

# Insights from Circular Economy Literature

Subjects: Economics

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The circular economy (CE) has become one of the prominent topics in both natural science and management literature over the last few decades. CE is a dual-loop regenerative system that focuses on the effective and efficient utilization of resources in the ecosystem, which is beneficial to environmental and economic performance optimization. Dual CE initiatives allow firms to increased resource eco-efficiency, as well as resource effectiveness.

Keywords: circular economy ; ecosystem ; circular design

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## 1. Introduction

In recent years, the circular economy (CE) has been the focus of attention from practitioners and academics. CE set out “pathways to provide opportunities for the dematerialization of resources throughout the product physical life cycle” <sup>[1]</sup>. The interface of the CE and the promotion of a resilient infrastructure have interested scholars for years. According to Awan et al. <sup>[2]</sup>, “CE is an industrial system that could be seen as a system that integrates economy with ecological design considerations and proposes a completely different way of resource utilization” (p. 12). A variety of conceptualizations have emerged to explain and understand CE, but none of them is unchallenged <sup>[3]</sup>. A CE is understood as the “realization of closed-loop material flow in the whole economic system” <sup>[4]</sup>.

There is increasing recognition of CE for the management of natural resources, which has resulted in a structural change in sustainability initiatives. Sustainability research informed us of how firms can identify and exploit the natural environment <sup>[2]</sup>. However, there has been little progress; the scholars have not produced a fully green innovation research paradigm <sup>[5]</sup>. The domain of CE has experienced rapid growth over the last decades. Much research in this area is focused on developing material efficiency and the design of new business models. Only recently has the CE field started to broaden from many different disciplinary backgrounds. CE is a value-oriented resource transformation concept <sup>[1]</sup>. Consistent with the current literature <sup>[6]</sup>, green technologies play an important role in our conceptualization of how green innovation supports sustainable development objectives. CE is defined as “optimizing the consumption of resources and patterns and redesigns industrial system at the system level” <sup>[7]</sup>. Perhaps the best-known CE definition in academic literature is by Stahel <sup>[8]</sup>, who first referred to a “closed-loop economy”. There have been some systematic literature reviews on the CE definition <sup>[9][10][11][12][13][14][15][16]</sup>. Recently, scholars have called for the conceptualization of CE definition, owing to change in organizations’ business models <sup>[16]</sup>.

The circularity concept became prevalent with the advent of industrial ecology, and it has attracted the most research attention. There is a need to establish a better understanding of the CE definition <sup>[10]</sup>. In spite of the comprehensive surge in the existing literature on CE, researchers do not agree on how to define CE <sup>[17]</sup>. The literature on CE is developing largely on a conceptualization of CE from the meso, micro, and macro-level <sup>[16]</sup>. Awan et al. <sup>[1]</sup> have highlighted the need to adopt an ecology theory perspective to explore the CE definition. Despite the growth of scientific knowledge, literature has generally tended to focus on material or resource efficiency. Given the complex nature of the CE concept, there are challenges in defining and operationalizing CE. The CE concept has also been the subject of an increasing number of practitioner-oriented studies <sup>[2]</sup>; however, researchers have yet to develop a widely accepted common definition of CE <sup>[11]</sup>. Future research is needed in order to understand how CE is defined <sup>[16]</sup>. The above gap in literature brings about the need to develop a working definition of CE with specific characteristics and measures so that a common language is developed to move action towards sustainable development and growth. The purpose of this study is to analyze the published definitions of CE (which are incoherent) and to develop a working definition of CE, along with future research opportunities.

## 2. Analyzing the Circular Economy Definitions: An Organizational Perspective

There are few insights into the system ecology. Further, Yuan, Bi, and Moriguchi<sup>[17]</sup> and Zink and Geyer<sup>[18]</sup> addressed CE as a continuous use of the material and closing the loop. Several scholars have attempted to define CE, and the focus was on the reduction of raw material consumption and reduction in the use of energy<sup>[19]</sup>. Basically, before 2010, Yap<sup>[20]</sup> described CE as where resources become products and emphasize recycling. In 2006, Yuan et al.<sup>[17]</sup> defined CE as the process of planning and the use of raw material to create products that satisfy human needs. MacArthur (2013) defines CE as “A circular economy approach encourages the organization of economic activities with feedback processes which mimic natural ecosystems through a process of natural resources transformation into manufactured products byproducts of manufacturing used as resources for other industries”<sup>[21]</sup> (p. 232). This definition focuses on organizational economic activities, but recognizes the reuse of the material as a source of other industries. This is the only definition since 2008 that prompts the concept of reuse of material as a resource for other industrial products. In 2009, Liu et al.<sup>[22]</sup> describe the concept of CE as a different way to solve the problems by emphasizing on keeping a balance between socio-economic and ecosystem. This definition includes the conceptualization of stakeholders included in the “ecosystem and the socioeconomic system” (p. 265). This definition did not use a holistic view of stakeholders. However, this definition has been central to CE, and CE should be understood for solving the problem from a positive and normative perspective.

