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A Literature Analysis of Definitions For a Circular Economy

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Abstract:

This chapter aims to identify and analyze the published definitions of circular economy (CE). Twenty-eight definitions were gathered through intensive critical literature review, using both Scopus and Web of Science. The definitions developed from peer-reviewed literature analysis covered a period from 1999 through 2019, although most definitions were published from 2011 onwards. CE received significant attention in the early 90s and now is considered a mainstream strategy for product design and social, economic and environmental sustainability. Given that research is still relatively new in the sustainable circular economy. CE offers a reverse resource regenerative idea to eliminate the linearity of production and consumption system to support sustainability objectives. The CE definition analysis revealed that so far, resilience and stakeholder perspective is not explicitly included in the definition, although stakeholder is considered to be part of a natural and ecology system. CE has an impact on different aspects of the business throughout the entire supply chain. The concept of a CE is a value-orientated resource transformational process. CE considers both upstream and downstream production and consumption patterns to promote the resilience orientation of resources. Currently, CE practices are carried out - meso, micro and macro. This chapter

highlights that suggest that it is imperative to consider exosystem and Chronosystem to better move away from linear to circular economy.

Introduction

Global warming and climate change issues are gaining popularity, thus the managers of supply chains are faced with the challenge of how to integrate the circular economy (CE) practices into the production and management of their organisations. The CE practices are a way forward to lowering global warming, greenhouse gases, and minimizing air pollution by integrating sustainability objectives into the design of operations and products. There is a growing realization that companies must direct the issue of resource scarcity and dematerialization in their product physical life cycle. Since the inception of the sustainability concept in the 1980s, debates on the application circular economy has grown significantly (Awan et al. 2020). CE is commonly defined as resource reduction to meet the sustainability agenda of the existing and future generation. Recently, CE has been the focus of attention from practitioners and academicians. There is increasing recognition of CE on the political agenda of nations and particularly in Europe (European Commission 2015). CE is expected to play a vital role in the move towards economic development by generating new business opportunities, saving material cost, improving the security of future supply, while at the same time move towards a sustainable future (Kalmykova et al. 2017). CE is commonly considered as a solution for environmental protection and economic growth by utilizing resources in circularity. CE is understood as the “realization of closed-loop material flow in the whole economic system” (Geng and Doberstein 2008).

In CE definitions confusion arises frequently surrounding the principles of 3R (reuse, reduction and repair). The term CE has been interpreted in a variety of different ways, ranging from closed flow of material to a “spiral-loop system” (Stahel and Reday-Mulvey 1981; Yuan et al. 2006). Previous CE definition tends to focus on transformation function of resources in the value chain (EllenMacArthur Foundation 2013), but as research expands, they are adopting CE concepts to sustainable development (SD) (Kirchherr et al. 2017b). There

has been an attempt to establish a preferable grasp understanding of the CE and the application of SD in an industrial ecology context. CE has been defined in various ways, with one possibility “optimising consumption of resources and patterns, and redesigns the industrial system at the system level” (European Commission 2014). In a broader perspective, CE signifies the resilience, resource efficiency, and a restorative economic system. Perhaps the best known was by Stahel and Reday-Mulvey (1981), who defined CE in academic literature, as a “closed-loop economy”. The management of the CE is receiving increasing recognition. A number of recent literature reviews on the CE definition have been published including Ghisellini et al. 2016; Lewandowski 2016; Lieder and Rashid 2016; Sauvé et al. 2016; Blomsma and Brennan 2017; Geissdoerfer et al. 2017; Kirchherr et al. 2017b; and Murray et al. 2017. These literature reviews are indeed necessary in order to further develop the concept and transparency regarding the existing understanding of CE (Blomsma and Brennan 2017; Kirchherr et al. 2017a). However, they merely present an account of available definitions, basis to understand how CE is currently constructed at the macro, meso and micro level.

There is an ongoing discussion about the significance and application of CE in a business context. However, the CE definition has not been explored in-depth, there are numerous and varied definitions of CE (Lieder and Rashid 2016). There is no broadly agreed definition of CE in the literature (Yuan et al. 2006). While Kirchherr et al. (2017b) write that no one single definition of CE has gained international acceptance. Merli et al. (2018) have pointed out the need for developing broader and more dynamic definitions and associated practices, in which they viewed CE as a system in which the value of the materials, products and resources is maintained in the entire product lifecycle.

