

Article

Sustainable Circular Economy Strategies: An Analysis of Brazilian Corporate Sustainability Reporting

Julia Romano Sanches ¹, Adriana Hofmann Trevisan ¹, Bruno Michel Roman Pais Seles ¹,
Camila Gonçalves Castro ^{1,2}, Roberta Souza Piao ³, Henrique Rozenfeld ¹ and Janaina Mascarenhas ^{1,*}

¹ Department of Production Engineering, São Carlos School of Engineering, University of São Paulo, Av. Trabalhador São Carlense, 400, São Carlos 13566-590, SP, Brazil; sanchesjulia@usp.br (J.R.S.); adrianatrevisan@usp.br (A.H.T.); bruno.seles@usp.br (B.M.R.P.S.); camilagcastro@usp.br (C.G.C.); roz@usp.br (H.R.)

² Federal Institute of Education, Science, and Technology of Minas Gerais, Campus Congonhas, Av. Michael Pereira de Souza, 3007, Congonhas 36415-000, MG, Brazil

³ Department of Production Engineering Polytechnic School, University of São Paulo, Av. Prof. Luciano Gualberto, n.1380, São Paulo 05508-010, SP, Brazil; robertacsouza@usp.br

* Correspondence: janainacosta@usp.br

Abstract: Corporate Sustainability Reporting provides essential data for academic and empirical research on sustainability and the still-growing adoption of the circular economy by companies. Despite the wide attention that the circular economy receives from the academy, a systematization and hierarchy of the strategies that embrace the sustainable circular economy are still necessary. In addition, there is a limitation of research on the analysis of Corporate Sustainability Reporting in emerging economies. In this study, fifty sustainable circular economy strategies emerged from a systematic literature review, arranged among nine categories. The differential of the identified strategies is the expansion of strategies for a sustainable circular economy vision. Then, 51 Corporate Sustainability Reporting from 17 multinational companies operating in Brazil in 2016, 2018 and 2020 were analyzed to identify companies' adoption of these strategies. The Corporate Sustainability Reporting analysis results suggest that companies operating in Brazil are directing significant efforts toward a sustainable circular economy. Based on these two results and the theory of business process management, we proposed the Business Process for Sustainable Circular Economy framework.

Keywords: sustainable circular economy; Corporate Sustainability Reporting; emerging economies; Brazil



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1. Introduction

The circular economy (CE) is presented as a sustainable alternative to the prevailing linear economic system [1] of “extract, produce, and dispose” [2]. It acts at all three levels: micro-level (products, companies, consumers), meso-level (eco-industrial parks), and macro level (city, region, nation)—aiming at achieving sustainable development [3,4]. CE reveals itself as a fundamental systemic change. For this reason, the concept of “sustainable circular economy (SCE)” is adopted in this study, which makes the caveat that a CE should prioritize social well-being, environmental quality and economic prosperity and thus be an SCE [5].

In Brazil, despite an “institutional void” at the macro level [6], in which public policies and government regulations to encourage companies' transition to circularity are lacking, some players are seeking to establish targets for this transition. The Brazilian Business Council for Sustainable Development, for example, has established as a goal the consolidation of the circular economy in the country by 2050 so that, by 2030, the effective circular design of products and services is advocated [7]. Oliveira et al. [8] point out that for the diffusion and adoption of circularity principles in Brazil, studies that contemplate sectoral diagnoses are necessary. An additional challenge, however, is the scarce literature

of examples of the adoption of circular strategies not only in developing economies [3] and on which perspectives the strategies are incorporated to achieve sustainable development.

Corporate Sustainability Reporting (CS Reporting) is currently the standard for corporate communication of their sustainable initiatives and goals. For the development of CS Reporting companies must strictly follow the methodologies of the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB) and Integrated Reporting (IR). The mandatory nature of these methodologies provides comparability, universality and relevance of the reported data [9], serving as an instrument of accountability for sustainability initiatives and results [10]. CS Reporting is, therefore, in its entirety, a useful and strategic source of information for academic and empirical research on the topic of sustainability and the still-growing adoption of the circular economy by companies [11].

Recently, CS Reporting has been research target regarding circular economy data analysis [12–17]. Some of these researches investigated firms by regions, such as Dagiliene et al. [13], which investigated 226 manufacturing firms in the European Union, and Marco-Fondevila et al. [15], which focused on 36 Spanish firms. Other research has done its investigations by sector, such as Upadhyay et al. [16], which focused on three of the five largest mining companies in the world. However, as highlighted by Navarrete-Oyarce et al. [18], analyses of CS Reporting from emerging economies are needed because of their undeniable role in global sustainable development.

