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CIRCULAR BUSINESS MODELS: AN ANALYTICAL PERSPECTIVE

Modelos de Negócios Circulares: Uma Perspectiva Analítica

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Abstract

The practices of Circular Business Models (CBMs) are valuable for the implementation of Circular Economy (CE). The objective of this study is to analyze the CBMs, considering the typologies, characteristics and attributes, practices related to their implementation and governance models adopted. The methodology used is a Systematic Literature Review, where 127 articles were analyzed using the Start software. The results show that in 66% of the cases, the business models used are the ReSOLVE Framework, 3Rs, product as a service or extended product life cycle. The attributes of value creation, synergy with product design, recycling trend and value capture are present in 59% of the business models; The types of practices highlighted were end-of-life recycling, product life cycle, product recovery and end-of-life management representing 51% of the mapped practices; In 61% of the cases, governance models were based on innovation programs, customer-oriented governance, product and service change and sustainability-oriented innovation. Theoretical contributions are associated with the mapping of typologies, characteristics and attributes, practices related to their implementation and governance models adopted by CBMs and a table, with 55 sets of typologies that guide CBMs. For practice, the steps of the application cycle of the typologies are presented. As a limitation, the growing number of publications is pointed out, which directly affects the results of the sample used and it is recommended for future studies, to explore the role of the typologies adopted, in the performance of the MNCs. For the practice, we contribute with an example of the steps of the application cycle of the typologies. As a limitation, the growing number of publications is pointed out, which directly affects the results of the sample used and it is recommended for future studies, to explore the role of the typologies adopted, in the performance of the CBMs.

Keywords*:* Circular Business Models. Circular Economy. Typologies.

Resumo

As práticas dos Modelos de Negócios Circulares (MNCs) são valiosas para a implementação da Economia Circular (EC). O objetivo deste estudo é analisar os MNCs considerando as tipologias, características e atributos, práticas relacionadas à sua implementação e modelos de governança adotados. A metodologia utilizada é uma Revisão Sistemática da Literatura, onde 127 artigos foram analisados por meio do software Start. Os resultados mostram que em 66% dos casos, os modelos de negócios utilizados são o Framework ReSOLVE, 3Rs, produto como serviço ou ciclo de vida do produto prolongado. Os atributos de criação de valor, sinergia com design de produto, tendência de reciclagem e captura de valor, estão presentes em 59% dos modelos de negócios; Os tipos de práticas destacadas foram reciclagem de fim de vida, ciclo de vida de produto, recuperação de produto e gestão de fim de vida representando 51% das práticas mapeadas; Em 61% dos casos, os modelos de governança foram baseados em programas de inovação, governança orientada para o cliente, mudança de produto e serviço e inovação orientada para a sustentabilidade. As contribuições teóricas, estão associadas ao mapeamento das tipologias, características e atributos, práticas relacionadas à sua implementação e modelos de governança adotados pelos MNCs e uma tabela, com 55 conjuntos de tipologias que orientam os MNCs. Para a prática, contribui-se com exemplo dos passos do ciclo de aplicação das tipologias. Como limitação, aponta-se o número crescente de publicações, que afeta diretamente os resultados da amostra utilizada e recomenda-se para estudos futuros, explorar qual o papel das tipologias adotadas, no desempenho dos MNCs.

Palavras-chave*:* Modelos de Negócios Circulares. Economia Circular. Tipologias.

1. Introduction

Circular Business Models (CBMs) emerge as an alternative to operationalizing a closed-loop production and consumption system (Zink & Geyer, 2017; Jensen, Prendeville, Bocken, & Peck, 2019). They are alternatives that seek to contribute to the circulation of resources as raw materials and reveal multiple shared value opportunities (Ellen MacArthur Foundation, 2015; Jensen, Prendeville, Bocken, & Peck, 2019). Adopting an CBMs involves increasing demands from management on human and economic factors and is directly related to the type of business the company operates (Wells & Zapata, 2012; Tisserant, Pauliuk, Merciai, Schmidt, Fry, Wood, & Tukker, 2017). Business models need to understand the types and possibilities for closing production cycles so that they can understand characteristics and attributes and can assert implementation practices in an assertive manner, thereby avoiding errors in the path to a circular economy (Ashton, 2008; Muranko, Andrews, Chaer, & Newton, 2019).

In this context, the questions that gave rise to this study emerge from the literature: what are the circular business models that companies adopt to make their supply chains sustainable? What are the circular economy practices adopted to operationalize these business models? What are the governance structures that allow the deployment of circular business models? What are the theories that are mobilized to discuss in the scientific environment the theoretical framework of circular business models? This set of questions motivates us to seek to answer the following objective: to analyze the Circular Business Models (CBMs) considering their typologies, characteristics and attributes, practices related to their implementation, adopted governance models and associated indicators.

The practical justification for this study is associated with the operationalization of the circular economy in organizations. There is a need for understanding how to make the circular economy a reality (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). Knowing what to do, how to do it, and who is responsible for driving change is vital. As well as identifying the governance structure adopted to transform the circular economy into a business model compatible with the reality of different industrial, commercial and societal contexts. To assimilate how, through which actions, practices, mechanisms, organizations implement CBMs. Know the theoretical frameworks that support the studies related to CBMs, and especially, understand how the academy investigates the CBMs and the relevant evidence mapped in these investigations. The theoretical justification of this study is associated with the advancement of the research field of CBMs. It is hoped to contribute to the presentation of an overview that illustrates and relates CBM types to circular practices and governance structures. Thus, further studies may use this analytical framework for empirical validation in different productive sectors and service providers.

The social relevance of the study is associated with encouraging the adoption of CBM, aiming at minimizing waste and waste, using cleaner and more efficient industrial resource processing alternatives, closing production cycles and providing services through modern alternatives. polluting and highly attractive for a sustainable production and consumption model. The article is structured in five sections, the first being the introduction to the subject and presentation of the objectives of the article. The second, a theoretical section that deals with CBMs, followed by the section that describes the methodological course of the study. The fourth section presents the results obtained and the fifth and last section presents the discussion of the results and the final considerations.

2. Circular Business Models (CBMs)

CBMs, by definition, adopt a set of practices that seek to contribute to maintaining resources in circulation in order to reduce waste and consumption of raw materials (Muranko, Andrews, Chaer, & Newton, 2019). Similarly, different types of business models are adopted for operationalizing the circular economy in organizations, namely remanufacturing (Jensen, Prendeville, Bocken, & Peck, 2019) or resource recovery (Geissdoerfer, Vladimirova, & Evans, 2018). ReSOLVE (EMF, 2015), 3Rs (Ranta, Aarikka-Stenroos, & Mäkinen, 2018), 4Rs (Allwood, Ashbya, Gutowski, & Worrell, 2011), 5Rs (Lacy & Rutqvist, 2015), 9Rs (Van Buren, Demmers, Van der Heijden, & Witlox, 2016), 10Rs (Kirchherr, Reike, & Hekkert, 2017), Circular Supply (Geisendorf & Pietrulla, 2017), Product Lifecycle Extension (Aboulamer, 2017; Geissdoerfer, & Pietrulla, 2017), Platforms sharing (Dentchev et al., 2018), products as a service (Tukker, 2015), and payment for use (Bocken, Mugge, Bom, & Lemstra, 2018).

