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► To cite this version:

Beatrice Colombo, Paolo Gaiardelli, Stefano Dotti, Albachiara Boffelli. Business Models in Circular Economy: A Systematic Literature Review. IFIP International Conference on Advances in Production Management Systems (APMS), Sep 2021, Nantes, France. pp.386-393, 10.1007/978-3-030-85906-0_43. hal-04022150

HAL Id: hal-04022150

<https://inria.hal.science/hal-04022150>

Submitted on 9 Mar 2023

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Business Models in Circular Economy: A Systematic Literature Review

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Abstract. Scientific literature lacks a comprehensive and extensive overview of business models built upon circular economy principles. Based on this premise, this paper performs a systematic literature review, through which it aims at identifying and then categorizing circular business models processed in the literature to date. Fifteen circular business models are identified and analysed. The results show that circular business models can be associated with different circular strategies, but that some are more studied than others. The research also indicates that each circular business model can be associated with one particular life cycle stage of a product-service, thus making it more suitable for a specific circular strategy.

Keywords: Systematic literature review, circular business model, circular economy.

1 Introduction

A Business Model (BM) is considered a fundamental driver for innovation [1]. Currently, the interest of academics and practitioners is moving towards sustainable BMs, as they are seen as a new source of competitive advantage [2]. In particular, with the recent emergence of Circular Economy (CE), the development of Circular Business Models (CBMs) has taken on a predominant role, for many reasons. Indeed, the introduction of a CBM leads to a number of positive effects in the environmental, financial, and social sphere, such as reduction of environmental impact, GDP growth, and creation of new jobs [3]. Moreover, at the micro-level, companies adopting CBMs reduce their costs, encounter new profit opportunities, improve their competitive advantage and foster their resilience in the long term [4]. Despite the significant benefits of adopting CBMs, the transition to sustainable BMs is often difficult to implement [5]. As shown by Kirchherr et al. [6] in their journey towards CBM, companies may encounter several barriers, which can be grouped into four main categories: cultural, regulatory,

market, and technological. Better awareness of possible strategies of CE and associated CBMs, with their distinctive features, would allow for more effective targeting of CBM adoption. Nonetheless, existing studies do not focus on analysing this relationship. Specifically, scientific literature lacks a comprehensive and extensive overview of all the BMs which can be implemented in order to capture CE principles into business practices. For instance, [7] found that only a few articles explore two or more CBMs concurrently. Based on these premises, this paper tries to bridge the existing gap by performing a systematic literature review. The goal is to create a comprehensive map of the main CBMs and their distinctive features. In addition, through the analysis of the state of the art, this paper aims to understand the relationship between each type of CBM and the main CE strategies, to help scholars to (re)direct their efforts within this research field and organizations to identify the proper actions to take in accordance with their circular strategy.

The paper is organized as follows: Section 2 outlines the methodology adopted to perform the systematic literature review, while Section 3 and 4 propose the main results of the final sample and the categorization of the papers based upon their content. Lastly, Section 5 discusses the results and concludes the work by also highlighting some limitations for future improvements.

2 Methodology

This paper performs a systematic review of the literature on the topic of CBMs. This methodology was identified as the best option to pursue the research objective, as it is widely used to explore emerging topics, investigate the development of specific research stream, and propose suggestions for future works [8]. In particular, the review process was structured by following the guidelines proposed by Tranfield et al. [9]. The material collection was carried out through Web of Science (WoS) and Scopus, as they are recognised as the most complete and exhaustive scientific databases. To capture all the studies concerning CBMs across the scientific community, the generic keyword “Circular Economy” combined with “Business model” was used as a research criterion in both databases. Moreover, the research record was “Topic” in WoS and “Title, Author keywords, Abstract” in Scopus. The first round returned 1161 results and was performed in August 2020. Then, in the second round, two selection criteria were applied. Specifically, only articles written in English and published after 2015 were considered, as the study aims at assessing the most innovative and recent publications in international academic research. Subsequently, duplicates of the two databases were removed, resulting in 754 unique records. In the fourth round, abstracts of all articles were carefully read to assess their relevance and alignment to the topic under investigation. In doing so, 678 articles were rejected. The remaining 76 sources were read in their entirety. Three cited articles were found to be of interest and therefore added to the search. Thus, the total amount of papers analysed was 79. Figure 1 shows all steps of the systematic literature review process.