A specific conceptual and theoretical development might be required for a better understanding of the concept in discourse. As far as, there is no comprehensive definition of the CE, however, CE is often studied with an explicit definition of the concept (Blomsma and Brennan 2017). A recent study on the conceptualization of CE through analyzing definitions by Kirchherr et al. (2017b) focusing on broadening the concept of the CE among scholars and practitioners. CE is defined in so many different perspectives that it is difficult to come up with a consensus single definition. One possible explanation as to why there

is no consensus regarding the definition of the CE could be due to the differences of conceptualization of various members about the implementation of CE in the context of reducing, reuse and recycling. These challenges potentially identify a need for a new definition of CE, as reported by the previous discussion in the literature. Firms employing CE approaches would also want to seize the potential benefits and opportunities offered by making use of waste prevention strategies before the design of the product. It is therefore important to discover what has not been addressed in the previous CE definitions and identify the knowledge gaps to suggest a new definition in a system perspective. This gap in the literature provided the impetus for the analysis of CE definitions by specific characteristics and measures, which is imperative for achieving sustainable growth.

This study is distinct from previous research studies in two aspects. First, the study used keywords search from Scopus and Web of Science from the period of 1999 to 2019. Second, the study addressed key CE characteristics assessed by the definitions in the literature. This study provides an overview of CE approaches development and analyzes the previous literature on circularity in firms to provide a shared definition and provides a series of future research avenues. Thus, the purpose of this paper is to identify and analyze how CE is defined in the existing literature and suggest future research direction. We have chosen the systematic literature review approach and summarize the salient findings of previous studies. The contribution of this study is two-fold: first to provide an update to literature review on CE, as well as to document the strengths and weakness of definitions in said literature. Second, to structure the literature in a way to provide a basis for the development of a comprehensive definition for a CE and point for future research in these areas.

Systematic literature review methodology

The systematic literature review was limited to articles that were published in English peer-reviewed journals during the last 20 years (1999-2019). We consider this timespan to the possible inclusion of the articles published during this time. We include Scopus and Web of science our main identification source of articles. We selected both

databases due to its broad coverage in engineering and technology journals. Since Scopus does not cover every peer-reviewed publication, it is possible to relevant papers published in the domain of circular economy might not miss. So, to avoid this, we also consider the web of science to search the related published work. To identify the relevant articles, we followed a structured pre-defined keywords search. Accordingly, the terms, “circular economy” and “Cradle to cradle” and “Cloos-loop” were separately searched. The search word conducted along with the key terms “definition”, “defined”, “define” and “refers” by utilizing “all field category” search in title, abstract and keywords. The data range to search the key terms were set for the papers published from 1999 to 2019 by utilizing the subject areas category. As of October 7, 2019.

The systematic literature review approach using keywords has been used previously in many studies. In this present study, to identify the most relevant articles, we decided to reduce the number of articles for the review following three additional criteria for our literature review on circular economy and cradle to cradle approach. First, to be included in our review, the title of the article must deal with the circular economy concept. Second, an abstract of the article must reflect the circular economy as the main concept related to the reuse, repair and recycling. Finally, the journal in which article appeared must have been ranked in the source database. After applying such criteria and removing duplicates articles that were appeared in a web of science and Scopus data sources. A total of 1134 articles identified in the engineering, environmental and management science. As of 347 duplicates articles were excluded from the review at the initial stage. we then eliminated 411 articles that did not fit these criteria, it led to an initial number of 376 articles. As a result of this approach, our overall sample included 177 articles.

After reading this article in-depth, we became familiar with this concept. We also noted that circular economy approaches have also appeared in published reports which have not been appeared in our keyword research. We carefully read these published working papers and decided to include in the references section. Given the scope and space consideration for this published working papers, however, we

present a brief view of definitions that have been appeared in this literature.