CBMs have been identified as facilitators for companies moving toward circular practices. They help extend the life of products and parts through successive cycles of reuse, repair, and remanufacturing (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). The understanding of circularity, referring to the closure of material and energy use cycles, is not new and constantly evolving (Gaustad, Krystofik, Bustamante, & Badami, 2018). It broadly involves the development of products in which it is possible to extend the shelf life of raw materials that have already been extracted from the biosphere. There are several ways to do this, such as by reusing a product or its components after its initial use is completed. The Product Service System (PSS) or Servitization approach integrates products and services to meet customer needs. This is a less resource-intensive business model, as consumers adopt a product service without taking ownership of it (Bressanelli, Perona, & Saccani, 2017). This implies a greater responsibility of the manufacturer for the product, as well as extending its use and replacing a new purchase with the use of the product only when necessary.

The advancement of CE requires institutional changes and an ability on the part of companies to adapt and adjust to changes (Daddi, Nucci, & Iraldo, 2017). The incorporation of EC resources into a business model depends on the specific context and on combinations of regulatory, normative, and culture-cognitive institutional features that influence activities in different ways (Antikainen & Valkokari, 2016). The necessarily normative definition of business success is an important starting point for business model development, which can be viewed as a conceptual model of logic for achieving desired outcomes (Upward & Jones, 2015).

The transformation of institutionalized social reality in organizations is seen as something long, difficult and often painful of creative destruction, leading to the incorporation of new values embedded in symbolic practices and meanings, from which a new identity emerges as part of the process of institutional transformation. which the company goes through (Randles & Laasch, 2015). As such, the proactive stance of becoming strongly sustainable and at the same time identifying the possibility of thriving as a legitimate business objective means a holistic and perhaps radical change for business and society (Upward &

Jones, 2015). Since such a stance demands that stakeholders, including managers, compose a normative collective understanding of business success that is, in fact, appropriate to local circumstances and shared worldviews. Companies need to collaborate with stakeholders to ensure reverse logistics, for example, allowing them to maximize the value of the products and materials they use (De Angelis, Howard, & Miemczyk, 2017; Gupta, Mejia, & Kajikawa, 2019). Thus, value creation and delivery of CBMs must invariably incorporate multiple stakeholders in the innovation process as collaborative partners. Such partners may differ from those taken as conventional value chain partners as they will be profoundly affected by the process (Bocken, Schuit, & Kraaijenhagen, 2018; Bocken & Short, 2020).

Circular Economy (CE) spells out increasing real pressure on existing resources, as circularity in the economy induces stakeholders to collaborate to maximize the value of products and materials, thereby contributing to minimizing the depletion of natural resources. and create positive social and environmental impact (Lacy, Long, & Spindler, 2020). Product design professionals, in this sense, in addition to thinking about the product itself, need to think about systems around products and reinvent how they can generate revenue by creating and maintaining value over time (Bocken, De Pauw, Van der Grinten, & Bakker, 2016). Circular logic is about capturing, creating and delivering value in innovation-induced closed cycles. Innovations processed in circular models occur in a network, with collaboration, communication, and arrangement of complex dependency connections between stakeholders and stakeholders (Bocken, Schuit, & Kraaijenhagen, 2018).

In order for CE to indeed emerge as a growth model, it must be able to effectively fulfill the juxtaposition of economic growth and sustainability. If companies are unable to compete economically with the current linear “have, do, and undo” model, implementing EC becomes a difficult process. The circular business model should provide a fundamental basis for the discussion of generating economic value in business (Ranta, Aarikka-Stenroos, & Makinen, 2018).

The perception of economic viability through reducing environmental impacts involves business model innovation, integrated product lifecycle planning, and value creation for each cycle (Bocken & Ritala, 2021). A key approach employed to foster model innovation is the study of process management and business practices. Modeling representations potentially systematize and reduce system complexity by revealing tacit structures to help understand and communicate how circular business happens, generating and developing new ideas, and removing obstacles to innovation (Blomsma & Brennan, 2017; König, Ungerer, Baltes, & Terzidis, 2018). However, in CBMs, there are no visualization tools that enable product lifecycle planning in a way that creates and captures value across various closed-material cycles and loops, as well as capturing how elements are adjusted to effectively implement, each step of the cycle (Levesque, Pietzcker, & Luderer, 2019).

The different EC processes and principles lead directly or indirectly to value creation for those involved (Ghisellini, Cialani, & Ulgiati, 2016). Some activities may be driven by performance enhancement, product design, technology transfer, or remanufacturing, recycling, reuse, among others. The transition to MNCs helps mitigate negative effects, especially related to the generation of environmental damage from the production of goods and services, controlling negative externalities and reducing indirect costs, which until then have not been measured by sustainability models (Romero & Rossi, 2017). Increased performance can be achieved, in turn, through better process control, equipment and technology modification, efficient practice sharing, and virtualization (Kirchherr, Reike, & Hekkert, 2017). Process control involves not only optimization by eliminating unnecessary losses such as spills, leaks, overheating, but also effective process planning and regulation to ensure optimal conditions. This requires, for example, continuous monitoring and efficient management, promoting a sense of environmental awareness in the teams, incentive mechanisms for optimal action, based on lean production and management thinking (Levanen, Lyytinen, & Gatica, 2018; Baumber, Scerri, & Schweinsberg, 2019).

Dematerialization is another strategy, indicated by Ünal, Urbinati, and Chiaroni (2018), which supports and enables EC resources and efficiency goals. The topic is widely discussed in the context of sustainable economic growth, considering that it refers to the reduction of materials needed to provide an economically efficient service intended. This can be accomplished in different ways. At the highest level, it involves a paradigm shift to fit into service-based economic models. Service economies (eg tourism, hospitality, finance, trade, transportation, government) often require less resource use and environmental impact than industrial economies (eg mining, manufacturing, construction), and therefore a Changing from a product economy to a service economy is considered more sustainable (Lazarevic & Valve, 2017).

Circularity, in this context, refers to concrete actions to obtain greater resource productivity, aiming to reduce waste and avoid waste generation, in which the flows of materials and technical nutrients are recycled in the industrial system (Govindan & Hasanagic, 2018). The closing of biological cycles, as occurs with technicians, demands to optimize the yields of natural resources, promoting the circulation of products, components, and materials always at their maximum level of utility. Cycle closure can be reinforced by bringing the industrial system into the reality of scarcity and urgency of new modes of production (Zhong & Pearce, 2017). At the community, company, or consumer unit level, value can be continually generated as post-consumer products are used to produce new products, for example. Similarly, when materials flow in this circle, less energy is consumed and less waste is emitted. What would be needed to satisfy the same desire for consumption in the circular economy paradigm is less offensive in the middle than with a traditional manufacturing paradigm (Lacy, Long, & Spindler, 2020).