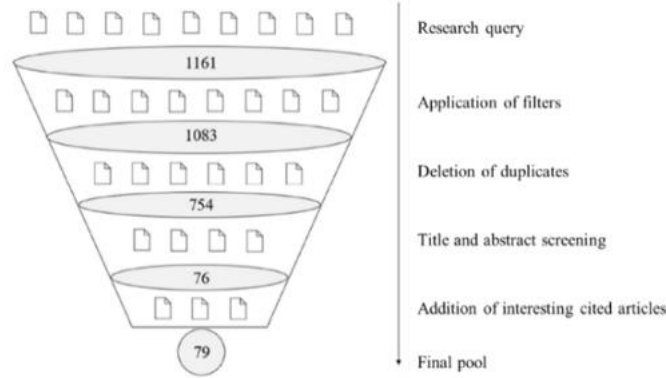


Fig. 1. Steps and number of papers along the systematic literature review

3 Papers descriptive analysis

In this section, the analysis of the documents selected through the systematic literature review is presented. In detail, the study reveals the growth of publications over the selected period, reaching a peak in 2019 with 27 articles. This result proves the increasing scientific interest in this research field. The analysis also indicates that articles are mainly concentrated in Journals focused on the environmental field. The same evidence is provided by the analysis on the application field, which shows that “Environmental Sciences” occupies a core placement. Nevertheless, data depict that other sectoral areas, such as Energy, Business and Management, Engineering and Social Sciences are at the forefront of the debate. Finally, the study reveals that most of the documents involve several areas, emphasising the interdisciplinary nature of research. This feature is partly in line with the definitions of CBM proposed in the literature, which, although different, agree that a CBM has an impact not only on the company and its stakeholders but also on society as a whole [10], addressing economic, environmental and social aspects through a systemic and transdisciplinary perspective, i.e. involving science and society in the development of integrated knowledge [11].

4 Paper categorization

As shown in Table 1 and briefly described in the following, the review of the scientific literature identified fifteen types of CBM, each with its distinctive features, and groupable into homogenous groups according to the circular strategies proposed by Bocken et al. [12] and, subsequently revised by Geissdoerfer et al. [13]. These are: closing, narrowing, slowing, intensifying, and dematerializing.

4.1 Closing loop strategy and relevant CBMs

A closing loop strategy involves all BMs which seek to maintain the value of the product by exploiting the materials of which it is made of [14]. Recycling, organic feedstock, and industrial symbiosis are the three main CBMs belonging to this group. The former focuses on activities that transform waste into raw materials for manufacturing new products, which can be either the same as or different from those recycled [15]. The second proposes biomass as an input for production processes, thus closing the resource loop [14]. In fact, the organic feedstock can be converted into energy sources. Industrial symbiosis, instead, is to use the production waste of one company as an input for the processes of another company. In doing so, resources remain longer in the cycle, leading to a reduction in the demand for virgin raw materials [16], and, also, decreasing the amount of waste disposed of in landfills [17].

4.2 Narrowing loop strategy and relevant CBMs

This strategy focuses on reducing resources that enter production processes [12]. It encompasses three types of CBM: resource efficiency, produce on demand, and renewable sources. Resource efficiency aims to optimize the use of virgin material and the consumption of other resources, such as water and energy, during the production phase [18]. In the produce on demand, the supplier produces only if there is demand and the products have already been ordered [19]. A company that uses renewable sources can reduce its greenhouse gas emissions [20] and the impact on natural capital [21].

4.3 Slowing loop strategy and relevant CBMs

Slowing loop concerns all BMs which seek to extend the life of the product by exploiting its value for as long as possible [12]. These are long-life products, repair and maintenance, remanufacturing and reuse. The first focuses on prolonging the intrinsic life of the products through functional and aesthetic improvements that make them more resistant to damage and wear over time, encouraging users to keep them in use [22]. The second is based on the direct sale of products with associated maintenance services that make the goods last longer [23]. The third, instead, consists of rebuilding a used or unwanted product by replacing non-functional parts with new ones [24]. Finally, the fourth concerns the offer of used products that can be sold without any changes or in a slightly improved form, by cleaning and repairing small defects [21].

