



Circular added value: business model design in the circular economy

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Keywords

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Abstract

The current linear production and consumption structures, which build upon the intensive use of natural resources and cheap energy, are crucial drivers for the rapid economic development in the last sixty years. Biodiversity loss, climate change, conversion of the planet earth's surface and resource depletion force researchers, policy-makers, business representatives, and consumers to think about alternative economic approaches and lifestyles. The circular economy concept has recently attracted increased attention from academic, political, and economic institutions. The transformation to an economy characterized by cyclical and cascading usage of natural and physical capital requires disruptive and systemic innovations. On business level, integrated strategies consisting of sufficiency, consistency, and efficiency factors are needed to implement the idea of circularity in the architecture of enterprises. Business developers have to restructure value creation processes, dematerialize value propositions, rethink and demerge global supply chains or consider ecological and social aspects in their cost-benefit analyses. Currently, the most business modeling tools and methods do not consider characteristics that are crucial for designing circular business models. This study is built upon a five-step systematic literature review methodology, which focused on circular economy, conventional as well as circular business model literature. The insights gained from the extensive literature analyses were used to redefine the logic, composition, elements, and potential element attributes of the Business Model Canvas in the context of circular economy.

Introduction

The current production and consumption patterns in the industrialized countries of the Global North as well as in some economically emerging countries have serious impacts on the interrelated ecosystems of planet earth. It is expected that the irreversible changes in ecosystems, triggered by anthropogenic emissions, will crucially influence the global food, water, and energy supply, which increases vulnerability of human beings (WBGU, 2014).

In the last forty years schools of thought such as Biomimicry (Benyus, 2002), Blue Economy (Pauli, 2010), Cradle to Cradle (Braungart & McDonough, 2003) or Performance Economy (Stahel & Reday-Mulvey, 1981) have been developed with the common basic objective to decarbonize and dematerialize economies. The circular economy concept combines the different schools of thought to construct a holistic approach for transforming economic and societal structures. It is an economic system characterized by the cyclical and cascading usage of natural and physical capital that aims to preserve natural resource stocks, while reducing greenhouse gas emissions and harmful pollutants for human health. Circular-oriented economies create new forms of innovative business models in order to enter emerging markets and enhance

the competitiveness in current industry sectors (Ellen MacArthur Foundation, 2015). Integrated structures arise with organized networks consisting of collaborative production and consumption, which revolutionize the traditional producer-consumer relationships. Ultimately, the concept of circular economy decouples on the one hand economic progress from consumption of finite natural resources and on the other hand future prosperity from economic growth (Angrick, 2013; Schneidewind & Palzkill, 2012).

The transformation to a circular economy is a complex process involving fundamental changes in current production-consumption-systems. In particular, the company's logic of creating, offering, and delivering value to one or several stakeholder groups will change substantially (Joustra et al., 2013; Lacy & Rutqvist, 2015). But which value activities of companies will be affected by the transformation to a circular economy? How are circular business models structured and designed? How can the value creation processes of companies be decoupled from the consumption of finite natural resources? Circular business model design methods and instruments provide opportunities for managers and business developers to design and reconstruct the value creation activities of

their companies (Joustra et al., 2013; Lewandowski, 2016). They work as manual tools suitable for developing circular business model innovations and assist in integrating ecological, social, and economical factors simultaneously in the key elements of the companies.

Within the fast-growing literature of business models, Osterwalder & Pigneur conceptualized in 2010 a well-established and in practice prevalently used instrument for business model development (Upward & Jones, 2016; Weiner et al., 2010). The so-called Business Model Canvas (BMC) is a strategic management tool for describing, analyzing, designing, and communicating a companies' logic of earning money. It consists of nine interrelated elements that represent the most important aspects of a company (Osterwalder & Pigneur, 2010). However, the BMC builds upon the notion that financial value is the only dimension of value that will be considered and measured in a business model (Joyce & Paquin, 2016). The embedded motivating logic of the BMC is to generate and maximize profits for the enterprise (Upward & Jones, 2016). There is no explicit integration of the ecological and social dimensions of sustainable development as well as circular economy characteristics.

