder Theory and Supply Chains in the Circular Economy | How stakeholders impact circular economy implementation | Draws on stakeholder theory to identify various challenges and risks that restrict businesses from building sustainable circular systems and turns attention on increasing the numbers of “scavengers” and “decomposers” in the system for attaining sustainable growth |

(Continued)

Table 1.1. (Continued)

| Book Section/Focus | Chapter | Authors | Chapter Title | Main Focus | Approach/Methodology |
|---|---------|------------------------------------|---|---|---|
| 4: The Role and Types of Business and Retail Consumers (Actor: Consumers) Chapters with focus on consumer acceptance, business-to-business arrangements in the circular economy, marketing, and brand aspect | 8 | Hazen, Confente, Pellathy, Russo | From End-of-the-Road to Critical Node: The Role of End-user “Consumers” in Shaping Circular Supply Chain Management | Consumer behavior and business to consumer marketing | Describes the economic, social, and ecological trends that motivate organizational leaders and managers to implement more CSC models. Introduces specific ideas on how managers can leverage end-users to close, slow, narrow, intensify, and dematerialize core supply chain processes |
| | 9 | Rogers, Chen, Rogers | Secondary Markets: Enabling the Circular Economy | Secondary markets and sustainable product disposition | Discusses the role of the secondary market as an important mechanism for achieving a circular economy |
| 5: The Role of Information and Financial Flows (Main Actor: Decomposers) Chapters with focus on how material databases and passports, micro-credits, sharing platforms, blockchain technology, and artificial intelligence enable circularity. | 10 | Kouhizadeh, Zhu, Alkhuzaim, Sarkis | Blockchain Technology and the Circular Economy: An Exploration | Blockchain technology and reverse logistics | Provides an overview of the potential linkages between blockchain technology and circular economy from a sustainability perspective with a specific focus on the performance measurement of reverse logistics activities |