

CIRCULAR ECONOMY: SUSTAINABILITY IMPLICATIONS AND CORPORATE MANAGEMENT CHALLENGES

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Abstract

The careful use of resources and the reduction and avoidance of environmental pollution and adverse social impacts is of particular importance for a sustainable economic system. Today, this is particularly associated with the term 'circular economy'. A transition to a circular economy requires a fundamental change in business models; concepts like recycling and reuse, product service systems, and notions of a service or sharing economy challenge traditional linear business models. To establish a circular economy, it is central to design products and services that are adapted for a such an economy along their life cycle and that, at the same time, accord with environmental and social principles. In order to identify the implications of sustainability as well as the challenges faced by companies along a value chain, the concept of circular economy is analyzed from both a management and a sustainability perspective. Doing so sheds light on both the way and under which conditions a circular economy contributes to the sustainable development of our societies and highlights the implications of a circular economy for the management of companies pursuing the ideas of sustainability and of circularity.

1. Introduction

The concept of a circular economy has received increased attention among public, societal and corporate actors in recent years, especially in Europe. The basic idea is that the current linear industrial system, which uses raw materials for infrastructure as well as products and services which are disposed of after their lifetime be transformed into a circular system in which products, materials and energies are used in cycles as long as possible. The advocates of a circular economy ascribe various benefits to making the transition from a linear to a circular economy, particularly environmental benefits such as less/zero waste, increased resource efficiency and fewer negative impacts on ecosystems as well as societal and economic benefits. Different definitions of the term "circular economy" have been proposed by political and societal actors (see table 1).

Table 1: Definitions of a circular economy (based on Chen, 2016)

Definition	Organization	Type of organization
A circular economy is an industrial system that is restorative or regenerative by intention and design; it replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems and business models.	Ellen MacArthur Foundation, 2012	Non-profit organization
A circular economy is an economic and industrial system	Bastein,	Research

based on the reuse of products and raw materials as well as the restorative capacity of natural resources. It attempts to minimize value destruction in the overall system and to maximize value creation in each link in the system.	Roelofs et al., 2013 (TNO)	institute
A circular economy combines new ideas and business models; the circular economy moves the debate away from efficiency and towards resource, labor and capital effectiveness. It is a perspective on waste that looks at the entire value chain: sourcing or creating clean materials, designing products that extend their lifecycle, new business models and consumer behavior, remanufacturing, reverse logistics and product take-back methods. It uses or generates renewable energy. It makes use of substitution, exchange and cascading of waste of one company as a resource for another.	Corporate Citizenship, 2014	consultancy
The term circular economy is a concept used to describe a zero-waste industrial economy that profits from two types of material inputs: (1) biological materials are those that can be reintroduced back into the biosphere in a restorative manner without harm or waste (i.e.: they breakdown naturally), (2) technical materials, which can be continuously re-used without harm or waste.	Center for Industrial Productivity and Sustainability, 2014, in Ellen MacArthur Foundation, 2014	Non-profit organization
A circular economy means a more circular/performance-based/resource efficient economy, but also a more energy-efficient one and, furthermore, an economy much more based on renewable energy.	Club of Rome, 2015	Think tank
A circular economy is an approach that would transform the function of resources in the economy. Waste from factories would become a valuable input to another process and products could be repaired, reused or upgraded instead of thrown away.	Preston, 2012 (Chatham House)	Research institute Research institute

The “EU Action Plan for the Circular Economy” establishes an ambitious programme of actions aiming at “closing the loop” of product lifecycles through greater recycling and reuse; it includes measures covering the whole lifecycle from production to consumption to waste management and the market for secondary raw materials (http://ec.europa.eu/environment/circular-economy/index_en.htm).

A circular economy requires a focus on the whole product life cycle as all stages, starting from raw material extraction, material and product design, production, distribution and consumption of goods to repair, remanufacturing and re-use right up to waste management and recycling, are all linked and can all contribute to closing material and energy flows (European Commission, 2015). However, two questions still require further attention:

- First, does a circular economy contribute to the vision of sustainable development?
- Second, what are the implications for companies if principles of circular economy are applied in our economic systems?