While numerous adaptions have been made to extend the BMC with sustainability and circularity factors (Antikainen & Valkokari, 2016; Dewulf, 2012; Hendriksen et al., 2012; Jonker, 2014; Joyce & Paquin, 2016; Lewandowski, 2016; Mentik, 2014; Upward & Jones, 2016), there is no structured extension of the BMC that integrates ecological, social, and economical sustainability dimensions as well as characteristics of circular business models simultaneously. Therefore, the research purpose was to develop a strategic management tool for designing and visualizing circular business models considering the three dimensions of sustainable development.

Research approach

The study pursued a theoretical-conceptual research approach, which focused on the analyses and critical examination of current conventional and circular business model literature. It builds on a rich body of literature to provide different concepts of sustainability and circularity, analyses of definitions and taxonomies of circular business models, systematic quality assessments of existing reference models for circular business model design on the basis of a detailed criteria set consisting of business model related aspects as well as circularity and sustainability factors. Furthermore, a meta-modeling language for business models has been developed to determine the element relationship structure of the examined reference models. The insights gained from the extensive literature analyses and reference model evaluations formed the basis of the conceptualized holistic circular business model design tool (Figure 1). This paper provides the synthesis about the central construct of circular business model as well as the overall description of the constructed holistic instrument for circular business model development without case example.

The study builds on a five-step systematic literature review methodology, which has been constructed for scientific research in the field of management and organization (Denyer & Tranfield, 2009). The academic databases EconBiz, Google Scholar, LIVIVO, Scopus and WISO were used for the literature search. The following five key assumptions were made to clearly define and to narrow the object of research: First, the business model is a central theoretical construct, more than a vogue expression. Second, business models are considered as a management construct e.g. to enable business transformations, to analyze and design the companies' architecture or to increase the effectiveness of innovations. Third, the literature streams of sustainable business models and

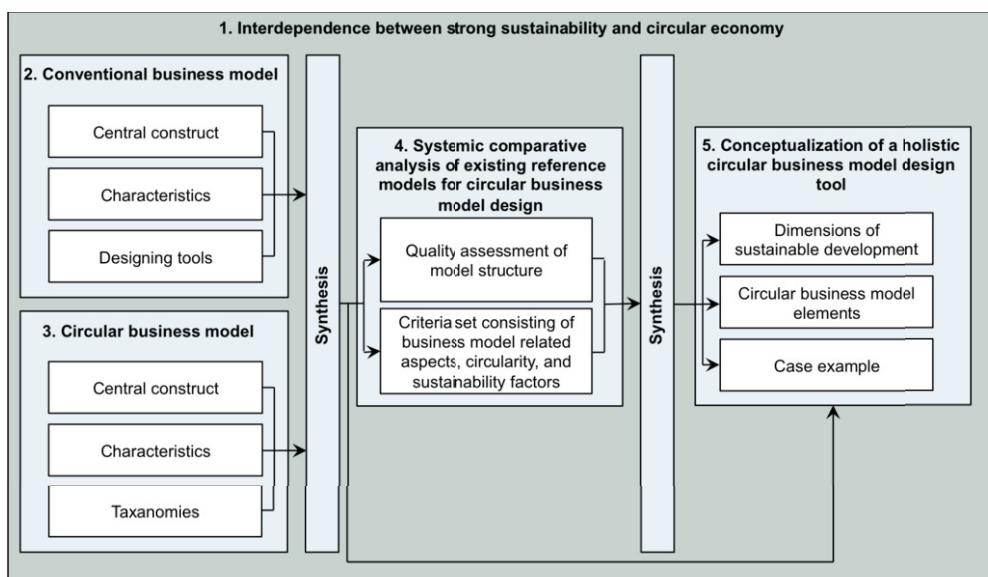


Figure 1. Structure of the study.

circular business models are closely related. Circular business models are regarded as a subcategory of sustainable business models. Fourth, the underlying definition of sustainability refers to the holistic concept of strong sustainability (Jackson 2009; Rogall, 2008; Steurer, 2001; BUND & Misereor, 1997; Daly, 1997). Therefore, circular business activities are perceived as important drivers to achieve the goals of strong sustainability.