The validity of the circular business model can be assessed against a variety of criteria such as turnover, margins, capital intensity, implementation time, supplier dependency, possible use of recycled, remanufactured or reused materials. , use of sustainable materials, additive manufacturing benefits, life cycle percentage, product-oriented, and guidance services (Blomsma, 2018). What is noticeable, especially in emerging economies, is that there is a void of formal policies and structures for the realization of such validity, which leads to the weakening of the principles and application of the circular economy. Among the main causes, Reike, Vermeulen, and Witjes (2017) cite the lack of political will, the precariousness of solid waste management policies, norms, and regulations, as well as the lack of qualified specialists at all levels of activity. Successful implementation of EC models depends on the synergy between the fundamental building blocks, including product design, new business models, reverse logistics, enablers, and system conditions.

The criteria for measuring the viability, validity, and profitability of circular business models should be adjusted to the micro, meso and macro-level of implementation (Lewandowski, 2016). The metrics refer to measuring the ecological footprint, financial value added by the recovery of materials and goods, revenue growth, among others (Ghisellini, Cialani, & Ulgiati, 2016). Other key indicators are pointed out by Laubscher and Marinelli (2014), who evaluate the performance of the circular model by revenue from repairs, reused parts, refurbished products, used material, the value of the recycled product after period X, second product revenue, hand, resource reuse times, the value of the technical life of the products, by-products used, resource separability, toxic materials used and leased products, among others (Korhonen & Granberg, 2020).

CE measurement indicators represent the intensity with which society is interrelated with nature and aims to prevent the depletion of resources, energy, and materials (Antikainen & Valkokari, 2016). Achieving this circular model requires cyclical and regenerative environmental innovations in the way society legislates, produces and consumes, in order to implement a differentiated development strategy, aiming to protect the environment and resources. This occurs at different levels through resource and energy recirculation, resource demand minimization, and value recovery (Prieto-Sandoval, Jaca, & Ormazabal, 2018).

The development of CE tools is associated with a circular design, essential for the presentation of practical and tangible results (Ünal, Urbinati, & Chiaroni, 2018). Extending the life cycle of products, resources or energy, reducing the emission of toxic materials and waste, as well as closing the production cycle requires the development of the circular design. Saidani, Yannou, Leroy, Cluzele, and Kendall (2018) point out five possible strategies to be implemented for their implementation: design focused on circular products; conservation of material resources and energy; design for extended use of product life; multi-cycle design; and design for systems change.

Saidani, Yannou, Leroy, Cluzel, and Kendall (2018) also propose a set of key indicators to identify different forms of circular economy measurement segmentation, based on a plurality of previous studies already consolidated. The author's index ten broad categories that bring together the different forms of understanding the circular economy based on indicators. The first comprises performance at implementation levels, divided into macro-level (city, state or province, region, country), meso level (symbiosis association) and micro-level (organization, product, consumers). The second characterizes the system feedback loops, such as maintaining, extending, reusing, recycling, refurbishing, with a focus on product design, operation, and end-of-life, mainly related to technical cycles, except biological ones. The third category considers circularity as a central element. Performance is associated with intrinsic or consequential circularity, considering that the focus of evaluation should be on both progress (resource efficiency, material consumption), and transition effects (evolution of energy consumption, the value of products and services). The fourth category, like the previous ones, is associated with the circular economy paradigm, adding the temporal element to the analysis. It is retrospective or prospective, especially in distinguishing what is actually real and what is the potential circumstance, since it is pertinent to evaluate transitions by measuring progress at the pre- and post-process stage (Saidani, Yannou, Leroy, Cluzel, & Kendall, 2018).

The fifth category, relates to the effects on the possible uses of available indicators, and this is susceptible to the subjectivity of users who make use of the indicator. The sixth deals with the transversality of indicators between sectors, segments or industries. They are indicators applicable to all sectors and types of companies, regardless of their size, location or industry. The focus is on providing operational responses and practical applications. The seventh (Saidani, Yannou, Leroy, Cluzel, & Kendall, 2018) is intended to differentiate the dimensionality of indicators for decision making and provide a greater degree of intelligibility for product evaluation specialists. The eighth dimension indicates the units of analysis, distinguishing qualitative from quantitative approach in terms of measurability. The analysis of the transition process itself to the circular economy already means the gathering of quantitative and / or qualitative data. The ninth level comprises the format of the evaluation framework associated with the indicators in order to facilitate their measurement. The last category deals with the fundamentals and sources of the indicators, by research agents, industrial organizations or consultancy agents, and governmental or environmental organizations.

Tacitly, these changes have to be economically, socially and environmentally sustainable to ensure a successful implementation of the circular economy, enabling the efficiency and effectiveness of its long-term maintenance (Kalmykova, Sadagopan, & Rosado, 2017). Therefore, the implementation of circular economy strategies, considering their practices and distinct procedures, as well as evaluation metrics, requires new business models (Ünal, Urbinati, & Chiaroni, 2018) with improved technologies, strengthening cooperation networks and knowledge transfer, as well as a redefinition of industrial processes and products through innovation.

3. Methodological procedures

This study consists of a systematic literature review on the topic of circular business models. Search strings (("Circular Business Model") OR ("Circular Economy Business Model") OR ("Sustainable Business Model") AND ("Circular Econmy")) were defined. The search was performed on January 25, 2019. The databases consulted for the study were Scopus, Web of Science and Science Direct. The reason for searching these databases is related to the number of journals indexed by them, and Scopus is the one with the largest coverage worldwide, currently covering 16,500 peer-reviewed journals in the scientific, technical, and scientific fields. of medical and social sciences. Scopus is the largest database of peer-reviewed abstracts and citations in the literature: scientific journals, books, congressional processes, and industry publications (Scopus, 2019). Complementarily, it was the 3 previously named databases that produced the best result in terms of coverage of articles published on the subject. Searches were performed in the Sage, Wiley, Spring, Spell and Emerald databases, but the articles found were already covered by the previous databases, which was considered the exclusion criteria of these databases for the mapping of articles for this study. Figure 1 presents the steps taken to accomplish the work.