2. Sustainability implications of circular economy

An important aspect in the discussion of circular economy is its relation to sustainable development: circular economy has to be seen as a means to an end to reach the goals of sustainable development. This idea has been granted importance by virtue of its definition as an overriding priority at the global (see UN sustainable development goals) and national levels. Sustainable development as defined by the Brundtland commission is an ethical standard (World Commission on Environment and Development, 1987). To concretize sustainable development a more tangible definition is necessary. The Framework for Strategic Development (FSSD) offers, along with the principles for sustainable development, such a tangible definition (Broman und Robèrt, 2017):

In a sustainable society, nature is not subject to systematically increasing ...

1. ... concentrations of substances extracted from the Earth's crust. This means limited extraction and safeguarding so that concentrations of lithospheric substances do not increase systematically in the atmosphere, the oceans, the soil or other parts of nature; e.g. fossil carbon and metals;
2. ... concentrations of substances produced by society. This means conscious molecular design, limited production and safeguarding so that concentrations of societally produced molecules and nuclides do not increase systematically in the atmosphere, the oceans, the soil or other parts of nature; e.g. NO_x and CFCs;
3. ... degradation by physical means. This means that the area, thickness and quality of soils, the availability of fresh water, the biodiversity, and other aspects of biological productivity and resilience, are not systematically deteriorated by mismanagement, displacement or other forms of physical manipulation, e.g. over-harvesting of forests and over-fishing.

Moreover, in a sustainable society, people are not subject to structural obstacles to ...

4. ... health. This means that people are not exposed to social conditions that systematically undermine their abilities to avoid injury and illness physically, mentally or emotionally, e.g. owing to dangerous working conditions or insufficient rest from work;
5. ... influence. This means that people are not systematically hindered from participating in shaping the social systems they are part of, e.g. by suppression of free speech or neglect of opinions;
6. ... competence. This means that people are not systematically hindered from learning and developing competence individually and together, e.g. through obstacles to education or owing to insufficient possibilities for personal development;
7. ... impartiality. This means that people are not systematically exposed to partial treatment; e.g. by discrimination or unfair selection with respect to job positions;
8. ... meaning-making. This means that people are not systematically hindered from creating individual meaning and co-creating common meaning; e.g. by suppression of cultural expression or obstacles to co-creation of purposeful conditions.

These principles form the basis for analyzing whether a certain activity, strategy or system is or is not contributing to sustainable development.

When implementing such a circular system, it is important to focus on waste avoidance and resource efficiency, value preservation of materials and products, product and service design enabling "circularity", business model innovation, and systems thinking at different levels. From a sustainability perspective, all of these can contribute to sustainable development if the sustainability principles as defined in the FSSD are respected. For example, increasing recycling rates will contribute to sustainability if these recycling activities do not lead to increasing concentrations of substances extracted from the earth crust or from man-made materials and if there are no negative effects on natural ecosystems or on social impacts.

Two propositions are formulated to describe the relation between circular economy and sustainable development:

Proposition 1: The goals and principles of circular economy are a means to an end to the goal of sustainable development.

Proposition 2: The principles of the Framework of Strategic Sustainable Development can be used to analyze whether a circular economy and the activities and strategies to realize a circular economy are contributing sustainable development.

3. Management implications of a circular economy

To discuss the management implications of a circular economy for companies, it is helpful to take both a strategic management perspective and a supply chain management perspective into account. As strategic management is about 'the long-term direction of an organization' (Johnson, Whittington et al., 2011, p. 3), the question is whether a circular economy influences the long-term success of individual companies, i.e. which potential benefits and potential risks are associated with a circular economy. Supply chain management is about organizing flows of materials, energy, components, systems and products throughout the economic/industrial systems in order to provide consumers with products and services (Mentzer, DeWitt et al., 2001). Therefore, insights from supply chain management can support the identification of challenges of the concept of circular economy for companies.