The emergence of the Circular Economy concept and definitions

The idea of the circular economy (CE) was first introduced by British environmental economists. They described the environment as a waste reservoir without a built-in propensity to recycle (Pearce and Turner 1990). In 1976, Stahel and Reday-Mulvey encouraged scholars to contribute to the natural resources and referred to CE as a “closed-loop economy”. Stahel and Reday-Mulvey (1981) In a regenerative ecology system, the origin of the word CE was not known. The term CE comes from western literature in the 1980s, to describe a closed-loop system concept to the recognition of the importance of quality of natural resources (Pearce and Turner 1990). In literature, the term gained prominence in the late '90s after prominence of the German and Swedish industrial ecological paradigm. CE was viewed as activity resource productivity and efficiency in the perspective of industrial ecology. Some claims that it first appears in China (Yuan et al. 2006). A circular economy is a multi-dimensional concept root in a product designed in such a way that can fully be recycled (Yap 2005). Several previous studies investigated CE definition in the engineering discipline based on the categorization of concepts in which CE appeared. CE received significant attention in the early 90s and now is considered a mainstream strategy for product design and social, economic and environmental sustainability.

The concept of CE was narrow and the focus was on a healthy economy and environment co-existing as a way to integrate environmental management throughout the 20th century (Chertow 2000). The German and Swedish environmental policy on a closed-loop originated from the industrial paradigm, and it has been followed by China's policymakers as a prospective strategy to furnish a solution to existing environmental problems. The concept of CE comes out from the industrial ecology and has a closed-loop of product flow. Industrial ecology (IE) is referred Awan (2020) to as “a subdiscipline of the natural ecosystem which aims to restructure the industrial ecosystem in ways of managing and designing linear to closed-loop industrial production and consumption system. Industrial ecology seeks to form

harmonized relations between ecological and human systems to provide sustainable benefits of all aspects of sustainability including social, environmental, and economic” (p.370). The focus of CE is on eco-efficiency and resource productivity to achieving improvements in resources and achieve. The government of China that enforced the policies related to “circular economy”, these were referred to as “Circular Economy Promotion Law of the People's Republic of China”. The concept of CE first to come into force in January 2009. CE was initially launched at three-levels in China, individual business level, eco-industrial parks, and at the eco-cities municipalities. Under these principles, CE aims to promote economic growth and at the same time bring about an economic development strategy (minimise material consumption and energy use) (Yuan et al. 2006). Industrial networks of China advance the initiative of CE and its practices at a country level.

Another phenomenon related to macro-level or national level has been described as the promotion of consumption and production of efficient resources, promote eco-cities with the aim of developing a recycling-oriented society (Geng et al. 2012). The term micro level means implementing cleaner production initiatives at the firm level. Their term Meso level means the study of inter-firm at the supply chain level represented firms in cluster use waste of another firm (Yuan and Shi 2009). The word circular related to the concept of cycle and economy in terms of production and consumption of two cycles, (1) bio-geo-chemical cycles and (2) idea of recycling of products (Murray et al. 2017). The idea of the circular economy has been expressed by (Kirchherr et al. 2017b) in 3R (i.e., reduce, reuse and recover) and 4R (European Commission 2008), reduce, reuse, recycle and recover. CE is defined as “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” (Murray et al. 2017).

Yuan et al. (2006) concept of CE was the foundational step in developing CE as a path to achieving eco-efficiency and resource productivity. While existing research has in a common theme “cyclical closed-loop system”(Murray et al. 2017). The basic premises of the CE appear to be closing and slowing loops. Closing

loops refers to (post-consumer waste recycling, slowing is about retention of the product value through 3R principals (Murray et al. 2017). Recently, Blomsma and Brennan (2017) term CE as prolonging resource productivity. However, Slowing resource loops referred as “Through the design of long-life goods and product-life extension (i.e. service loops to extend a product’s life, for instance through repair, remanufacturing), the utilization period of products is extended and/or intensified, resulting in a slowdown of the flow of resources”. Closing resource loops referred to as “through recycling, the loop between post-use and production is closed, resulting in a circular flow of resources”(Bocken et al. 2016)(p.309). Stahel (2016) referred good use of the utilization of end of life products as Loop (or circular) Economy.

This unavailability of definitional comprehensibility brings forth the potential approach of misunderstanding, supporting dispersion than the convergence of views and additionally predicting cumulative examination of development on circular economy approaches. Table 1 Representative definitions of Circular Economy.