From conventional business models to business models for the circular economy

A business model is a simplified and clearly structured representation of the mechanism of how an organization creates, offers, and delivers value to their potential customer segments through the conversion of scarce resources (Osterwalder & Pigneur, 2010; Teece, 2010; Magretta, 2002; Amit & Zott, 2001). It incorporates the most important interdependent components of an enterprise and allows expressing the companies' logic of earning money (Johnson et al., 2008; Skarzynski & Gibson, 2008; Osterwalder, 2004). Hence, the business model describes how the combination of key resources and key capabilities create a value proposition that defines the benefits offered to particular customer segments through a bundle of products and services (Lüdeke-Freund et al., 2016).

In academic literature exists a huge range of different conceptions, which and how many interrelated components and elements form and characterize a business model. Value proposition (value configuration), business infrastructure (key resources, key capabilities, key partners), customer segments (relationships and channels), and profit formula (revenue and cost structure) were the most mentioned business model elements in the reviewed literature (Doleski, 2014; Rusnjak, 2014; Gassmann et al., 2013; Schallmo, 2013; Bieger & Reinhold, 2011; Osterwalder & Pigneur, 2010; Teece, 2010; Johnson

et al., 2008; Skarzynski & Gibson, 2008; Osterwalder, 2004). The main objective for business developer is to find a harmonious balance between the above-mentioned elements in order to establish a resilient and robust enterprise.

The different views and approaches in the conventional academic literature about business modeling have to be extended to consider the challenges of resource depletion, destruction of ecosystems, climate change or the increasing social oppression, injustice, and inequality. Instead of concentrating purely on profit maximization and market share extension, circular business model innovations focus on creating value for a broader range of stakeholder while pursuing eco- and social-effective business activities.

The design and interplay of the various business model elements changes fundamentally within a circular economy. Enterprises with circular business models are deeply involved in the product usage phase; they mainly generate revenues through provisioning product-service-systems instead of selling physical products; they offer used, refurbished or remanufactured modular products, which pass several usage cycles in order to grow the number of users that gain benefits from the same (modified) products; they rethink the classical producer-consumer-relationships, value creation activities and value propositions; ecological and social factors complement the overall business culture and philosophy (Bocken et al., 2016; Florin et al., 2015; Lacy & Rutqvist, 2015; Linder & Williander, 2015; Bakker et al., 2014; Tukker, 2004). Table 1 shows the differences between conventional and circular business models.

Based on the gained insights from the systematic literature review and the comparison of several circular business model taxonomies (Bocken et al., 2016; Florin et al. 2015;

	Conventional business models	Circular business models
Focus of value creation	Generating and maximizing financial profits.	➡ Eco- and social-effectively business activities while generating stable financial profits.
Structure of value creation	Supply chains end with the consumers.	➡ Circular supply chains.
Material input	Efficient use of fossil, critical, and finite resources. Use of biodegradable materials.	➡ Absolute reduction in total use of fossil, critical, and finite resources through reuse, refurbishment, remanufacturing and/or recycling. Cascading use of biodegradable materials.
Ownership structure	Product use/consumption requires ownership. Selling products result in loss of control over the different types of invested capital (natural resources, labor etc.).	➡ Access to products and services does not require ownership. Company retains ownership of the provided products.
Producer-consumer relationships	Strong collaboration with direct suppliers and customers in the supply chain. Traditional producer-consumer relationships.	➡ Strong collaboration with all network partners in the circular supply chain. Networks of collaborative production and consumption arise.
Success measurement	Corporate success is measured in financial performance.	➡ Corporate success is measured in balanced ecological, social and financial performance

Table 1. Characteristics of conventional and circular business models (adapted from Kooloos et al., 2016; Hiemenga et al., 2015).