3.1 Strategic management

Different theories and views contribute to the topic of strategic management and are relevant for the discussion of circular economy and its consequences for individual companies; these include the market-based view, the resource-based view, and the concept of emergent strategies.

The market-based view is a so-called outside-in view as the strategy is formulated based on an investigation of market opportunities; it basically assumes that the source of a strategic success for a company is based on products and services which can be provided at lower costs than those of its competitors (cost-leader strategy), or that products and services have distinct features consumers are willing to pay a higher price for (differentiation) (Porter, 1980; Porter, 1985). Trying to do both equally is, in Porter's view, risky and will lead to significantly lower performance than with other strategies. The concept of hybrid strategies goes beyond Porter's model of generic strategies. Contrary to Porter's model, a company can use differentiation and cost leadership simultaneously (Ostendorf, 2000, pp. 28; Thornhill und White, 2007).

The resource-based view basically assumes that the long-term success of a company depends on its unique set of resources (and in the further development of this approach in its dynamic capabilities) (Barney, 1991). This is an inside-out perspective where these internal company resources are used to develop and market competitive products and services. The resource based view has its roots in the book from Edith Penrose's (1959) "The Theory of the Growth of the Firm" (Penrose, 1959); she recognized that firms had resources or capabilities that were unique to the firms, depending on, among other things, the origins of the firm and the paths firms had taken in their growth. Building on Penrose's work, the resource-based view of the firm rests on the assumption of heterogeneity of firms and their resources and the assumption of resource immobility. That is, firms can be thought of as bundles of productive resources, but different firms would hold different bundles, hence the term heterogeneity. In addition, if the resources are possessed by only a small number of competing firms and are costly to copy or inelastic in supply, then they can be a source of advantage, hence the term resource immobility (Penrose, 1959). Barney (1991) developed a framework for analyzing a firm's resources or capabilities. This VRIO analysis is structured in a series of four questions to be asked about the firm's activities: (1) the question of value, (2) the question of rarity, (3) the question of inimitability and (4) the question of organization:

- Value: a resource or capability is valuable if it enables the firm to respond to environmental threats and opportunities, that is, to exploit opportunities and neutralize threats.
- Rarity: a rare resource is one that is controlled by only a small number of competing firms.
- Inimitability: the resource cannot be imitated, obtained or developed by firms not possessing it.
- Organization: the firm's policies and procedures are organized to support the exploitation of its valuable, rare, and costly-to-imitate resources.

An underlying assumption of the market-based and the resource-based views is that a strategy is a result of a planned process. In contrast to that, the concept of emergent strategies assumes that strategy formulation can't be separated from strategy implementation and that within an organization, strategy emerges out of practice in a bottom-up or undirected way (Mintzberg und Waters, 1985). Mintzberg argues that strategy formulation can't be separated from strategy implementation (Mintzberg, 1994; see also Mintzberg, 1978). He suggests that strategy making consists of both deliberate and emergent elements and that the purely planned strategy is the unlikely extreme on a wide continuum (Mintzberg und Waters, 1985).

3.2 Supply chain management

There are different definitions and interpretations of supply chain management, but it is essentially about coordination between suppliers, producers and distributors for the purpose of delivering products and services to the consumer. Some authors define supply chain management in operational terms, some see it as a management philosophy, and some in terms of management processes (Tyndall, Gopal et al., 1998). A supply chain is defined as an alignment of firms that brings products and services to the market (Lambert, Stock et al., 1998), starting with raw material extraction, followed by component production, product assembly, the movement of goods from wholesalers to retailers, including the transportation facilitating that movement (LaLonde und Masters, 1994). The physical product life cycle, beyond the supply chain itself, encompasses product use and end-of-life as well as associated forms of recycling and disposal, all of which constitute the basis for life cycle assessment of environmental impacts according to ISO 14040/14044." However, the cooperation of firms along a physical product life cycle does not usually form a linear chain, but rather a network of firms interwoven on a global level for many products. For instance, a smartphone is composed of materials and components delivered by more than 500 suppliers, and a car consists of more than 30,000 parts delivered by more than 1,000 suppliers (see www.sourcemap.com). The coordination of such a network of suppliers in a supply chain is the task of supply chain management. A scholarly definition is as follows: "Supply chain management is the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business within the supply chain for the purpose of improving the long-term performance of the individual companies and the supply chain as a whole" (Mentzer, DeWitt et al., 2001). The performance of a supply chain is usually defined as a multi-dimensional set of objectives, i.e. with respect to the quality of products and services delivered meeting the specifications, speed in terms of short production times and delivery to customers, dependability with regard to the correct and punctual delivery of products, and flexibility in the sense of scope for changes in production volume and at low costs.