Sr. No	Authors	Key definition	Key terms
1	Cooper (1999)	“A circular economy is proposed, in which the throughput of energy and raw materials is reduced”(p. 10).	Reduction of use of energy and raw material consumption
2	Yap (2005)	“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
3	Yuan et al. (2006)	“CE is the circular (closed) flow of materials and the use of raw materials and energy through multiple phases”(p.5)	Focus on the closed flow of material

4	Geng and Doberstein (2008)	“A circular economy approach encourages the organisation 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”(p.232)	Reuse of the materials
5	Liu et al. (2009)	“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
6	Hu et al. (2011)	“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
7	Bilitewski (2012)	“A circular system when the connection between resource use and waste residuals”(p.1)	Use of waste
8	MacArthur (013)	“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

9	Thomas and Birat (2013)	“3R’s principles (Reduce, Reuse, Recycle) or Sustainable Design are concepts that should lead to this idea of a circular or closed-loop economy”.(p.5)	Focus on closed-loop
10	Stahel (2013)	“Reducing the economic importance of resource extraction and waste management, and also reducing the environmental impairment caused by these industrial sectors”(p.4)	Reducing environmental damage
11	Geng et al. (2013)	“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
12	Webster (2015)	“ 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
13	Haas et al. (2015)	“The circular economy (CE) is a simple, but convincing, strategy, which aims at reducing both inputs of virgin materials and output of wastes by closing economic and ecological loops of resource flows”(p.765)	Closing economic and ecological loops
14	Sauvé et al. (2016)	“Production and consumption of goods through closed-loop material flows that internalize environmental externalities linked to virgin resource extraction and the generation of waste (including pollution)”(p.49)	Closed-loop of material flow
15	Stahel (2016)	“Loop (or circular) economy is to bring goods and molecules back into new use in a grave-to-cradle approach”(p.6)	Resource effectiveness

16	Murray et al. (2017)	<p>“The circular economy 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)</p>	Maximize ecosystem functioning
17	Geissdoerfer et al. (2017)	<p>“Circular economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimised 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)</p>	Regenerative system
18	Blomsma and Brennan (2017)	<p>“An emergent framing around waste and resource management that aims to offer an alternative to prevalent linear take-make-dispose practices by promoting the notion of waste and resource cycling”(p.603)</p>	Take-make-dispose practices
19	Cullen (2017)	<p>“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)</p>	Restorative and regenerative by design
20	Den Hollander et al. (2017)	<p>“The economic and environmental value of materials is preserved for as long as possible by keeping them in the economic system, either by lengthening the life of the products formed from them or by looping them back in the system to be reused” (p.517)</p>	Persevered material for long-life

21	Murray et al. (2017)	“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
22	Zink and Geyer (2017)	“Circular economy-the concept of closing material loops to preserve products, parts, and materials in the industrial system and extract their maximum utility”(p.1)	Closing material loops
23	Genovese et al. (2017)	“Circular economy pushes the frontiers of environmental sustainability by emphasizing the idea of transforming products in such a way that there are workable relationships between ecological systems and economic growth”(p.354)	Restoration and value addition in resources
24	Kirchherr et al. (2017b)	“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.”(p.224-225)	Creating environmental quality
25	Moreau et al. (2017)	“ A concept and practice, promoting closed material cycles by focusing on multiple strategies from material recycling to	Increased resource efficiency

		product reuse, as well as rethinking production and consumption chains toward increased resource efficiency” (p.497)	
26	Homrich et al. (2018)	“CE is a strategy that emerges to oppose the traditional open-ended system, aiming to face the challenge of resource scarcity and waste disposal in a win-win approach with economic and value perspective” (p.534).	Promoting resource resilience
27	Korhonen et al. (2018)	“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 utilises ecosystem cycles in economic cycles by respecting their natural reproduction rates”(p.39)	Maximizes the service produced
28	Suárez-Eiroa et al. (2019)	“Circular economy is a regenerative production-consumption system that aims to maintain extraction rates of resources and generation rates of wastes and emissions under suitable values for planetary boundaries, through closing the system, reducing its size and maintaining the resource’s value as long as possible within the system, mainly leaning on design and education, and with a capacity to be implemented at any scale” (p.14)	Regenerative production-consumption system

