

# Contents

**Part I LCM, Circular Economy and Product Value Chain**

**Life Cycle Management Approaches to Support Circular Economy** ..... 3  
Sébastien Zinck, Anne-Christine Ayed, Monia Niero, Megann Head,  
Friedrich-W. Wellmer, Roland W. Scholz and Stéphane Morel

**Sustainability Performance Evaluation for Selecting the Best Recycling Pathway During Its Design Phase** ..... 11  
Guilhem Grimaud, Nicolas Perry and Bertrand Laratte

**A Synthesis of Optimization Approaches for LCA-Integrated Industrial Process Modeling: Application to Potable Water Production Plants** ..... 21  
Florin Capitanescu, Antonino Marvuglia and Enrico Benetto

**A Bi-dimensional Assessment to Measure the Performance of Circular Economy: A Case Study of Tires End-of-Life Management** ..... 33  
Geoffrey Lonca, Romain Muggéo, Hugue Tétreault-Imbeault,  
Sophie Bernard and Manuele Margni

**Bio-based Materials Within the Circular Economy: Opportunities and Challenges** ..... 43  
Birgit Brunklaus and Ellen Riise

**Bio-Economy Contribution to Circular Economy** ..... 49  
Sara Corrado and Serenella Sala

**Life Cycle Management and Circular Economy Challenges for the Textile Sector: Session Wrap Up** ..... 61  
Keith James and Julian Lings

**Life Cycle Assessment of Organic, BCI and Conventional Cotton: A Comparative Study of Cotton Cultivation Practices in India** ..... 67  
Pragnesh Shah, Abhishek Bansal and Rajesh Kumar Singh

|                                                                                                                                                                                 |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Life Cycle Management in the Pharmaceutical Industry Using an Applicable and Robust LCA-Based Environmental Sustainability Assessment Approach</b> . . . . .                 | 79  |
| Yasmine Emara, Marc-William Siegert, Annekatrin Lehmann and Matthias Finkbeiner                                                                                                 |     |
| <b>Establishing LCA in the Healthcare Sector</b> . . . . .                                                                                                                      | 89  |
| Nanja Hedal Kløverpris                                                                                                                                                          |     |
| <b>Improving the Life Cycle Performance of Chemical Products and Materials Through Data Exchange Along the Value Chain—Synthesis of LCM2017 Session Presentations</b> . . . . . | 95  |
| Guido Sonnemann and Carmen Alvarado                                                                                                                                             |     |
| <b>Biomass Balance: An Innovative and Complementary Method for Using Biomass as Feedstock in the Chemical Industry</b> . . . . .                                                | 101 |
| Christian Krüger, Andreas Kicherer, Claudius Kormann and Nikolaus Raupp                                                                                                         |     |
| <b>Greening Agri-food Value Chains in Emerging Economies</b> . . . . .                                                                                                          | 109 |
| Matthias Stucki and Anél Blignaut                                                                                                                                               |     |
| <b>Assessment of Cleantech Options to Mitigate the Environmental Impact of South African Dairy Farming</b> . . . . .                                                            | 115 |
| Regula Keller, Lea Eymann, Sarah Wettstein, Deborah Scharfy and Matthias Stucki                                                                                                 |     |
| <b>Food Waste Management (Sector) in a Circular Economy</b> . . . . .                                                                                                           | 127 |
| Nicole Unger and Francesco Razza                                                                                                                                                |     |
| <b>The Role of Compost in Bio-waste Management and Circular Economy</b> . . . . .                                                                                               | 133 |
| Francesco Razza, Lorenzo D’Avino, Giovanni L’Abate and Luca Lazzeri                                                                                                             |     |
| <b>Agri-Food Waste Streams Utilization for Development of More Sustainable Food Substitutes</b> . . . . .                                                                       | 145 |
| Sergiy Smetana, Kemal Aganovic, Stefan Irmscher and Volker Heinz                                                                                                                |     |
| <b>Implementation and Management of Life Cycle Approaches in Business—Challenges, Opportunities, Business Learnings and Best Practice</b> . . . . .                             | 157 |
| Lena Landström and Sara Palander                                                                                                                                                |     |
| <b>Neuro-marketing Tools for Assessing the Communication Effectiveness of Life Cycle Based Environmental Labelling—Procedure and Methodology</b> . . . . .                      | 163 |
| Anna Lewandowska, Barbara Borsiak, Christian Dierks, Pasquale Giungato, Ewa Jerzyk, Przemysław Kurczewski, Jagna Sobierajewicz, Sangwon Suh and Joanna Witzak                   |     |