3.3 Challenges and implications of circular economy for companies

Realizing a circular economy requires a change in the economic and political system. Such a change will inevitably involve changes for individual companies. Companies can be active change agents shaping such a development shift towards a circular (and perhaps sustainable) economy, or they can simply react to such a development. However, both active and reactive companies will be confronted at least to some extent with the following challenges in a circular economy:

1. The inter-organizational management challenge: a circular economy requires the collaboration of companies within the supply chain and with companies from other supply chains in order to exchange materials, energies, re-used products and to repair and refurbish products. This goes beyond usual cooperation experiences in conventional supply chains since, in addition to the material flow from supplier to customer, multidimensional flows of materials, energy and “re-products” have to be coordinated in terms of quantity, quality, time and costs.
2. The value creation and performance measurement challenge: the goals ascribed to a circular economy are not only economic ones, but also related to the society and the natural environment. Companies have to manage the balance between profits, competitiveness, and environmental and social impacts. This is especially challenging as there will be different time-horizons and trade-offs in realizing economic and non-economic benefits.
3. The innovation and re-design challenge: to realize the vision of a circular economy, new ways of cooperation between companies, consumers and other societal actors are required. This will go far beyond conventional exchange of materials, energy and products and lead to new product-service systems and new business models.
4. The cultural challenge: this enhanced cooperation with other actors (challenge 1) and this need for innovation (challenge 3) is only possible if the organizational culture in a company is open for innovation, cooperation and the environmental and social imperatives of the circular economy.

To deal with these challenges, insights from strategic management and supply chain management are combined with the principles of a circular economy. Hence, the following propositions are therefore suggested:

Proposition 3: A company following a cost-leader strategy according to the market-based view will adopt circular economy activities such as reducing waste, increasing resource efficiency, re-designing the business model for a circular economy or designing circular products only as long as such activity is cost efficient.

Proposition 4: A company following a strategy of differentiation according to the market-based view will adopt circular economy activities such as reducing waste, increasing resource efficiency, re-designing the business model for a circular economy or designing circular products in order to offer unique products and services to its customers. Thus, it must be possible to communicate these circular economy activities in a reliable way to the customers.

Proposition 5: A company developing unique resources in terms of circular economy will be able to gain sustainable competitive advantages, according to the resource-based view. These competencies have to be valuable, rare, and non-imitable.

Proposition 6: From the viewpoint of emergent strategies, a company strategy can emerge out of practice in a bottom-up or undirected way. Circular economy will increase possibilities for this emergence of strategies because there are already new actors, new policies and new developments in the economic and the societal environment related to circular economy and because more of them will arise in future.

Proposition 7: Companies experienced with advanced practices and instruments of supply chain management can deal more easily with the inter-organizational management challenge of a circular economy.

4. Concluding summary

This paper analyzed the relation between the circular economy and sustainable development and between circular economy and business management. Circular economy can contribute to the vision and goals of sustainable development if sustainability principles – like those defined in the

Framework for Strategic Sustainable Development – are adhered to. A circular economy increases strategic options for companies, and new business opportunities will arise with the transition to a circular economy in terms of avoiding waste, increasing resource efficiency, offering product service systems or creating collaborative production and consumption systems. The following challenges have been identified related to this transition: inter-organizational management, value creation and performance measurement, innovation and re-design and (organizational) culture.