It is interesting to note that no definitions define the stakeholder aspects except (Murray et al. 2017), but rather described what CE constitutes for human well-being. There are a variety of available

definitions of CE and they are frequently referring to few dimensions, although they relate to different phrases, they fail to represent any guidance on how to manage stakeholders perspectives within these CE definitions. Circular economy order origin as a normative closed-loop strategy discipline becoming popular in 2003. Some scholars presented an inclusive treatment of CE definition which positions CE as a hybrid field intertwined from industrial ecology, natural resources and regenerative ecology system. Eco-effectiveness has been couched by CE to a great extent in which focus is to material extraction to continue use at the end of life and recycle.

Literature analysis reveals that there is still a need to realise benefits from industry 4.0 including co-creation and expansion of the circular economy. Additionally, there are no research studies which investigated what artificial intelligence management capabilities needed for successful industry 4.0 transformations. Internet of things applications in the CE are underutilised, and until now, there is a lack of research studies has been carried out regarding the implementation of Industry 4.0 in the resource conservation and closed-loop supply chain. CE as a regenerative concept inherently increases resource efficiency, effectiveness and encourage the continued use of the material as new strategic resource management. Literature shows that natural environmental system is changing as a response to activities in the last few decades. The purpose of CE is to develop a resource management strategy to achieve resource utilization at an optimal level and add value in the current consumption patterns. The circular economy is about continuous using products even after the end of life for downcycling or upcycling.

The definition of Circular Economy debate

The exponential growth of the CE concept is evident in recent literature, however, uptake and use of CE as strategic management literature are still at infancy. According to (Geng and Doberstein 2008) ecological modernization is a central concept in the circular economy. Kainuma and Tawara (2006) posited that environmental management is a sub-discipline of circular economy and include recycling, reuse concepts throughout the life cycle of services and products. Therefore, a key concern is the CE literature is what to consider in a traditional

sense in an analysis of the definition. Rather, McArthur has extended this concept and highlight the need to keep materials in continuous use, rather eco-efficiency which focuses on dump the material at the end of life or recycled. CE views the firm as a resource effectiveness entity, accomplish straight objective to support the natural environment and meet the interest and expectations of the various players and full fill demands. Towards this end, CE is intended to address the key questions, which material is to use continuous and which material is to be used. As such, management attention to resources planning and management is at the heart of CE strategy (Bocken et al. 2017).

Yuan and Shi (2009) and Zink and Geyer (2017) address CE as continuous use of the material and closing the loop. On the other hand, many authors explicitly address the multiple dimensions of the CE. In these papers (Cooper 1999; Liu et al. 2009; Stahel 2013) address the minimizing the environment impairment by reducing the material used. The remaining definitions, (MacArthur 2013; Webster 2015; Cullen 2017; Geissdoerfer et al. 2017; Murray et al. 2017; Suárez-Eiroa et al. 2019) focused exclusively on regenerative and restorative by design. Environmental and social issues were not solely characterized in any previous literature excepts (Geng et al. 2013; Kirchherr et al. 2017b; Murray et al. 2017). Blomsma and Brennan (2017) focused on the combination of taking make and dispose of and resource recycling. Den Hollander et al. (2017) highlighted the combination of environmental and economic ethics, and suggested that preserve material for the long-life. Genovese et al. (2017) focused on environmental sustainability by highlighting the importance of transforming a product that supports sustainable development consideration. Moreau et al. (2017) explicitly mentioned the importance of promoting closed material cycles and increase resource efficiency. Among the other CE characteristics examined, only the eco-efficiency and resource productivity were addressed by some of the definitions. None of the definitions was mentioned CE resilience as an adaptive ability to minimize environmental impairment and transforming products in such a notion of reusing and recovering material. The CE definition analysis revealed that so far, stakeholder perspective is not explicitly included in the definition, although stakeholder is considered to be part of a natural and ecology system. Stakeholder and resilience perspective is rarely discussed in the literature. This may help explain why these

dimensions were not mentioned and incorporated in the CE published definitions. Based on the CE definition analysis, reduction of material use, eco-efficiency and resource productivity, regenerative and restorative of resources, focus on closed-loop, maximize ecosystem functioning, persevered material for long-life and promoting resource resilience are used randomly in the definitions.