Lacy & Rutqvist, 2015; Planing, 2015; Bakker 2014), circular business model can be defined as follows:

A Circular business model describes the rationale of how an organization creates, offers, and delivers value through the structured linkage of various elements while minimizing ecological and social costs in order to achieve the goals of strong sustainability. Only the integration in a circular business network enables organizations to contribute to closing material and product loops.

Over the last decade, tools or rather reference models have been developed that can be used to visualize, analyze, design, and communicate the business model of an enterprise. Reference models are generalized models that represent a specific category of models with basic assumptions (Hars, 1994). One of the most well-known and widely used reference model for business model design in both academics and practice is the Business Model Canvas (BMC) (Upward & Jones, 2016; Weiner et al., 2010). It consists of nine interrelated elements: value proposition, customer segments, customer channels, customer relationships, key activities, key resources, key partners, cost structure, and revenue streams. However, the BMC builds upon the notion that financial profits and costs are the only essential dimension of business activities, which will be considered and measured in enterprises (Joyce & Paquin, 2016; Upward & Jones, 2016).

Numerous adaptions have been made to extend the BMC with ecological and social (Joyce et al., 2016; Upward & Jones, 2016; Fichter & Tiemann, 2015; Dewulf, 2012; Doranova et al., 2012; Hendriksen et al., 2012; Bertens & Statema, 2011) as well as circularity aspects (Antikainen & Valkokari, 2016; Lewandowski, 2016; Mentik, 2014). A systematic comparative analysis of the three circular economy BMC extensions, including criteria set consisting of business modeling, sustainability, and circularity principles as well as quality assessment of the model structure, shows that there is lack of structured integration of both sustainability and circular economy characteristics.

C3 Business Model Canvas

The findings of the extensive systematic literature reviews and reference model analyses were used to redefine the logic, structure, elements, and possible element attributes of the BMC in the context of circular economy. The investigations form the basis for the construction of a management instrument for designing, describing, analyzing, and communicating circular business models by taking into account the ecological, social, and economical dimensions of sustainable development (Figure 2).

The name C3 Business Model Canvas (C3BMC) arises from the three pillars of the conceptualized reference