In addition to what Navarrete-Oyarce et al. [18] highlighted, despite the wide attention that CE receives from academia, there is still a need for systematization and prioritization of the concepts that embrace the SCE, in particular, of its strategies [4]. The absence of research in this direction entails the difficulty of implementation or a fragile implementation of CE. Developing countries must be able to adhere to the strategies of the SCE that is already becoming increasingly present in the European community and China. A critical analysis of the main strategies adopted in the European community should be carried out, taking into account the economic situation and consumption patterns of developing countries [19]. Understanding these particularities can contribute to establishing public policies and sectoral agreements that encourage sustainable development.

Given the two gaps presented so far, (1) need to systematize and prioritize SCE strategies; and (2) lack of analyses on CE in CS Reporting from emerging countries like Brazil, the research questions of this study are:

RQ1: *What are the main strategies of a sustainable circular economy?*

RQ2: *Which of these strategies are present in the CS Reporting of companies operating in Brazil?*

The objectives are: (1) identify and analyze circular and sustainable strategies presented in the academic literature; (2) analyze the adoption of SCE strategies practiced by multinational companies operating in Brazil; (3) propose a framework on SCE in companies' processes to facilitate business decision-making.

To achieve "objective 1", a meta-analysis of seminal papers that reviewed circular and sustainable strategies in the academic literature was conducted. Then, to achieve "objective 2", the adoption of these strategies by multinational companies operating in Brazil was analyzed based on the reports made in their CS Reporting. To achieve "objective 3", a sustainable circular economy (SCE) framework was proposed—the BP4SCE framework, which provides SCE categories and strategies within companies' processes. The framework was built based on the results achieved in the first two objectives and also on business process management theory [20]. It was formulated to help companies structure their activities to achieve more excellent sustainable value through their strategies and practices, which is similar to Porter's value chain model [21] and also the APQC Process Classification Framework (PCF) [22].

This article is organized into four other sections. Section 2 presents the materials and methods adopted for the collection and analysis of primary and secondary data and the concepts for building the framework. Section 3 presents the results and discussions of the study, comprising a descriptive analysis of the selected articles, the SCE strategies,

and the results of the CS Reporting analyses. The framework developed is presented in Section 4. Finally, Section 5 highlights the article's contributions, limitations and future research paths.

2. Materials and Methods

This article employs three research approaches, as can be seen in the complete dark blue boxes in Figure 1. To achieve "objective 1", a systematic literature review was carried out to select sustainable circular strategies (Section 2.1). Then, to achieve "objective 2", the adoption of these strategies by multinational companies operating in Brazil was identified based on a content analysis of CS Reporting (Section 2.2). These two approaches answered the two research questions. Thus, both results enabled the development of the BP4SCE framework, reaching "objective 3". The description of the framework construction is summarized in Section 2.3, as employed by Liu et al. [23].