On the other hand, Hu et al.<sup>[23]</sup> identified eco-efficiency and resource productivity as expanding the conceptualization of CE, and stated that the application of new technology and management renovation is important to firm actors to create value rather than focus on eco-efficiency. In 2012, Bilitewski<sup>[24]</sup> emphasized the need for a connection between use and waste residual. On the other hand, MacArthur<sup>[21]</sup> incorporated the concept of the end of life. The regenerative economy perspective in the 2013 definition was seen as an important step forward as MacArthur<sup>[21]</sup> defined CE as “A circular economy is an industrial system that is restorative or regenerative by intention and design” (p. 07). This CE definition is most accepted and warranted of the elimination of waste through the better design of process, material, and products within existing organizational business models. In 2013, Thomas and Birat<sup>[25]</sup> made advances in the concept of CE and introduced the idea of a “closed-loop economy” (p. 5). This definition states that CE is the activity of a set of three core principles: reduce, reuse, and recovery. Stahel's<sup>[26]</sup> definition maintained a waste management orientation by explicitly focusing on industrial sectors at large from an economic perspective. In 2013, Geng et al.<sup>[27]</sup> suggested a new definition of CE. This definition emphasizes large and important entities to support long-term sustainability. This definition considers the need for the exchange of resources for sustainability. A more appropriate definition of CE by Webster<sup>[28]</sup> must include “restorative by design” in determining value creation ”(p. 16). This definition again emphasizes the utilization of material value for creating high-quality products. This definition partially emphasizes the concept of material resilience. This concept is rarely discussed in the CE literature.

Gregson et al.<sup>[29]</sup> provided a CE definition that implies extending the item's life by managing the reuse after consumption. Rizos et al.<sup>[30]</sup> indicated that CE is a concept that questions the linear economic systems. Witjes & Lozano<sup>[31]</sup> stated that CE is the transfer of waste into resources. Haupt et al.<sup>[32]</sup> followed the CE definition including “production and consumption system with minimal losses of materials and energy through extensive reuse, recycling, and recovery” presented by Geng and Doberstein<sup>[33]</sup>. However, Jurgilevich et al.<sup>[34]</sup> defined CE as it is referred to as the ability to change waste into a beneficial resource through CE principles such as re-using, re-paring, and recycling. Moreover, Bocken et al.<sup>[35]</sup> supported the definition of CE as the method to help avoid sustainability pressures according to the Ellen MacArthur Foundation & European Commission in 2014. Meanwhile, the 2016 CE definition by Sauvé<sup>[12]</sup> included internalizing environmental externalities linked to the generation of waste. This definition describes the importance of resilience, but fails to address the outside organizational environment to articulate more sophisticated management strategies that have an environmental and social impact.

Stahel<sup>[36]</sup> offered a revised CE definition “loop (or circular) economy is to bring goods and molecules back into new use in a grave-to-cradle approach” (p. 6). This definition reaffirms the importance of the grave to cradle approach and brings back material to the loop. Given the importance of CE, Murray et al.<sup>[13]</sup> also pointed out the importance of procurement and production functions to “maximize ecosystem functioning and human well-being”(377). This definition devotes significant attention to understanding human well-being and reprocessing the material for an integrative ecosystem functioning. (Blomsma & Brennan, 2017) referred to the definition presented by Murray et al.<sup>[13]</sup>. This definition provides an exchange of material and resource efficiency concept as the central concept in CE, although it does not focus on human well-being. Murray et al.<sup>[13]</sup> claimed that CE is a process that supports the natural environment and involves minimizing waste throughout the production process. Emergent thought signals a paradigm shift toward the business

model [37]. Kirchherr et al. [37] describe CE as an “economic system that is based on business models which replace the end-of-life concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes” (pp. 224–225).

As opposed to a linear economy, Malinauskaite et al. [38] mentioned, based on (European commission, 2015), that “circular economy is defined as one in which the value of products, materials, and resources is maintained for as long as possible, minimizing waste and resource use”. This definition implies the necessity of managing waste and turning it into better reuses and sustainable development. This definition means the industrial domain items are sustained by closed-material flow, as Korhonen [39] pointed out that CE has placed considerable influence, which is defined as “societal production-consumption systems that maximize the service produced from the linear nature-society-nature material and energy throughput flow” (p. 39).