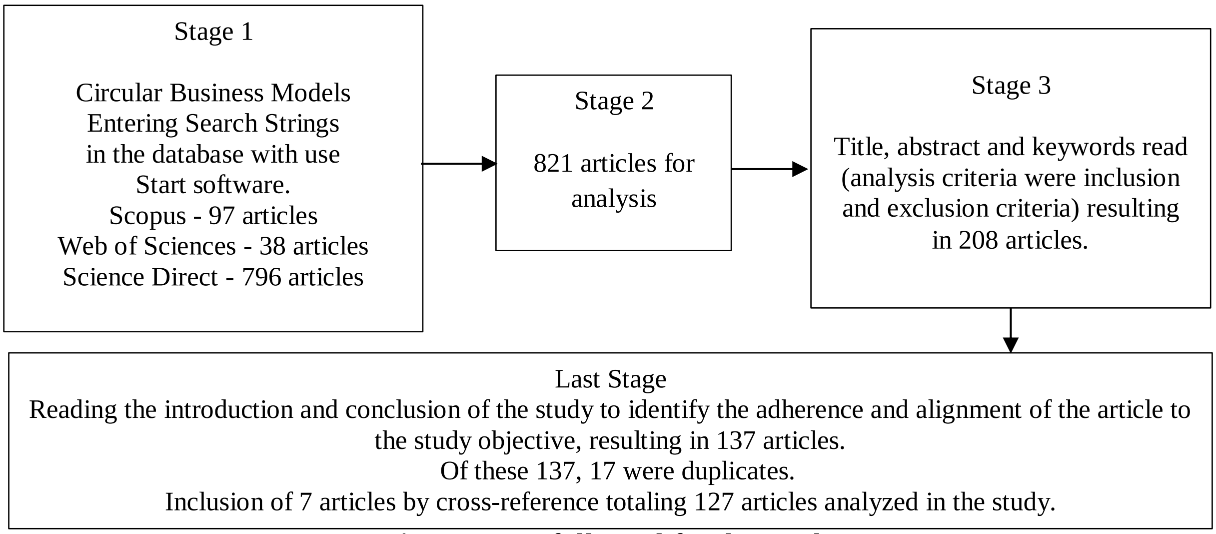

Fig. 1. Steps followed for the work.

The general criteria for selection, exclusion and inclusion of articles (Figure 1) applied during the manipulation process followed 7 criteria, and for each criterion the inclusion and exclusion criterion was applied. In criterion 1 - Focus - the inclusion was to address the theme circular business models or circularity of resources in organizations and production chains and the exclusion was to refer to the circular economy theme in a generic way. In criterion 2 - Circular Business Models the inclusion was to present different typologies of circular business models applied to different organizational contexts and the exclusion was not to directly address the circular business models theme, not to present characteristics of circular business models. In criterion 3 - Characteristics of circular business models - in the inclusion criteria was to deal directly with characteristics of circular business models, their specificities and ways of operationalizing them in organizations and exclusion not to address directly characteristics of circular business models, their specificities and ways of operationalizing them in organizations. In criterion 4 - Access - the inclusion criterion was to locate the full document file online free of charge and to be written in English, Portuguese or Spanish and the exclusion criterion was not having access to the work, not being written in English, Portuguese or Spanish. In criterion 5 - Quality - the inclusion criterion was for being peer reviewed scientific journal and in the exclusion criterion was peerless scientific journal, business journals, current magazines, conferences, books and websites. In criterion 6 - Theoretical framework - the inclusion was that the concepts of circular business models, in a context of operations management and / or supply chain management, sustainability as a focus of work and exclusion was to talk about circular economy in a way generic. In criterion 7 - Analysis unit - the inclusion criterion was circular business models from supplier, industry, logistics, retail, to the end consumer and in the exclusion was to deal with business models in communities, materials, environment, or individuals not related to organizations.

4. Data presentation and analysis

In order to classify the most published Journals on the theme CBMs (Table 1), it was sorted in decreasing order, from most published to least published.

Table 1
Journals that published on the circular business models theme

N.	Journal	Total	Impact Factor	ABS Ranking	N.	Journal	Total	Impact Factor	ABS Ranking
1	Journal of Cleaner Production	40	5,651	2	18	Materials and Design	1	4,525	0
2	Procedia CIRP	20	0	0	19	Journal of Industrial Ecology	1	4,365	2
3	Resources, Conservation & Recycling	16	5,12	0	20	International Journal of Hydrogen Energy	1	4,229	0
4	Sustainability	6	2,075	0	21	Energy Research & Social Science	1	3,815	0
5	Business Strategy and the Environment	3	5,355	2	22	Advanced Engineering Informatics	1	3,358	0
6	Environmental Innovation and Societal Transitions	3	5,265	0	23	Sustainable Production andConsumption	1	3,12	0
7	EcologicalEconomics	3	3,895	3	24	Technological Forecasting & Social Change	1	3,129	3
8	Thunderbird International Business Review	3	0,38	2	25	Social Responsibility and Business Ethics	1	2,917	0
9	Procedia Manufacturing	3	0	0	26	Forest Policy and Economics	1	2,496	0
10	California Management Review	2	3,302	3	27	Journal of Environmental Management	1	2,197	3
11	International Journal of Production Research	2	2,623	3	28	Futures	1	1,802	2
12	Journal of Business Research	2	2,509	3	29	Journal of High Technology Management Research	1	1,06	2
13	Production Planning & Control	2	2,33	3	30	Journal of Industrial and Production Engineering	1	0	2
14	Management Decision	2	1,525	2	31	Management Research Review	1	0	1
15	Journal of Manufacturing Technology Management	2	2,194	1	32	REGE - Revista de Gestão	1	0	0
16	Applied Energy	1	7,9	0	33	Technology Innovation Management Review	1	0	0
17	Long Range Planning	1	5,901	3					
						Total	**127**		

In quantities of publications on the theme CBMs, (Table 1) it appears that the Journal of Cleaner Production published 40 times excelling over the other Journals. The use of theories in the studies was accentuated from the year 2016 being present in the years 2017 and

2018. In the 127 papers analyzed, 28 theories were used and of these, three theories used in the biennium 2017 and 2018 are present in the studies. Institutional Theory, Actor-Network Theory and General Systems Theory. As for the continents they publish, the European stands out in number of countries and started to grow from 2016.