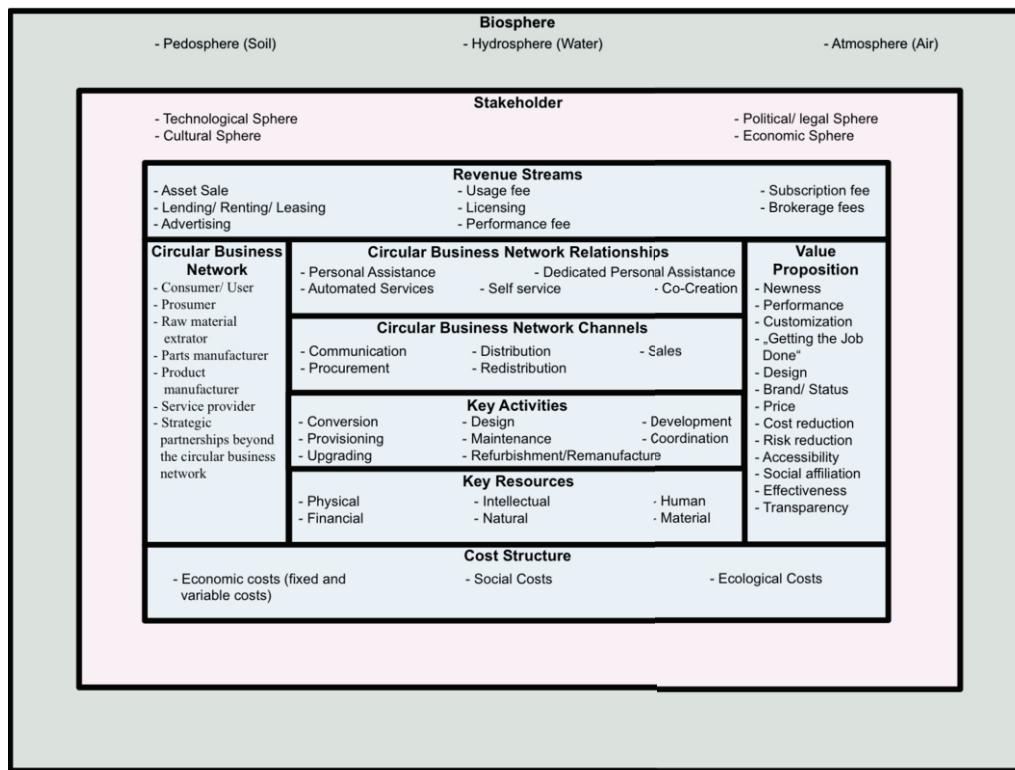


Figure 2. C3 Business Model Canvas

model for circular business model design. The "C" derived from the first letter of the word "circular" that represents the circular economy context. The superscript "3" stands for the three integrated ecological, social, and economic dimensions of sustainable development while the term "Business Model Canvas" refers to the conceptual roots of the reference model. The C3BMC follows the concept of strong sustainability, which means that biological diversity, the regenerative capabilities and resources of nature are essential prerequisites for human life, human development as well as establishing and maintaining social systems. Hence, protection and preservation of nature is the overarching objective of sustainability (Figure 3).

Permanent resource and information exchange processes with its business environment are essential attributes of enterprises. These exchange processes enable organizations to operate in society, to provide services and maintain or increase their market shares. Therefore, the different business environment spheres can be considered as crucial contexts for corporate activities (Rüegg-Stürm, 2002; Freeman & McVea, 2001; Figg & Schaltegger, 2000).

This means, business models need to adapt to changing business environment spheres for ensuring long-term existence of the firm. Hence, it is even more important that users of tools for business model design recognize how the specific business model elements interact with the environment and which stakeholders profoundly influence value creation processes. The consideration of the different habitats (pedosphere, hydrosphere, atmosphere) and social spheres (technological, cultural, political/ legal, economic) illustrates that the interrelated elements of the 'open system' organization are part of a

much larger network rather than an independent self-standing entity.

The C3BMC surrounding building block "Biosphere" (ecological dimension) allows the tool user to document direct emissions to soil, water, and air of the drafted circular business model. The building block "Stakeholder" (social dimension) describes the network of various groups who engage in direct and indirect exchange processes with the business model.

The following eight circular business model elements of the C3BMC and their several attributes allow expressing the value creation architecture of circular oriented companies: Circular Business Network, Value Proposition, Circular Business Network Channels, Circular Business Network Relationships, Key Activities, Key Resources, Revenue Streams, and Cost Structure.

Conclusion and future research

The practical work with the C3 Business Model Canvas marks just the beginning of a profound transformation process in existing enterprises. Modifying conventional business models in order to maximize the degree of circularity might require a challenging and resource intensive process of change and adaption. To meet the requirements for a pervasive business, redesign a framework for management practice will be needed, which assists and supports the managers by achieving the pursued transformation. However, this kind of comprehensive approach does not exist in the current scientific discourse about circular business model innovations. A suitable management framework must combine different creativity techniques with analytical

