Journal of Cleaner Production 175 (2018) 525–543

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Review

The circular economy umbrella: Trends and gaps on integrating pathways

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ARTICLE INFO

Article history:
Received 28 June 2017
Received in revised form
8 November 2017
Accepted 9 November 2017
Available online 16 November 2017

Handling Editor: Cecilia Maria Villas Bôas de Almeida

Keywords:
Circular economy
Bibliometric study
Qualitative content analysis
Semantic analysis
Research
Publications
Social networks
Factor analysis

ABSTRACT

Among scholars, politicians and practitioners, the term "circular economy" (CE) has become increasingly familiar, but the concept comes from different epistemological fields and there is still a lack of consensus and convergence in the literature. This paper investigates the trends and gaps on the pathways convergence of the circular economy literature. The research method is a combination of semantic analysis, bibliometrics, networks and content analysis in a systematic literature review. The sample is composed of 327 articles extracted from the Web of Science and Scopus database. The results point out the lack of consensus on terminologies and definitions, thus, based on semantic analysis, a definition is proposed. In addition, the literature shows two main clusters, with different backgrounds, of different leading research groups in distinctive geographic regions. One cluster focuses on ecoparks and industrial symbiosis, mostly in the context of China. The second cluster is concerned with supply chains, material closed loops and business models.

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https://doi.org/10.1016/j.jclepro.2017.11.064
0959-6526/

1. Introduction

In the academic world, among politicians, and practitioners of real-life industrial operations, the term “circular economy” (CE) is being more frequently mentioned. Circular economy can be understood as “an idea and ideal” (Gregson et al., 2015, p.218) for facing the increasing limitations of Earth's natural resources (Meadows et al., 2004), facing the limitations as a new path to the transition to production and consumption for sustainability (Cooper, 2005).

Circular economy enables cyclical thinking, instead of having an open-ended conception of the value-added chain (Wuebbeke and Heroth, 2014), looking for “closed loops” (Bocken et al., 2016), or minimizing the consumption of virgin materials and energy (Wuebbeke and Heroth, 2014). However, “CE is emerging as an economic strategy rather than a purely environmental strategy”(Yuan et al., 2006), requiring a “complete reform of the whole system of human activity, which includes both production processes and consumption activities” (Yuan et al., 2006). The industrial structure and industrial policies reform must be adjusted to promote new technologies development in order to reach a solution by changing the waste recycling focus (Yuan et al., 2006; Tu et al., 2011).

Although the expression “circular economy” still remains open, in general it must include at least the notion of inputs reduction, reuse, and recycling waste; this naturally creates the necessity of optimized networks between companies and eco-industrial parks (Yu et al., 2013), exemplified by industrial symbiosis and extended product life (Gregson et al., 2015, p.218). In turn, the concepts within industrial ecology, such as cradle-to-cradle can be considered leading principles for eco-innovation, in which wastes are used as raw materials for new products and applications known as “zero waste economy” (Mirabella et al., 2014).

In order to move towards this new path, circular supply chain management (CSCM) is crucial, to enable new business models for the circular economy (Bocken et al., 2014) through the closing, narrowing and slowing of loops (Bocken et al., 2016). Product lifecycle thinking is fundamental from the beginning, from the design of the goods being manufactured, to ensure favorable and enabling conditions for disassembly and adaptation for reuse. This is also reflected in an alternative economic mindset based on reconditioning, remanufacturing and recycling (Gregson et al., 2015).

It is possible to say that the terminology around “circular economy” has been diverging rather than converging, and the term “closed loop” is often used in parallel (Bocken et al., 2016). Some authors also say that CE is a concept that emerged from the industrial ecology paradigm and has a closing-loop notion as its original central idea. (Yuan et al., 2006). In addition, distinctive research streams coming from different epistemological fields like biology, economy, and ecology provide a conceptual umbrella such as cradle-to-cradle (McDonough and Braungart, 2002), industrial ecology (Graedel and Allenby, 1995), and biomimicry (Benyus, 2002).

The present study aims to narrow the identified gap by performing a mapping study, analyzing the emergent literature on the circular economy from different fields, and exploring a large sample of publications. To accomplish this objective, this paper seeks to answer the following research questions:

- *(RQ#1) What are the main research streams, the core topics, authors, and journals?*

To achieve a more complete and inclusive understanding, based on the findings from this first question, the main definitions on circular economy are identified and used to develop a more comprehensive one, by answering the second research question:

- *(RQ#2) What is the definition of circular economy?*

To further analyze the circular economy content, the most recent ideas from this research area and identify future research agendas, the third question is proposed:

- *(RQ#3) What is the most up-to-date thinking, trends and gaps in the literature?*

To answer these questions, the research design merges semantic analysis, bibliometrics, network and content analysis in a systematic literature review. The paper is organized in six sections. Section 2 outlines the concept of CE and its theoretical foundations, followed by Section 3, which presents the research design. In Section 4, the results are presented by analyzing divergences in terminology around circular economy, applying bibliometrics, semantic analysis to present a comprehensive definition of CE, followed by the content analysis to answer the research questions. Sections 5 and 6 present the discussion and conclusions.

2. Literature review

The introduction of the concept of circular economy is associated with Pearce and Turner (1990) as mentioned in the papers of the following authors: Su et al. (2013); Ghisellini et al. (2016) and Geissdoerfer et al. (2017). They investigate the influence of natural resources on economic systems and the impacts of linear and open-ended perspectives.

Among firms and practitioners, the concept of circular economy has been disseminated by the Ellen MacArthur Foundation as “an industrial system that is restorative or regenerative by intention and design” (MacArthur, 2015) and driven by four principles: (i) waste is equal food; meaning that restorative loops is the central idea, (ii) building resilience through diversity, (iii) creating energy from renewable resources, and (iv) thinking in systems. To understand the closed loop concept, a butterfly diagram illustrates the two butterfly wings: the right is the technical and the left the biological closed loop (MacArthur, 2013).

However, from the academic perspective, there is a lack of consensus and various definitions of circular economy coexist, as discussed further in this paper and summarized in Appendix A. The most frequent research streams that refer to the foundation of CE are presented in Table 1. The concept of closed loops is one of the most frequently mentioned aspects related to CE; biological loops are more aligned to environmental and biology backgrounds, while technical closed loops are more aligned to economic and industrial perspectives. More recently, the fields of management and strategy are paying more attention to CE with a growing literature on circular business models (Linder and Williander, 2017; Lewandowski, 2016; Bocken et al., 2016).

With so wide a range of theoretical influences from different epistemological fields such as economy, biology, and environment, it is hard to achieve a consensus about what CE really is. This is what motivates this study.

3. Research methods

The research design combines quantitative and qualitative strategies. It merges bibliometrics, semantic and content analysis because these methods are complementary (Carvalho et al., 2013). Owing to the great number of academic publications, bibliometric