4.4 Intensifying loops strategy and relevant CBMs

An intensifying loop strategy stresses the importance of a more intensive use phase [13]. In particular, it involves four CBMs such as sharing economy, access model, performance model, and sufficiency economy. Sharing economy encourages manufacturers to operate as service providers and to consider customers no longer as product owners or buyers, but as users [25]. The supplier continues to own the good throughout its life cycle and is responsible for end-of-life strategies [26]. Instead, the access model provides a product-oriented offer in which the value is given by temporary access to

products. Specifically, companies have a continuous flow of revenues coming from subscriptions or rental payments [25]. Similarly, in the performance model, the customer buys the product performance or specifically defined results rather than the product itself [23]. Lastly, the sufficiency economy aims at moderating the consumption of end customers, thus, it represents a radical change in the concept of traditional value acquisition [27].

4.5 Dematerializing strategy and relevant CBMs

A dematerializing strategy is related to the formulation of a digitalization CBM which concerns the virtualization of tangible assets [24]. In this case, firms acquire the value through revenues from subscription contracts for services offered [11].

Table 1. Classification of CBMs and related percentages of papers (% per Circular strategy may be greater than 100% as one article can be associated with several CBMs).

Circular strategy	CBM	% of papers	% per Circular strategy
Closing	Recycling	30.6%	55.6%
	Organic feedstock	8.3%	
	Industrial symbiosis	16.7%	
Narrowing	Resource efficiency	13.9%	33.3%
	Produce on demand	8.3%	
	Renewable sources	11.1%	
Slowing	Long-life products	16.7%	64.0%
	Repair and maintenance	5.6%	
	Remanufacturing	25.0%	
Intensifying	Reuse	16.7%	114.0%
	Sharing economy	30.6%	
	Access model	38.9%	
	Performance model	38.9%	
	Sufficiency economy	5.6%	
Dematerializing	Digitalization	11.1%	11.1%

5 Discussion, Conclusion and Further Research

Although each CBM could be studied in more detail in the future, this initial analysis allows some insights to be extracted. First of all, it is possible to state that the topic has gained momentum over time, but that attention of academia and industry has not been paid to the different CBMs with the same intensity. Indeed, the study shows that research has mainly been focused on CBMs belonging to intensifying, slowing and closing strategies, such as sharing economy, access model, performance model, remanufacturing and recycling. Therefore, it can be stated that academics have been interested

both in the issue of waste management and valorisation and in exploring new approaches to changing the way products and services are offered to customers. The attitude is perhaps still too much oriented towards a traditional view, where circular actions are mainly carried out to eliminate problems by reducing or decelerating their effects but not by acting on their causes, thus leaving the tendency to the immoderate consumption of resources unchanged. Narrowing and dematerializing circular strategies, instead, are significantly less studied than the others. This might be due to the fact that the CBMs belonging to a narrowing strategy require substantial changes to the way a company does business, e.g. by reducing the amount of resource input or producing on demand, while the dematerializing strategy concerns a relatively new subject and not yet closely related to the concept of CE. However, applying CBMs related to these two circular strategies could provide significant results for the environment, society and economy, as they are directly linked to the principle of reduction, which is considered the most important factor of CE as its implementation allows the problem to be solved at source [27]. The analysis also has revealed the key role of *servitisation* in supporting circular strategies, as highlighted by many CBMs based upon the idea of loss of ownership in favour of service provision. In particular, performance and access model have been increasingly studied over the last few years. Contrariwise, the sufficiency economy received less attention. This may be due to the different origin of the change in perspective and habits of the end customer. While *servitisation*, in fact, derives from a market need and is, therefore, more natural (pull), whereas the latter derives from the will of the company and is more difficult to implement (push).