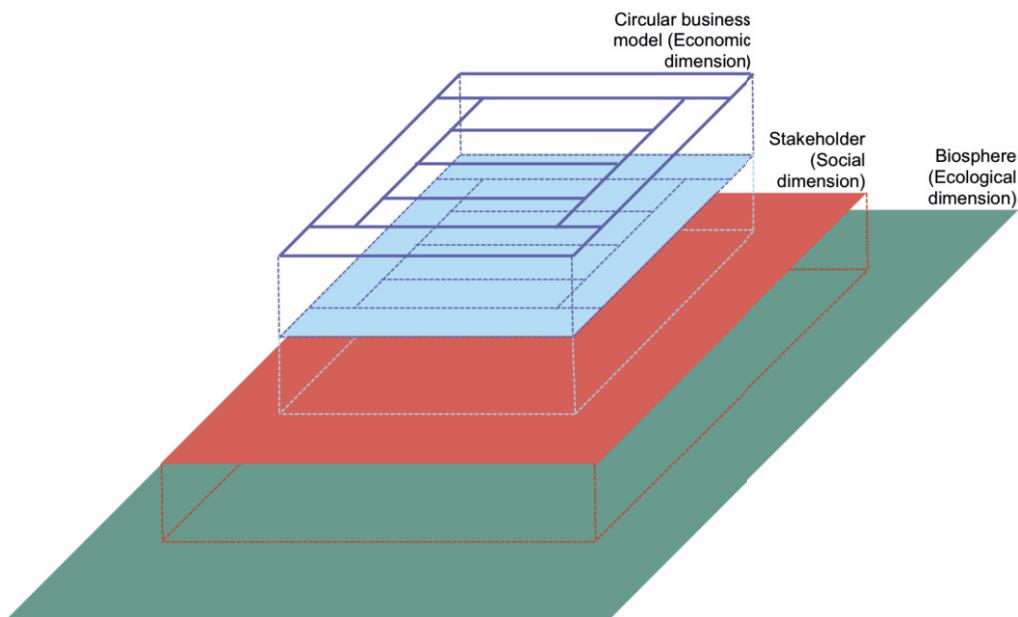


Figure 3. Context of the C3 Business Model Canvas

methods to provide a holistic systemic process to handle the complexity of business model transformations. Longitudinal studies could explore and determine the key phases and challenges of circular business model designing and restructuring progresses.

This study was based on systematic literature review, which implies two major limitations. First, it contains primarily literature related to the overall concept of circular economy. There is a much wider body of literature on sustainable business model innovations, especially literature related to each school of thought underlying the circular economy such as industrial ecology, sharing concepts, collaborative approaches, industrial symbiosis etc. Further research is

required to combine, link and integrate these different fields of literature. The second limitation of this study is the lack of empirical evidence. Hence, further research could focus on empirical validation of the applicability of the conceptualized reference model for circular business models in general as well as in different business settings and industries.

The C3BMC presented in this paper contributes to the scientific discourse on circular economy at business level and supports practitioners with a tool to accelerate transformation processes for the achievement of environmental, social, and economic sustainability.