**Part II Innovation for Sustainable Production and Urban Systems**

**LCM for Transport and Mobility** ..... 177  
Stephan Krinke and Mara Neef

**Conceptual Development of Hybrid Structures Towards Eco-Efficient Vehicle Lightweighting** ..... 181  
Alexander Kaluza, Tim Fröhlich, Sebastian Kleemann, Wolfgang Walk, Christoph Herrmann, Stephan Krinke and Thomas Vietor

**LCA in Strategic Decision Making for Long Term Urban Transportation System Transformation** ..... 193  
Florian Ansgar Jaeger, Katrin Müller, Cornelia Petermann and Eric Lesage

**Management of Construction Waste: LCA and Complex System Modeling** ..... 205  
Anne Ventura and Maxime Trocmé

**Guidelines for Effective and Sustainable Recycling of Construction and Demolition Waste** ..... 211  
Serena Giorgi, Monica Lavagna and Andrea Campioli

**Environmental Assessment of Energy Related Products and Energy Systems Across Their Life Cycle** ..... 223  
N. Espinosa and Y. J. Suh

**Is It Useful to Improve Modelling of Usage Scenarios to Improve the Environmental Footprint of Energy-Using Product?** ..... 231  
Charlotte Heslouin, Véronique Perrot-Bernardet, Lionel Pourcheresse and Nicolas Perry

**Life Cycle Management of Energy and Energy Transitions—Managing the Complexity of Todays and Future Energy Systems with a Life Cycle Focus: Challenges and Methodological Solutions** ..... 243  
Karin Treyer, Roberto Turconi and Alicia Boyano

**Integrating Energy System Models in Life Cycle Management** ..... 249  
Miguel F. Astudillo, Kathleen Vaillancourt, Pierre-Olivier Pineau and Ben Amor

**LCM at the Urban Scale: BIM and Nature Based Solutions** ..... 261  
Antonino Marvuglia, Benedetto Rugani and Germain Adell

**Design-Integrated LCA Using Early BIM** ..... 269  
Alexander Hollberg, Julia Tschetwertak, Sven Schneider and Guillaume Habert

|                                                                                                                                                                                                                                                                                                                                        |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>A Proposition to Extend CityGML and ADE Energy Standards for Exchanging Information for LCA Simulation at Urban Scale</b> . . . . .                                                                                                                                                                                                 | 281 |
| Adélaïde Mailhac, Emmanuelle Cor, Marine Vesson, Elisa Rolland, Pascal Schetelat, Nicoleta Schiopu and Alexandra Lebert                                                                                                                                                                                                                |     |
| <b>Dynamic Assessment of Nature Based Solutions Through Urban Level LCA</b> . . . . .                                                                                                                                                                                                                                                  | 293 |
| Duygu Başoğlu, Emre Yöntem, Seda Yöntem, Beril Şenyurt and Özge Yılmaz                                                                                                                                                                                                                                                                 |     |
| <b>Role of Carbon Capture and Storage (CCS) or Use (CCU) on Climate Mitigation</b> . . . . .                                                                                                                                                                                                                                           | 307 |
| Jan Bollen                                                                                                                                                                                                                                                                                                                             |     |
| <b>Part III Development of LCM Methods and Tools</b>                                                                                                                                                                                                                                                                                   |     |
| <b>Potentials and Limitations of Combined Life Cycle Approaches and Multi-dimensional Assessment</b> . . . . .                                                                                                                                                                                                                         | 313 |
| Johanna Berlin and Diego Iribarren                                                                                                                                                                                                                                                                                                     |     |
| <b>Propagating Uncertainty in Life Cycle Sustainability Assessment into Decision-Making Problems: A Multiple Criteria Decision Aid Approach</b> . . . . .                                                                                                                                                                              | 317 |
| Breno Barros Telles do Carmo, Manuele Margni and Pierre Baptiste                                                                                                                                                                                                                                                                       |     |
| <b>The Value of Transdisciplinary Perspectives During Transition to a Bio-based Economy: The Prospect for Converting Mixed Food Waste into Bio-based Chemicals</b> . . . . .                                                                                                                                                           | 327 |
| Birgit Brunklaus, Emma Rex, Johanna Berlin, Frida Røyne, Johanna Ulmanen and Graham Aid                                                                                                                                                                                                                                                |     |
| <b>Improving Interpretation, Presentation and Visualisation of LCA Studies for Decision Making Support</b> . . . . .                                                                                                                                                                                                                   | 337 |
| Serenella Sala and Jessica Andreasson                                                                                                                                                                                                                                                                                                  |     |
| <b>Visualizing the Effects of Parameter Variability on Comparative LCA Results</b> . . . . .                                                                                                                                                                                                                                           | 343 |
| Céline Alexandre, Elisabeth van Overbeke, Maxime Dupriez, Johan Lhotellier and Bernard De Caemel                                                                                                                                                                                                                                       |     |
| <b>Life Cycle Management in Industry—Supporting Business with Life Cycle Based Assessments</b> . . . . .                                                                                                                                                                                                                               | 351 |
| Andreas Bednarz, Julia Beier, Thomas Grünenwald, Birgit Himmelreich, Bärbel Hundt, Florian A. Jaeger, Martin Kirchner, Stephan Krinke, Ulla Létinois, Christina Merz, Lisa Mohr, David Morris, Nikolaj Otte, Gerald Rebitzer, Peter Saling, Urs W. Schenker, Diederik Schowanek, Gerd Vollmer, Niklas von der Assen and Alain Wathelet |     |