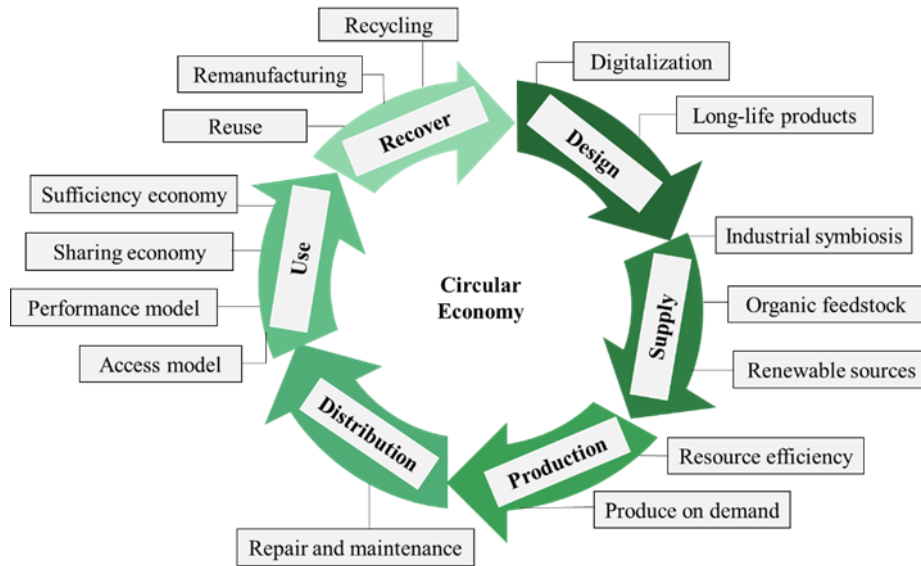


Fig. 2. Classification of CBMs according to the stage of the product life-cycle that most influences

As shown in Figure 2, the study also made it possible to understand that each CBM is able to influence each phase of the life cycle of a product-service with different intensity. In other words, some CBMs belonging to the same circular strategy are not placed in the same stage of the life cycle. This is due to the fact that, despite aiming to pursue the same goal, they try to achieve it in different ways. Therefore, this study could help companies understand which is the most suitable CBM to adopt once they have established the circular objective to be leveraged or rather identify the best set of CBMs to be adopted at the same time to involve all stages of the life-cycle.

Finally, this study presents some limitations. First of all, the categorization of the information is necessarily affected by researcher bias. This was reduced by describing the research process as transparently as possible and by relying on well-established categories. Furthermore, only the scientific literature has been included in this study. The inclusion of grey literature could result in an important contribution to the topic, especially concerning practical examples of CBM implementation. The latter represents a promising future research avenue. Lastly, given the level of generality of the approach used in this discussion, it might be interesting in future studies to focus more attention on the most suitable CBMs with reference to the production characteristics and/or the different levels of the supply chain.

References

1. Chesbrough, H.: Business model innovation: Opportunities and barriers. *Long Range Plann.* 43, 354–363 (2010). <https://doi.org/10.1016/j.lrp.2009.07.010>
2. Nidumolu, R., Prahalad, C.K., Rangsawami, M.R.: Sustainability is the key driver of innovation. *Harv. Bus. Rev.* 87, 56–64 (2009)
3. Ferronato, N., Rada, E.C., Gorritty Portillo, M.A., Cioca, L.I., Ragazzi, M., Torretta, V.: Introduction of the circular economy within developing regions: A comparative analysis of advantages and opportunities for waste valorization. *J. Environ. Manage.* 230, 366–378 (2019). <https://doi.org/10.1016/j.jenvman.2018.09.095>
4. Rizos, V., Behrens, A., Kafyke, T., Hirschnitz-Garbera, M., Ioannou, A.: The Circular Economy: Barriers and Opportunities for SMEs. CEPS Working Documents No. 412/September 2015. CEPS Work. Docuemnts. (2015)
5. Geissdoerfer, M., Vladimirova, D., Evans, S.: Sustainable business model innovation: A review, (2018)
6. Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., Hekkert, M.: Barriers to the Circular Economy: Evidence From the European Union (EU). *Ecol. Econ.* 150, 264–272 (2018). <https://doi.org/10.1016/j.ecolecon.2018.04.028>
7. Merli, R., Preziosi, M., Acampora, A.: How do scholars approach the circular economy? A systematic literature review, (2018)
8. Goodwill, G.M., Geddes, J.R.: Introduction to systematic reviews, <http://journals.sagepub.com/doi/10.1177/0269881104042629>, (2004)
9. Tranfield, D., Denyer, D., Smart, P.: Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *Br. J. Manag.* 14, 207–222 (2003). <https://doi.org/10.1111/1467-8551.00375>
10. Guldman, E., Huulgaard, R.D.: Barriers to circular business model innovation: A multiple-case study. *J. Clean. Prod.* 243, (2020). <https://doi.org/10.1016/j.jclepro.2019.118160>