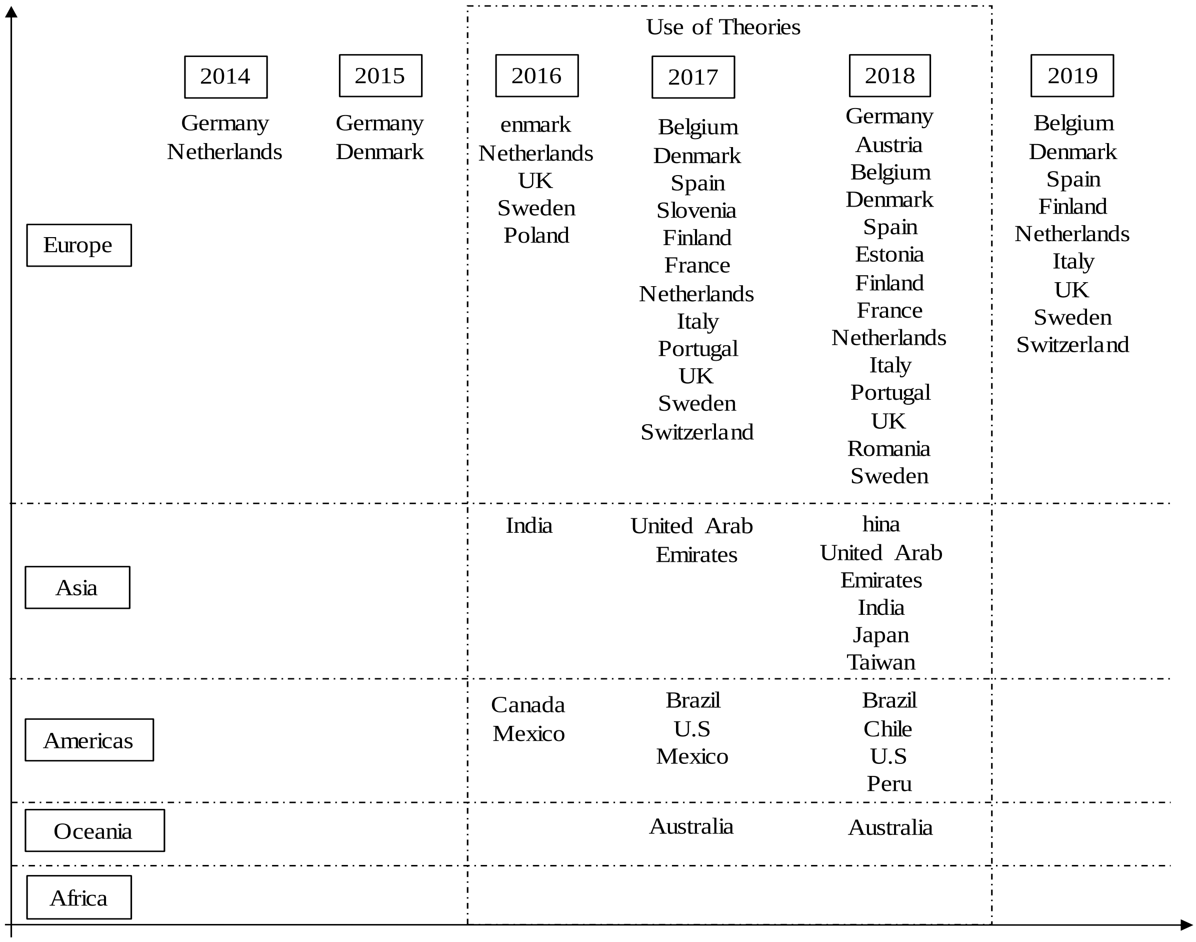

Fig. 2. Evolution of publications by continent and countries and the use of theories.

For continents, Asia, the Americas, Oceania and Africa (Figure 2), growth opportunities for CBMs emerge. As more countries tackle CBMs, more opportunities to showcase their work on the continents and generate new insights in the area for future work.

4.1 Analysis of circular business models

The circular economy paradigm has the potential to bring about positive economic, environmental and social benefits (Ellen MacArthur Foundation, 2015) and for a circular economy to deliver on its promise and business models to adopt types (Table 2) that assist in the process (Zhong & Pearce, 2018) of their business models.

Table 2
Types of MNCs mapped in the analyzed studies

Typologies	A.F.*	R.F. (%)**	Standard deviation	Variance
Framework Resolve	19	18,26		
3Rs	19	18,26		
Product as a service	16	15,39		
Extend Product life cycle	15	14,42		
5Rs	10	9,61		
Pay-per-use	8	7,69	6,63836	44,0679
10Rs	6	5,76		
Circular provision	3	2,89		
7Rs	2	1,93		
9Rs	2	1,93		
Resource rerecovery	2	1,93		
Plataforms of sharing	2	1,93		
Total	104	100		

* Absolute Frequency ** Relative Frequency

Table 2 shows that four business models account for 66.33% of the business models cited in previous studies. Famework Resolve (Table 2) uses the central principles of circularity and watches over the practices of regenerating, sharing, optimizing, virtualizing, and exchanging (Heyes, Sharmina, Mendoza, Gallego-Schmid, & Azapagic, 2018). The Resolve Framework and the application of 3Rs (reduction, reuse and recycling) (Prieto-Sandoval, Jaca & Ormazabal, 2018) are practical actions aimed at establishing a harmonious relationship for the company to adopt practices (Table 2) seeking cost reductions and favoring sustainable development of the company. Framework Resolve, 3Rs, Product as a service, and Extend product life cicle typologies represent 69 applications mapped in the studies.

Table 3
MNC Features and Attributes

Features and attributes	A.F.*	R.F. (%)**	Standard deviation	Variance
Value creation	34	21,25		
Synergy with product design	24	15		
Tendency to recycle	19	11,88		
Value capture	17	10,62		
Notion of a closed circuit	16	10		
New Value Proposition	14	8,75		
Optimize to eliminate waste	11	6,88	8,24588	67,9945
Product Life Extension	8	5		
Product manufacturing and reuse	6	3,75		
Dematerialization	5	3,12		
Closing loops	2	1,25		
Extended Liability	2	1,25		
Energy and Resource Recovery	2	1,25		
Total	160	100		

* Absolute Frequency ** Relative Frequency

Characteristics and attributes, value creation, synergy with product design, tendency to recycle and value capture accounted for 58.75% of responses. The perception of value creation (Table 3) is directly related to CBM typology and normative care (Randles & Laasch, 2015) corresponding to the strategies used to increase the perceived value of a particular product, brand, service or company. (Prendeville & Boccken, 2017) is to define and create practices (Table 4) to perform in the daily activities of the company.

Table 4
MNC Implementation Practices

Practices adopted	A. F.*	R. F. (%) **	Standard deviation	Variance
End of Life Recycling	90	23,2		
Product Life Cycle	55	14,17		
Recovery systems	53	13,65		
Product End-of-Life Management	31	7,98		
Industrial ecology	23	5,92		
Regenerative Economy	21	5,41		
Remanufacturing & Repair	16	4,12		
Reverse logistic	16	4,12		
Cleaner production practices	14	3,6		
Improved resource efficiency	10	2,57		
Blue economy	10	2,57	17,26561	298,1013
Servitization	10	2,57		
Circular design	9	2,3		
Renewable Energy Use	8	2,05		
From cradle to cradle	7	1,8		
Dematerialization	5	1,29		
Innovation Process Practices	3	0,71		
Pay for use	3	0,71		
Intentional Design	2	0,51		
Pollution prevention	1	0,25		
Long lasting design	1	0,25		
Biodegradability	1	0,25		
Total	389	100		

* Absolute Frequency ** Relative Frequency

End-of-life product recycling (Table 4) excels in the practices adopted for implementing circular business models. For this, the involvement of various stakeholders (Bocken et al., 2018) is considered essential for good results. Adopting, regardless of the type of practice (Table 5), a business model will require the involvement of managers (Blomsma, 2018).