References

- Amit, R. & Zott, C. (2001). Value Creation in E-business. *Strategic Management Journal* (22), 493-520. doi: 10.1002/smj.187
- Antikainen, M. & Valkokari, K. (2016). A Framework for Sustainable Circular Business Model Innovation. *Technology Innovation Management Review* 6(7), 5-12. <http://timreview.ca/article/1000>.
- Bakker, C., Hollander, M., Den Hinte, E., van Zijlstra, Y. (2014). Products that last: product design for circular business models. Delft: TU Delft.
- Benyus, J. M. (2002). Biomimicry: Innovation Inspired by Nature. New York: Harper Perennial.
- Bertens, C. & Statema, H. (2011). Business models of eco-innovations: An explorative study into the value network of the business models of eco-innovations and some Dutch case studies. Zoetermeer: EIM.
- Bieger, T. & Reinhold, S. (2011). Das wertbasierte Geschäftsmodell: Ein aktualisierter Strukturierungsansatz. In Bieger, T., zu Kniphhausen-Aufseß, D., Krys, C. (Eds.), *Innovative Geschäftsmodelle* (13-70). Berlin: Springer Gabler.
- Bocken, N. M. P., de Pauw, I., Bakker, C., van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering* 33(5), 308-320. doi: 10.1080/21681015.2016.1172124.
- Braungart, M. & McDonough, W. (2003). Cradle to Cradle: Remaking the Way We Make Things. New York: Macmillan.
- BUND & Misereor, 1997. Zukunftsfähiges Deutschland: Ein Beitrag zu einer global nachhaltigen Entwicklung. Basel: Birkhäuser Verlag.
- Daly, H. E. (1997). Beyond growth: the economics of sustainable development. Boston: Beacon Press.
- Denyer, D. & Tranfield, D. (2009). Producing a Systemic Review. In Buchanan, D. & Bryman, A. (Eds.), *The Sage Handbook of Organizational Research Methods* (671-689). London: SAGE Publications.
- Dewulf, K. (2010). Play it forward: a game-based tool for sustainable product and business model innovation in the fuzzy front end. ERSCP-EMSU conference. Delft, the Netherlands, October 25-29, 2010. Delft: Delft University of Technology.
- Doleski, O. D. (2014). Integriertes Geschäftsmodell: Anwendung des St. Galler Management-Konzepts im Geschäftsmodellkontext. Wiesbaden: Springer Gabler.
- Doranova, A., Miedzinski, M., van der Veen, G., Reid, A., Leon, L. R., Ploeg, M., Carlberg, M., Joller, L. (2012). Business Models for Systemic Eco-innovations. Brussels: technopolis group Belgium.
- Ellen MacArthur Foundation (2015). Towards the circular economy: Economic and business rationale for an accelerated transition. Cowes: Ellen MacArthur Foundation.
- Fichter, K. & Tiemann, I. (2015). Das Konzept „Sustainable Business Canvas“ zur Unterstützung nachhaltigkeitsorientierter Geschäftsmodellentwicklung. Oldenburg: Carl von Ossietzky Universität Oldenburg.
- Figge, F./ Schaltegger, S. (2000). Was ist „Stakeholder Value“? Vom Schlagwort zur Messung. Paris: UNEP.
- Florin, N., Madden, B., Sharpe, S., Benn, S., Agarwal, R., Perey, R., Giurco, D. (2015). Shifting Business Models for a Circular Economy: Metals Management for Multi-Product-Use Cycles. Sydney: UTS.
- Freemann, R.E.E./ McVea, J. (2001). A Stakeholder Approach to Strategic Management. *Social Science Research Network Electronic Journal* 01(02), 1-33. doi: 10.2139/ssrn.263511.
- Gassmann, O./ Frankenberger, K./ Csik, M. (2013). Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler Business Model Navigator. München: Carl Hanser.
- Hars, A. (2013). Referenzdatenmodelle: Grundlagen effizienter Datenmodellierung. Heidelberg: Springer Gabler.
- Henriksen, K., Bjerre, M., Maria Almasi, A., Damgaard-Grann, E. (2012). Green Business Model Innovation: Conceptualization report. Oslo: Nordic Innovation Publication.
- Hieminga, G. (2015). Rethinking finance in a circular economy: Financial implications of circular business models. Amsterdam: ING Bank N.V.
- Johnson, M. W., Christensen, C. M., Kagermann, H. (2008). Reinventing Your Business Model. *Harvard Business Review* (12601), 57-68. <https://hbr.org/2008/12/reinventing-your-business-model>.
- Jackson, T. (2009). Prosperity without growth: Economics for a finite planet. London: Earthscan.
- Jonker, J. (2014). New Business Models: Collaborating to Create Value. Den Haag: Academic Service.
- Joustra, D. J., de Jong, E., Engelaar, F. (2013). Guided Choices towards a Circular Business Model. Eindhoven.
- Joyce, J. & Paquin, R. (2016). The triple layered business model canvas: a tool to design more sustainable business models. *Journal of Cleaner Production* 135(1), 1474-1486. <https://doi.org/10.1016/j.jclepro.2016.06.067>.
- Kooloos, R., Butterworth, J., Shannon, A., Dustbar, S., Acsinte, S., Verbeek, A., Jollands, N., Nacci, G., Naber, G., Tellini, M., Monticelli, A., Wies, P., Kraanen, F., Plomp, R., Fischer, A., Piechotki, R., Schoenmaker, D., Achterberg (2016). Money makes the world go round (and will it help to make the economy circular as well?). Zeist: PGGM.
- Lacy, P. & Rutqvist, J. (2015). Waste to Wealth: The Circular Economy Advantage. Hampshire: Palgrave Macmillan.
- Lewandowski, M. (2016). Designing the Business Models for Circular Economy: Towards the Conceptual Framework. *Sustainability* 8(43), 1-28. doi: 10.3390/su8010043.
- Linder, M. & Williander, M. (2015). Circular Business Model Innovation: Inherent Uncertainties. *Business Strategy and the Environment* (2015), 1-15. doi: 10.1002/bse.1906
- Lüdeke-Freund, F., Massa, L., Bocken, N., Brent, A., Musango, J. (2016). Business models for shared value. Cape Town: Network for Business Sustainability.