From the literature discussion, there are varying views on defining the CE. It appears from the above discussion that CE is a dual-loop regenerative system that focuses on the effective and efficient utilization of resources in the ecosystem, which is beneficial to performance optimization. CE is a dual loop system because it is a combination of a closed-loop and take back system. Dual CE initiatives allow firms to increased resource eco-efficiency, as well as resource effectiveness. A linear economy is a single loop, where material produces and consume, and a circular economy, where the material takes back for re-consumption. In summary, the CE literature encompasses considerable differences in the definitions and conceptualization of the key constructs. Considering the little insight into the ecosystem and more on economic and industrial/material perspectives, along with building on the previous discussion, we propose, from an organizational perspective, a comprehensive working definition of CE as follows.

CE is the set of organizational planning processes for creating, delivering products, components, and materials at their highest utility for customers and society through effective and efficient utilization of ecosystem, economic, and product cycles by closing loops for all the related resource flows.

Based on the literature review, a commonly understood and accepted CE definition can pave pathways for advancing research and theory. Organizational CE activities are actions that occur in the development of infrastructure and relationships with different actors to achieve material efficiency through closing ecological loops. In essence, the CE is a set of practices aimed to keep products in use as long as possible even after the end of their lives.

**Table 3.** Circular economy (CE) key definitions and terms in the literature review.

Author (Year)	Key Definition	Key Terms
[20]	“Circular economy is described as a scientific development model where resources become products, and the products are designed in such a way that they can be fully recycled” (p. 13)	Emphasize on recycling
[22]	“Circular economy defines its mission as solving the problems from the perspective of reducing the material flux and making the material flow balanced between the ecosystem and the socioeconomic system” (p. 265)	Reduction of material use
[22]	“Circular economy (CE) focuses on resource-productivity and eco-efficiency improvement in a comprehensive way, especially on the industrial structure optimization of new technology development and application, equipment renewal and management renovation” (p. 221)	Eco-efficiency and resource productivity
[21]	“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, within this, business models” (p. 07)	Regenerative and restorative of resources
[27]	“A circular economy is an industrial system focused on closing the loop for material and energy flows and contributing to long-term sustainability” (p. 1256)	Closing the loop for material
[28]	“A circular economy is one that is restorative by design, and which aims to keep products, components and materials at their highest utility and value, at all times” (p. 16)	Restorative by design
[29]	“The circular economy is what seeks to stretch the economic life of goods and materials by retrieving them from post-production consumer phases. This approach too valorizes closing loops but does so by imagining object ends in their design and by seeing ends as beginnings for new objects.” (p. 9)	CE prolongs product's life
[34]	“Circular economy means to reuse, repair, refurbishing, and recycling of the existing materials and products; what was earlier considered to be waste becomes a resource” (p. 2)	Transform waste into a resource

Author (Year)	Key Definition	Key Terms
[35]	"The circular economy (CE) is viewed as a promising approach to help reduce our global sustainability pressures according to Ellen MacArthur Foundation and European Commission" (p. 300)	CE promotes sustainability
[38]	"circular economy is defined as one in which the value of products, materials, and resources is maintained for as long as possible, minimizing waste and resource use". (p. 2014)	Sustainability development
[18]	"The concept of closing material loops to preserve products, parts, and materials in the industrial system and extract their maximum utility" (p. 1)	Products are sustained by the closed-material flow
[13]	"CE is an economic model wherein planning, resourcing, procurement, production, and reprocessing are designed and managed, as both process and output, to maximize ecosystem functioning and human well-being" (377)	Maximize ecosystem functioning
[14]	"Circular economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling" (p. 759)	Regenerative system
[40]	"A circular economy is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times" (p. 483)	Restorative and regenerative by design
[13]	"An economy is envisaged as having no net effect on the environment; rather it restores any damage done in resource acquisition, while ensuring little waste is generated throughout the production process and in the life history of the product" (p. 371)	Restoration by design
[16]	"A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro-level (products, companies, consumers), meso level (eco-industrial parks) and macro-level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations."(pp. 224–225)	Creating environmental quality
[41]	"Circular economy is an economy constructed from societal production-consumption systems that maximize the service produced from the linear nature-society-nature material and energy throughput flow. Circular economy limits the throughput flow to a level that nature tolerates and utilizes ecosystem cycles in economic cycles by respecting their natural reproduction rates" (p. 39)	Maximizes the service produced
[1]	"Circular Economy (CE) is an activity, set of process for reducing the material used in production and consumption, promoting material resilience, closing loops and exchange sustainability offering in such a way that maximize the ecological system"(p. 30)	Reducing the environmental burden with an ecological system theory approach

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