Table 5
Governance models adopted for the implementation of MNCs

Governance models adopted	A.F.*	R.F. (%)**	Standard deviation	Variance
Based on innovation programs	105	16,77		
Customer-focused governance	99	15,81		
Product to service change	90	14,37		
Sustainability oriented innovation	86	13,73		
Collaboration between organizations	29	4,63		
Collaboration in research projects	29	4,63		
Operations Reset	22	3,52		
Leasing	20	3,19		
Marketing strategies	19	3,06		
Principles of producer responsibility	17	2,72		
Waste management goals	16	2,55		
Decision maker's attitude	15	2,39	25,59335	655,0197
Identification of common group characteristics	14	2,23		
Networks Sharing and Stakeholders	12	1,91		
Complete lifecycle management	12	1,91		
Economic Growth Policy	7	1,12		
Public policy	7	1,12		
Top-down approach	6	0,96		
Eco design policy	6	0,96		
Canvas Template	5	0,82		
Circular Promotion Law	4	0,64		
Remanufacturing & Recovery Centers	3	0,48		
Works collectively	2	0,32		
Eco-label	1	0,16		
Total	626	100		

* Absolute Frequency ** Relative Frequency

Business Models (Table 5) should represent consumer aspirations (Blomsma, 2018) so that CBMs can be seen as drivers of sustainability (Pieroni, McAloone, & Pigosso, 2019). CE is an approach of the European continent and there has been a gradual growth of publications on the theme (Figure 2). Only from 2016 onwards has it been spread to other continents and has been showing gradual growth in Europe, Asia and the Americas as well as the use of theories showing that there are opportunities for important advances in these loci. Business model types can guide business decisions so that the business model has an orientation of what to adopt so that characteristics and attributes can contribute to practices generating in the governance model robustness in organizational practices. Resulting from the mapping of typologies, we built a set of these typologies and concepts (Table 6) that guide the business models.

Table 6
Set of mapped typologies and concepts that guide CBMs

Ano	Authors	Set of mapped typologies that drive CBMs
2019	Baldassarre, Schepers, Bocken, Cuppen, Korevaar, & Calabretta	It reconciles environmental and economic objectives, reducing and optimizing resource utilization and stimulating economic growth.
2019	Favi, Marconi, Germani, & Mandolini	Product architecture, functionality and modularity are considered throughout the lifecycle, focusing on their use and sharing.
2019	Jensen, Prendeville, Bocken, and Peck	They inspire the development of many other concepts and fields for sustainability through virturalization and automation
2019	Mokhtar, Genovese, Brint, & Kumar	Pushes forward environmental, economic and social sustainability, emphasizing the idea of product transformation in such a way that there are ecological functional relationships.
2019	Muranko, Andrews, Chaer, & Newton	Proposal for value creation and delivery by integrating the principles of bioeconomy into products and services.
2019	Paridaa, Burströmc, Visnjicd, & Wincenta	Customers pay for product access or use with a focus on service and reuse.
2019	Pieroni, McAloone, & Pigosso	Proposed three main forms of value management being value proposition, value creation and delivery, and value capture for the new service standard.
2018	Blomsma	It combines industrial symbiosis with regenerative design contributing to a change of mindset to avoid excessive resource consumption.
2018	Bocken, Mugge, Bom, & Lemstra	Value proposition, supply chain with reverse logistics and financial model among business model stakeholders.
2018	Bocken, Schuit, & Kraaijenhagen	Businesses that drive sustainability with practices that minimize the depletion of natural resources extending the life of materials.
2018	Geissdoerfer & Vladimirova	Creates customer value with the product or service by optimizing and reintegrating resources and materials.
2018	Geissdoerfer, Vladimirova, & Evans	Value capture as part of the value generated for a stakeholder and transformed into business value through remanufacturing.
2018	Hopkinson, Zils, Hawkins, & Roper	First: involve the extension; Second, they involve redistribution and reuse; Third, involve remodeling and remanufacturing, and Fourth, involves recycling.
2018	Lee	Concern with saving material and energy by minimizing waste and leveraging resource use consciously.
2018	Lieder, Asif, Mihelic, & Kotnik	Changing business models through new value propositions and introducing new technologies.
2018	Lüdeke-Freund, Gold, & Bocken	Part of an ongoing process to achieve greater resource efficiency and effectiveness with sharing practices.
2018	Marra, Mazzocchitti, & Sarra	Dynamism and cooperation for the application of the end-of-life concept with reuse and recycling.
2018	Núñez-Cacho, Molina-Moreno, Corpas-Iglesias, & García	Restorative or regenerative by intention and design to increase product efficiency.
2018	Nußholz	Reconcile the creation of business value with the adoption of circular strategies that extend the life of products and parts.
2018	Oghazi & Mostaghel	They represent waste solutions improving environmental impacts and increasing economic profit by reintroducing reprocessed materials.
2018	Prieto-Sandoval, Jaca, & Ormazabal	Create, capture and add value with the logic of creating value designed to improve resource efficiency by helping to extend the life of products and parts.
2018	Popescu	Waste should be raw material for new revenue sources and reintroduced into the system.
2018	Reike, Vermeulen, &Witjes	Production model that applies waste recycling thinking about pollution prevention.
2018	Saidani, Yannou, Leroy, Cluzel, & Kendall	Product design synergy, reverse logistics, enablers and system conditions.
2018	Stål & Corvellec	Repair, reuse, refurbishment, remanufacturing, sharing, collection and recycling, outsourcing decoupling and separation.
2018	Ünal, Urbinati, & Chiaroni	Profound changes in management practices to reduce their environmental impact by applying the principles of reduce, reuse and recycle.
2018	Ünal, & Shao	Management practices system with resource allocation standards for a value setting in the circular design increasing performance.
2018	Whalen, Milios, & Nubholz	They base their value proposition around extending the life of products by contributing and encouraging reuse.
2018	When & Montalvo	Longevity effects with end-of-life reuse of materials.
2018	Xu, Zhang, Yeh, & Liu	Structure to facilitate systematic identification of sustainability-related criteria by integrating the sustainability tripod.

2018	Zucchella & Previtali	Operational and cost-effective architecture to make the ecosystem viable and sustainable with new technologies.
2017	Aboulamer	Extend the life of a product as long as possible while minimizing resource use and waste.
2017	Blomsma & Brennan	Optimize resource performance by circulating products, components and materials at all times within technical and biological cycles.
2017	Bressanelli, Perona, & Saccani	They improve the use of products to enable reuse, remanufacturing, refurbishing and recycling.
2017	Daddi, Nucci, & Iraldo	Business strategies with value derived from the efficient use of design features for durability.
2017	Geisendorf & Pietrulla	Raw materials should not become discarded waste always thinking about reduction, reuse and recycling.
2017	Geissdoerfer, Savaget, Bocken & Hultink	Strategies of narrowing resource ties to increase efficiency or dematerialization.
2017	Kirchherr, Reike, & Hekkert	They embrace fundamental change of the current system as a facilitator in the transition to all dimensions of reducing, reusing, recycling and recovering.
2017	Lazarevic & Valve	Zero waste program as a basis for closing cycles in such a way that the ecological impact of these activities is minimized.
2017	Marconi, Favi, Germani, Mandolini, & Mengarelli	All stakeholders involved in the product life cycle from an economic and environmental perspective seeking to extend shelf life.
2017	Nußholz	Increased resource efficiency and environmental gains through reduced raw material extraction and waste generation.
2017	Prendeville & Bocken	Interconnected activities that determine business between customers, partners and suppliers creating, capturing and distributing value.
2017	Romero & Rossi	Promotes increased resource productivity with design application and lean thinking.
2017	Sousa-Zomer, Magalhães, Zancul, & Cauchick-Miguel	Design practices, adoption of different end-of-life strategies (reuse, remanufacturing or recycling) and implementation of cleaner production practices.
2017	Toxopeus, Haanstra, Van Gerrevink, & Van der Meide	Close collaboration with value chain stakeholders to accumulate transfer and knowledge to promote separation, reverse logistics and recycling.
2017	Van Loon, Delagarde & Van Wassenhove	A closed-loop system assuming that a product must be rented several times to consumers before reaching the end of its useful life.
2016	Bonou, Laurent, & Olsen	Renewable energy generation consumed over its lifetime with increased performance.
2016	Poulikidou, Jerpdal, Björklund, & Åkermo	Energy and resource recovery enabling composite recyclability.
2016	Scheel	Design innovation with new technologies for industrial ecology.
2016	Singh & Ordõnez	Product design and optimization to eliminate waste, allowing reuse, disassembly and recovery.
2016	Van Buren, Demmers, Van der Heijden, & Witlox	Focus on meeting user needs in an effort to reduce environmental impacts.
2015	Scheepens, Vogtländer, & Brezet	Eco-efficient value creation with product and service quality where the environment plays a role in conjunction with design for durability.
2015	Tukker	Nature-regulated business mode to enable restoration and regeneration processes.
2015	Upward & Jones	They move from a linear understanding of consumption and production to a circular model, where products continue to circulate rather than end up as waste.
2014	Bakker, Wang, Huisman, & Den Hollander	Material efficiency, extended product life and product recycling.