**Sustainable Design of Complex Systems, Products and Services with User Integration into Design** ..... 365  
Nicolas Perry and Julien Garcia

**Implementation of Environmental Considerations in the Innovation Process of Complex Systems: Groupe PSA Case Study** ..... 371  
Julien Garcia, Pierre Tonnelier and Sophie Richet

**Development of an Environmental Evaluation Tool in the Transport Sector and Its Impact on Decision-Making in the Early Stages of Design** ..... 381  
Sergio A. Brambila-Macias, Lisbeth Dahllöf, Karin Eriksson and Tomohiko Sakao

**Discussion Panel—Assessment of Externalities: Monetisation and Social LCA** ..... 391  
Stéphane Morel, Marzia Traverso and Philipp Preiss

**Applying LCA to Estimate Development Energy Needs: The Cases of India and Brazil** ..... 397  
Narasimha D. Rao, Alessio Mastrucci and Jihoon Min

**Integrating the Concept of Planetary Boundaries into Decision Making Processes** ..... 407  
Marcial Vargas-Gonzalez

**Exploring the Linkages Between the Environmental Sustainable Development Goals and Planetary Boundaries Using the DPSIR Impact Pathway Framework** ..... 413  
Chanjief Chandrakumar and Sarah J. McLaren

**Part IV How to Develop and Sustain LCM-Based Innovations**

**Financing Innovation and Circular Economy** ..... 427  
L. Goovaerts, C. Schempp, L. Busato, A. Smits, L. Žutelija and R. Piechocki

**Life Cycle Approaches to Sustainable Regional Development** ..... 433  
Fritz Balkau and Timothy Grant

**Turning the Lens Around: LCA Success Stories Outside-In** ..... 439  
Eric Mieras and Alain Wathelet

**Integrated Product Development at Nestlé** ..... 447  
Namy Espinoza-Orias, Karen Cooper and Sofiane Lariani

**The City Performance Tool-How Cities Use LCM Based Decision Support** ..... 457  
Jens-Christian Holst, Katrin Müller, Florian-Ansgar Jäger and Klaus Heidinger

**Sustainability of Bio-based Products: Linking Life Cycle Thinking with Standards, Certification and Labelling Schemes** . . . . . 469  
Mauro Cordella and Renata Kaps

**Sustainability Assessment of Blue Biotechnology Processes: Addressing Environmental, Social and Economic Dimensions** . . . . . 475  
Paula Pérez-López, Gumersindo Feijoo and María Teresa Moreira

**Integrating Life Cycle Assessment and Eco-design Strategies for a Sustainable Production of Bio-based Plastics** . . . . . 487  
Venkateshwaran Venkatachalam, Sebastian Spierling, Hans-Josef Endres and Andrea Siebert-Raths

**Using LCA and EPD in Public Procurement Within the Construction Sector** . . . . . 499  
Kristian Jelse and Kristof Peerens

**Green Public Procurement and Construction Sector: EPD and LCA Based Benchmarks of the Whole-Building** . . . . . 503  
Sara Ganassali, Monica Lavagna, Andrea Campioli and Sergio Saporetti

**Special Session on Product Environmental Footprint** . . . . . 515  
Mélanie Guiton and Enrico Benetto