- Mentik, B. (2014). Circular Business Model Innovation: A process framework and a tool for business model innovation in a circular economy (Master-thesis). Delft University of Technology & Leiden University.
- Osterwalder, A. (2004), The business model ontology: A proposition in a design science approach (Doctoral dissertation). Licencié en Sciences Politiques de l'Université de Lausanne University Lausanne.
- Osterwalder, A. & Pigneur Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. New York: John Wiley and Sons.
- Pauli, G. A. (2010). Blue Economy. Tacos: Bertrams.
- Planing, P. (2015). Business Model Innovation in a Circular Economy Reasons for Non-Acceptance of Circular Business Models. *Open Journal of Business Model Innovation*, 1-11.
- Rogall, H. (2008). Ökologische Ökonomie: eine Einführung. Wiesbaden: GWV Fachverlage.
- Rüegg-Stürm, J. (2002). Das neue St. Galler Management-Modell: Grundkategorien einer integrierten Managementlehre. In Dubs, R., Euler, D., Rüegg-Stürm, J., Wyss, C. E. (Eds.), *Einführung in die Managementlehre* (65-143). St. Gallen: Haupt Verlag.
- Rusnjak, A. (2014). Entrepreneurial Business Modeling: Definitionen – Vorgehensmodell – Framework – Werkzeuge - Perspektiven. Wiesbaden: Springer Gabler.
- Schallmo, D. (2013). Geschäftsmodell-Innovation: Grundlagen, bestehende Ansätze, methodisches Vorgehen und B2B-Geschäftsmodelle. Wiesbaden: Springer Gabler.
- Schneidewind, U. & Palzkill, A. (2012). Suffizienz als Business Case. Wuppertal: Wuppertal Institut für Klima, Umwelt, Energie.
- Skarzynski, P. & Gibson, R. (2008), Innovation to the core: a blueprint for transforming the way your company innovates. Boston: Harvard Business Review Press.
- Stahel, W.R. & Reday-Mulvey, G. (1981): Jobs for tomorrow: the potential for substituting manpower for energy. New York: Vantage Press.
- Steurer, R. (2001). Paradigmen der Nachhaltigkeit. *Journal of Environmental Law and Policy*, (4/2001), 537-566.
- Teece, D. J. (2010), Business Models, Business Strategy and Innovation. *Long Range Planning* 43(2010), 172–194. doi:10.1016/j.lrp.2009.07.003
- Tukker, A. (2004), Eight types of product-service system: eight ways to sustainability? Experiences from SusProNet. *Business Strategy and the Environment*, (13), 246–260. doi: 10.1002/bse.414.
- Upward, A. & Jones, P. (2016). An Ontology for Strongly Sustainable Business Models Defining an Enterprise Framework Compatible with Natural and Social Science. *Organization & Environment*, 29(1), 97-123. doi: 10.1177/1086026615592933
- WBGU (German Advisory Council on Global Change) (2014). Zivilisatorischer Fortschritt innerhalb planetarischer Leitplanken: Ein Beitrag zur SDG-Debatte. Berlin: WBGU.
- Weiner, N., Renner, T., Kett, H. (2010). Geschäftsmodelle im "Internet der Dienste": Aktueller Stand in Forschung und Praxis. Stuttgart: Fraunhofer-Institut für Arbeitswirtschaft und Organisation IAO.