However, it is noteworthy that consumers negatively perceive products from CBMs (Table 6) that adopt practices of reusing, repairing, reconditioning, remanufacturing, recycling or extending product life (Muranko, Andrews, Chaer, & Newton, 2019). These factors contribute to the low adherence of MNCs aligned with the CE principles. If the company changes its behavior and focuses on the intention to conduct a CCM aligned with the principles of CE, it will generate more favorable attitudes and perceptions for the consumer to adopt positive behavioral intention, which may lead to desirable behavior. Understanding CE principles for adoption in NCMs can influence a behavior change (Simon, 1976) to change beliefs, values, and attitudes (Muranko, Andrews, Chaer, & Newton, 2019) in a robust and systemic manner.

To apply the typologies (Figure 3) we can adopt a cycle so that the interrelationship of the typologies occurs. As an example, we use the first element of each typology (Tables 2, 3, 4, and 5) where the company adopts the practice and implementation of the Resolve Framework (Figure 3 – Step1) directing efforts towards the characteristic and attributes developing value (Figure 3 - Step 2), adopting end-of-life recycling in its CBM (Figure 3 - Step 3), generating a corporate governance model (Figure 3 - Step 4), developing innovation programs for the model.

The cycle for applying typologies and interrelationships (Figure 3) can be implemented in the company regardless of size and business model, where the company can choose the typologies that are most aligned with its model, as well as adopt a set of proactive and challenging way. Proactively, they can seek knowledge of all practices that the EC addresses, analyzing their business and practices and challenging to implement concrete actions in their products and processes, developing ways of operationalizing and promoting the systemic involvement of all stakeholders, from the company.

Regardless of the area of activity, business models should consider as fundamental for efficient operationalization and promotion, focus on determination and perseverance, orientation of actions towards the completion of the operationalization cycle as well as monitoring the involvement and goals proposed for the business model (Kirchherr, Reike, & Hekkert, 2017; Ünal, Urbinati, & Chiaroni, 2018). Thus, according to Baldassarre, Schepers, Bocken, Cuppen, Korevaar, and Calabretta (2019) the contribution to the cycle for applying typologies and interrelationships (Figure 3) can be implemented in the company regardless of size and business model, where the company it can choose the typologies that are most aligned with its model as well as adopt a set of proactive and challenging way. Proactively, they can seek knowledge of all practices that the CE addresses, analyzing their business and practices and challenging to implement concrete actions in their products and processes, developing ways of operationalizing and promoting the systemic involvement of all stakeholders, from the company.

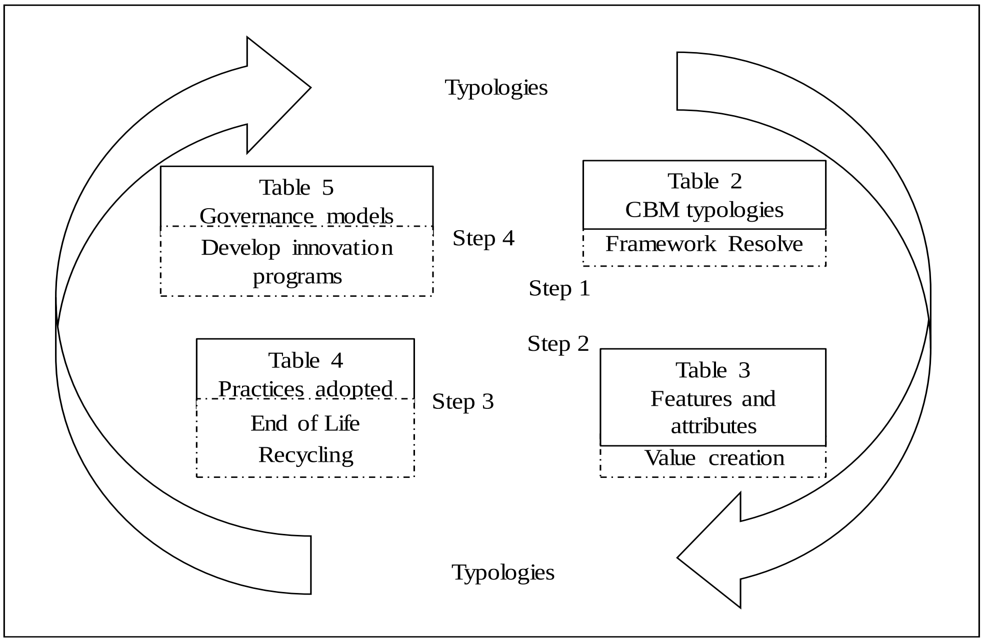

Fig. 3. Cycle for application of typologies.

Regardless of the area of activity, business models should consider as fundamental for efficient operationalization and promotion, focus on determination and perseverance, orientation of actions towards the completion of the operationalization cycle as well as monitoring the involvement and goals proposed for the business model (Kirchherr, Reike, and Hekkert, 2017; Ünal, Urbinati, & Chiaroni, 2018). Thus, according to Baldassarre, Schepers, Bocken, Cuppen, Korevaar, and Calabretta (2019), the contribution to the development of the business model based on typologies can benefit companies and support their circular business model (Sehnem, Lopes de Sousa Jabbour, Conceição, Weber, & Julkovski, 2021).

After determining which processes will be the focus of application of the typologies (Figure 3), one must decide which are the best approaches to implement (Figure 4). The company must define and study what problems it is facing and analyze existing data to make the best improvement decision. With these studies and understandings, a project is implemented and the actions are controlled to ensure improvements. This is because the choice of typologies and stages depend on the complexity and needs of the company.