11. Pieroni, M.P.P., McAloone, T.C., Pigosso, D.C.A.: From theory to practice: systematising and testing business model archetypes for circular economy. *Resour. Conserv. Recycl.* 162, (2020). <https://doi.org/10.1016/j.resconrec.2020.105029>
12. Bocken, N.M.P., de Pauw, I., Bakker, C., van der Grinten, B.: Product design and business model strategies for a circular economy. *J. Ind. Prod. Eng.* 33, 308–320 (2016). <https://doi.org/10.1080/21681015.2016.1172124>
13. Geissdoerfer, M., Morioka, S.N., de Carvalho, M.M., Evans, S.: Business models and supply chains for the circular economy. *J. Clean. Prod.* 190, 712–721 (2018). <https://doi.org/10.1016/j.jclepro.2018.04.159>
14. Lüdeke-Freund, F., Gold, S., Bocken, N.M.P.: A Review and Typology of Circular Economy Business Model Patterns. *J. Ind. Ecol.* 23, 36–61 (2019). <https://doi.org/10.1111/jiec.12763>
15. Ünal, E., Urbinati, A., Chiaroni, D.: Managerial practices for designing circular economy business models: The case of an Italian SME in the office supply industry. *J. Manuf. Technol. Manag.* 30, 561–589 (2019). <https://doi.org/10.1108/JMTM-02-2018-0061>
16. Rosa, P., Sassanelli, C., Terzi, S.: Circular economy in action: Uncovering the relation between circular business models and their expected benefits. In: *Proceedings of the Summer School Francesco Turco*. pp. 228–235 (2018)
17. Fraccascia, L., Magno, M., Albino, V.: Business models for industrial symbiosis: A guide for firms. *Procedia Environ. Sci. Eng. Manag.* 3, 83–93 (2016)
18. Salvador, R., Barros, M.V., Luz, L.M. da, Piekarski, C.M., de Francisco, A.C.: Circular business models: Current aspects that influence implementation and unaddressed subjects, (2020)
19. Marke, A., Chan, C., Taskin, G., Hacking, T.: Reducing e-waste in China's mobile electronics industry: the application of the innovative circular business models. *Asian Educ. Dev. Stud.* 9, 591–610 (2020). <https://doi.org/10.1108/AEDS-03-2019-0052>
20. Ghisellini, P., Cialani, C., Ulgiati, S.: A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *J. Clean. Prod.* 114, 11–32 (2016). <https://doi.org/10.1016/j.jclepro.2015.09.007>
21. Henry, M., Bauwens, T., Hekkert, M., Kirchherr, J.: A typology of circular start-ups: Analysis of 128 circular business models. *J. Clean. Prod.* 245, 118528 (2020). <https://doi.org/10.1016/j.jclepro.2019.118528>
22. Singh, J., Cooper, T., Cole, C., Gnanapragasam, A., Shapley, M.: Evaluating approaches to resource management in consumer product sectors - An overview of global practices. *J. Clean. Prod.* 224, 218–237 (2019). <https://doi.org/10.1016/j.jclepro.2019.03.203>
23. Planing, P.: Towards a circular economy – How business model innovation will help to make the shift. *Int. J. Bus. Glob.* 20, 71–83 (2018). <https://doi.org/10.1504/IJBG.2018.10009522>
24. Lewandowski, M.: Designing the business models for circular economy-towards the conceptual framework. *Sustain.* 8, 1–28 (2016). <https://doi.org/10.3390/su8010043>
25. Urbinati, A., Chiaroni, D., Chiesa, V.: Towards a new taxonomy of circular economy business models. *J. Clean. Prod.* 168, 487–498 (2017). <https://doi.org/10.1016/j.jclepro.2017.09.047>
26. Widmer, T., Tjahjono, B., Bourlakis, M.: Defining value creation in the context of circular PSS. *Procedia CIRP.* 73, 142–147 (2018). <https://doi.org/10.1016/j.procir.2018.03.329>
27. Bocken, N.M.P., Short, S.W.: Towards a sufficiency-driven business model: Experiences and opportunities. *Environ. Innov. Soc. Transitions.* 18, 41–61 (2016). <https://doi.org/10.1016/j.eist.2015.07.010>