In essence, the circular economy is a set of practices aimed to keep products in its process after the end of life products. There are two main approaches, openly closed-loop supply chain and closed-loop supply chain. A traditional re-manufacturing is concerned with economic value. Unlike the traditional recycling process, the recycling process in the circular perspective integrates the economic and environmental concerns. The literature on CE is growing as both practitioners and researchers begin to realise that the management of raw materials and end of life product is critically important to meet the needs of future generations.

The characteristics of the circular economy(CE) identified in this paper provide the ground for proposing a new definition for CE. Building on the previous discussion in this paper, circular economy may be defined as:

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.

Altogether, this shows that the purpose of the CE is increased material utilization and promotion of material resilience. Previous literature on CE has examined on meso, micro and macro level (Kirchherr et al., 2017b). Ecological system theory (Bronfenbrenner 1979) can be seen as an important theoretical lens to understand the CE. Currently, CE indicators are measured at three-level, micro, meso and macro level. Following (Bronfenbrenner 1979) ecological system theory dimen-

sions, we extend it towards a better understanding of circular economy practices. A future research study with ecological system theory perspective may give further insights into our understanding of exo-system (firm does not experience and affect directly but indirectly by the external environmental forces, such as customers, competitors, buyers and social forces) and Chronosystem (is concerned with the environmental patterns influences on the firm circular economy practices over time). In exo-system, A firm does not experience and affect directly but indirectly by the external environmental forces, such as customers, competitors, buyers and social forces. In Chrono-system, a firm experienced and concerned with the continuous changing environmental patterns which influence on the firm circular economy practices over time.

However, how CE is to be understood by the business and consumer marketing still poses a challenge. CE has started to make an impact on a different aspect of the business value chains and extends through the entire supply chain. CE has been interpreted in a variety of ways, ranging from resource reduction to resource transformation. In this situation, more investigation is needed to carefully evaluate what specific type of digitization tools could have a significant impact on the management decision in restorative and regenerative use of material. Early CE initiatives tend to focus on resource reduction, but increasingly they are focusing on the adoption of sustainable development objectives.

Conclusion

In this chapter, the circular economy(CE) definition analysis is viewed from the manufacturing companies' perspective utilising a critical literature review. It may not possible to develop a standard definition; however, it is possible to develop insights to expand the current literature on how CE is defined. The literature analysis showed that there were varied CE characteristics i.e., Reduction of virgin material, resource-productivity and eco-efficiency improvement, restorative or regenerative system, closed-loop, the value of materials is preserved and take-make-dispose practices. 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. CE is diverging the application and use of natural resources rather than converging it. The concept of a CE is a value-orientated resource transformational process. CE considers both upstream and downstream production and consumption patterns to promote the resilience orientation of resources.

Given that research is still relatively new in the sustainable circular economy. CE offers a reverse resource regenerative idea to eliminate the linearity of production and consumption system to support sustainability objectives. CE is a tool of promotion of resilient sustainability objectives. CE is a new archetype for companies to achieve resource effectiveness and efficiency objectives by lowering their sustainability risks and impacts while raising material resilience. This chapter highlights the need that companies require new ways to define business models by incorporating eco-philosophy thinking. Circular economy business models set out pathways to provide opportunities for the dematerialization of resources throughout the product physical life cycle. CE is a practice of maximum utilization of material use across the whole life-cycle as well as deliver value addition in production and consumption. Literature addresses sustainability only in a few definitions, while resilience and stakeholder focus were not captured clearly by any of the published definitions. CE aims to integrate a system thinking approach as a way to achieve ecological efficiency and minimizing the environmental impairment into the material to support restorative and regenerative system and meets stakeholders' requirements and improve organizational triple-bottom-line performance. A future research study with ecological system theory perspective may give further insights into our understanding of exo-system, Chronosystem in addition to meso, macro and micro level system. CE embedded in the internet of things (IoT) is not yet a discipline that has attracted attention in many emerging countries. CE practices in this context are particularly difficult to achieve in the manufacturing industry because the product shipped to various customers and difficult to keep track of the product.

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