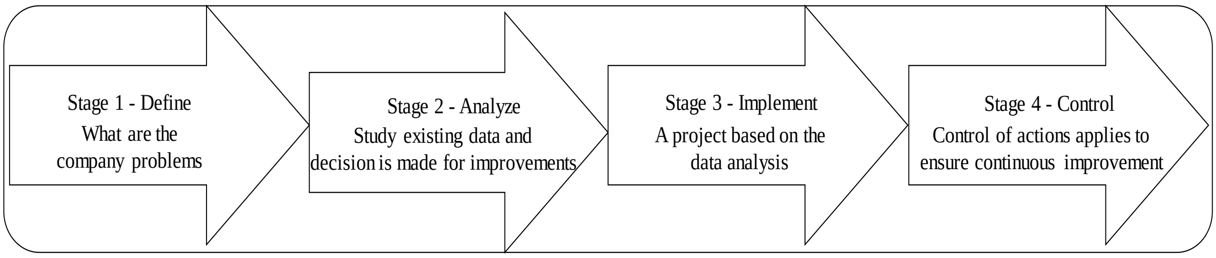

Fig. 4. Stages of application

Adopting the stages (Figure 4) of defining, analyzing, implementing and controlling can guarantee the company's path and its business model in continuous improvement, precisely because it is cyclical and allows control in all phases making it possible to highlight the performance of the activities developed.

5. Discussion

The objective of this study is to analyze the Circular Business Models considering their typologies, characteristics and attributes, practices related to their implementation and adopted governance models. While not every organization has a definite or explicit strategy, business models such as the Resolve Framework, 3Rs, Extend product life cycle, 5Rs, Pay-per-use, 10Rs, Circular provision, 7Rs, 9Rs, Resource recovery and Platform of sharing can be present in the processes, whether the company recognizes and applies them formally or not. Recognizing and formally applying will represent the success of the business model. It is the analysis of these factors and how a company organizes itself to create value that highlights the existence of business models. Business Models have a product architecture, functionality and modularity so they can be considered throughout the lifecycle, focusing on usage and sharing (Favi, Marconi, Germani, & Mandolini, 2019) and are viewed as an abstract representation. the structural architecture of an organization to create, deliver and capture value for stakeholders (Geissdoerfer, Vladimirova, & Evans, 2018).

With value creation, delivery, and capture, the business model tends to validate business characteristics and attributes at all stages, providing value creation, synergy with product design, value capture, value capture, notion of a closed circuit, new Value Proposition, Optimize to eliminate waste, Product Life Extension, Product manufacturing and reuse, Dematerialization, Closing loops, Extended Liability and Energy and Resource Recovery

(Prendeville & Boccken, 2017) contributing to business model innovation. As a result, attributes provide companies with directions to combine attributes to improve business models by differentiating themselves from others, extending product life, contributing and encouraging new business model practices and contributing to companies becoming more sustainable. (Whalen, Milios, & Nubholz, 2018).

The characteristics and attributes of business models contribute to the dynamic flow between company choices and their consequences to become more sustainable. These choices are defined from the stage 1 analysis which is when the company should study what its problems are. This analyzes all existing data to implement assertive actions and broad control so that practices can drive continuous improvement. This innovation, in turn, will represent in the business model not only from a proposal perspective, but from an effective perception, of realization. The model, therefore, emerges as a reflection of innovative actions, allowing the company to visualize and interpret the results of what was implemented. Thus, innovating in business models (Gupta, Mejia, & Kajikawa, 2019) means understanding the full cycle of production processes, thereby enabling continuous monitoring of the environment and the company's position in the creation, delivery and capture of value.

Implementing any practices such as End of Life Recycling, Product Life Cycle, Recovery systems, Product End-of-Life Management, Industrial ecology, Regenerative Economy, Remanufacturing & Repair, Reverse logistic, Cleaner production practices, Improved resource efficiency, Blue economy, Servitization, Circular design, Renewable Energy Use, From cradle to cradle, Dematerialization, Innovation Process Practices, Pay for use, Intentional Design, Pollution prevention, Long lasting design, Biodegradability ends up being considered strategic for the company and depend on adopting practices of governance as Based on innovation programs, Customer-focused governance, Product to service change, Sustainability oriented innovation, Collaboration between organizations, Collaboration in research projects, Operations Reset, Leasing, Marketing strategies, Principles of producer responsibility, Waste management goals, Decision maker's attitude , Identification of common group characteris Sharing and Stakeholders, Complete lifecycle management, Economic Growth Policy, Public policy, Top-down approach, Eco-design policy, Canvas Template, Circular Promotion Law, Remanufacturing & Recovery Centers, Works collectively, Eco-label so they can strengthen dynamics of the business model, thus activating the circular economy in the company.

In other words, the dynamics are characterized by the creation of cyclical movements in relation to the interdependencies of the practices and between the existing components of the governance model practiced in the business models. The movements, responsible for stimulating and evolving the components, impact the management actions of the company, implying cycles of continuous interaction of practices, strengthening the actions of the business model and positively affecting the improvement and continuity of the business model, and can evidence the level of information of companies (Sato & Ferreira, 2021).

6. Conclusion

The objective of this study was to analyze the circular business models (CBMs) considering their typologies, characteristics and attributes, practices related to their implementation, adopted governance models. Key findings revealed that practices for CBMs are valuable and note that there are opportunities to expand the theme in emerging countries on Framework Resolve applications, 3Rs, Product as a Service, Extended product life cycle. In addition, data show that there is a growing number of countries publishing the CBMs theme and the use of theories in circular economy studies may expand, such as the use of TME, Behavioral Learning Theory, Higher classes, Stakeholder Theory, Social Theory and Instructional Planning Theory. A table containing 55 sets of mapped typologies that guide the CBMs was constructed and a cycle of interrelationships that can be adopted by companies to implement typologies in the field, your business model. In addition, the results confirmed that the typologies, characteristics and attributes, related implementation practices, adopted governance models and associated indicators are united through the processes of developing new CBMs. The practical contribution to this study is associated with the operationalization of CE in organizations and there is a need to understand how to make CE a reality. The theoretical contribution of this study is associated with the advancement of the CBMs research field. Understanding the field will enable CBMs to be more likely to include the principles of circularity in their organizational actions and thus promote circular economics as an inherent and fundamental business concept, as well as the growth of quantitative studies in the coming years.

A CE can generate a vicious cycle and be crucial for CBMs, providing economic growth and encouraging new companies to adopt CBMs. Knowing what to do, how to do it, and who is responsible for driving change is vital to CBM growth and cycle continuity. Governance structures are critical in this cycle, as they will provide the support for the transformations needed for a circular economy to occur through the deployment and maintenance of CBMs. It is aimed at the application of interrelation cycle that can be implemented in the company, regardless of size and business model, where the company can choose the typologies that are most aligned with its model, as well as proactively and challengingly adopt, a set of them. Regarding educational institutions, they can use the guidelines to develop integrative forms, bringing theories closer to practices. This article brings conceptual and methodological considerations contributing to the organizations' sustainability practices and research in CBMs providing structured steps to evaluate the historical evolution of countries that develop studies on the theme CBMs. The limitations of this research are related to the applied techniques for the review of the literature. As future works we point to the accomplishment in exploring other databases as well as investigating the tendency of countries that publish the subject totally covering other periods.

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