The results of this paper are relevant for practitioners as they can use the propositions clarifying the relation between circular economy, sustainable development and business management to understand implications of a shift towards a circular economy for their businesses. Academics might find interesting ideas for their further research and might benefit from the management challenges and propositions identified.

5. References

- Barney, J.B. (1991): Firms Resources and Sustained Competitive Advantage. In: *Journal of Management*, Vol. 17, No. 1, 98-120.
- Bastein, T.; Roelofs, E.; Rietveld, E.; Hoogendoorn, A. (2013): Opportunities for a Circular
- Broman, G.; Robèrt, K.-H. (2017): A framework for strategic sustainable development. In: *Journal of Cleaner Production*, Vol. 140, 17-31.
- Chen, H.-L. (2016): *Circular Design Toolkit: Development of a Framework and Supportive Tools for Product Service Design in a Circular Economy*. Masterthesis, University of Graz
- Club of Rome (2015): *The Circular Economy and Benefits for Society: a Swedish Case Study Shows Jobs and Climate as Clear Winners*. Club of Rome.
- Ellen MacArthur Foundation (2012): *Towards the Circular Economy 1: Economic and Business Rationale for an Accelerated Transition*.
- Ellen MacArthur Foundation (2014): *Towards the Circular Economy: Accelerating the scale-up across global supply chains*.
- European Commission (2015): *Roadmap: Circular economy strategy, 4/2015*
Brussels.
- Johnson, G.; Whittington, R.; Scholes, K. (2011): *Exploring Strategy*. 9th edn, Essex: Prentice Hall.
- LaLonde, B.J.; Masters, J.M. (1994): Emerging Logistics Strategies: Blueprints for the next Century. In: *International Journal of Physical Distribution and Logistics Management*, Vol. 24, No. 7, 35-47.
- Lambert, D.M.; Stock, J.R.; Ellram, L.M. (1998): *Fundamentals of Logistics Management*. Boston: Irwin/McGraw-Hill.
- Mentzer, J.T.; DeWitt, W.; Keebler, J.S.; Min, S.; Nix, N.W. (2001): Defining Supply Chain Management. In: *Journal of Business Logistics*, Vol. 22, No. 2.
- Mintzberg, H. (1978): Patterns in strategy formation. In: *Management Science*, Vol. 24, 934-948.
- Mintzberg, H. (1994): Rethinking strategic planning part I: pitfalls and fallacies. In: *Long Range Planning*, Vol. 27, No. 3, 12-21.
- Mintzberg, H.; Waters, J.A. (1985): Of strategies, deliberate and emergent. In: *Strategic Management Journal*, Vol. 6, No. 3, 257-272.

- Ordonez, I.; Singh, J. (2015): Resource recovery from post-consumer waste: important lessons for the upcoming circular economy. In: Journal of Cleaner Production, Vol. in press.
- Ostendorf, R.J. (2000): Dynamische Ökologieführerschaft: eine Wettbewerbsstrategie gewinnorientierter Unternehmen - theoretische Darstellung und praktische Überprüfung am Beispiel der Automobilindustrie. Sternenfels: Wissenschaft und Praxis.
- Penrose, E. (1959): *The Theory of the Growth of the Firm*. New York: John Wiley and Sons.
- Porter, M.E. (1980): *Competitive Strategy*. New York: Free Press.
- Porter, M.E. (1985): *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.
- Preston, F. (2012): *A global redesign? Shaping the circular economy*. London: Chatham House.
- Sinding, K. (2000): Environmental management beyond the boundaries of the firm: Definitions and constraints. In: *Business Strategy and the Environment*, Vol. 9, No. 2, 79-91.
- Thornhill, S.; White, R.E. (2007): Strategic purity: A multi-industry evaluation of pure vs. hybrid business strategies. In: *Strategic Management Journal*, Vol. 28, No. 5, 553-561.
- Tyndall, G.; Gopal, C.; Partsch, W.; Kamauff, J. (1998): *Supercharging Supply Chains: New Ways to Increase Value through Global Operational Excellence*. New York: John Wiley and Sons.
- World Commission on Environment and Development (1987): *Our Common Future*. Oxford: Oxford University Press.