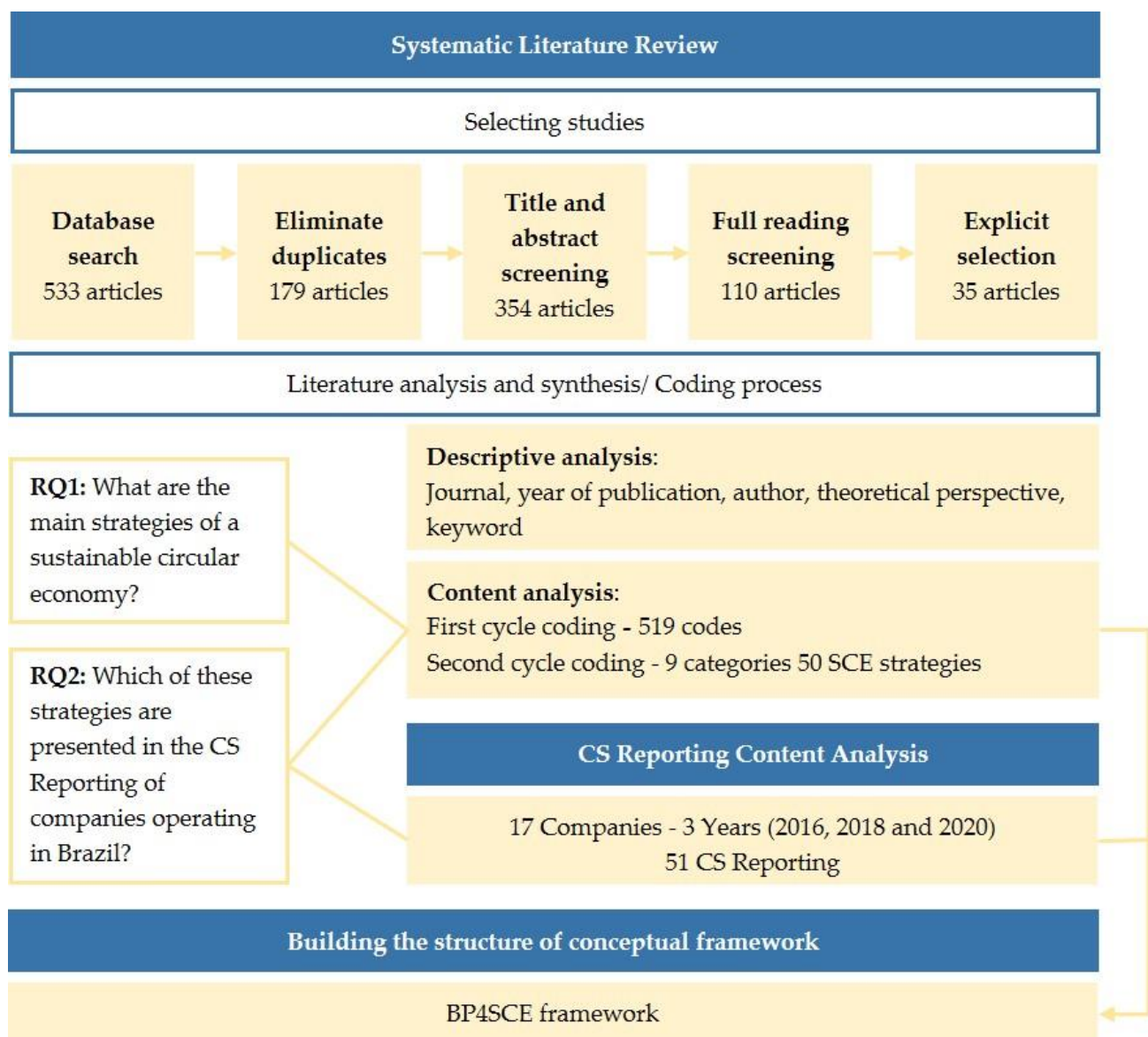


Figure 1. Research methodological processes.

2.1. Systematic Literature Review

The systematic literature review (SLR) approach was employed in this paper to originate a set of strategies that operationalize a sustainable circular economy. The literature in

this paper was searched and selected following the rules of Briner and Denyer [24]. The approach locates existing studies and selects and analyzes them following a rigorous and well-defined research protocol.

2.1.1. Identifying and Refining the Review Scope

Firstly, a specific set of words relevant to the field of research was defined, namely circular economy strategies and/or sustainability practices of organizations. Then those words were applied in previous works that carried out a literature review on these topics. For this, three sets of words were inserted in the search string. The “AND” operator was used to find each contribution. The “OR” operator was used to search for alternative words from each other [25]. Examples of these words are: “circular economy strategy”/“sustainability practice”, “business”, and “systematic literature review”. The original search string employed is provided below:

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TITLE-ABS-KEY ((“circular economy strategy*” OR “circular economy practice*” OR “circular strategy*” OR “circular practice*” OR “circularity practice*” OR “circularity strategy*” OR “sustainability practice*” OR “sustainability strategy*” OR “sustainable practice*” OR “sustainable strategy*”) AND (“business*” OR “corporate*” OR “corporation*” OR “compan*” OR “industr*” OR “entrepreneurial” OR “enterprise”) AND (“systematic literature review*” OR “SLR” OR “literature review*” OR “systematic review*”))
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The search for studies was conducted in Scopus and Web of Science. Published journal articles and conference papers were included to mitigate publication bias [24]. Only publications written in English were included. Searches of the material were conducted in June 2021.

2.1.2. Selecting Studies

The selection process found 305 studies in the Scopus database and 228 in the Web of Science, 179 of which were duplicates. The remaining 354 articles were analyzed, and after reading the abstracts, 110 articles were selected for the full-text reading phase. The reading of the full articles resulted in the selection of 35 articles considered suitable for the qualitative content analysis process. Only articles that reviewed the literature on circular and/or sustainable strategies were included. Articles that focused on a single sector (e.g., fashion) were not selected for analysis.

2.1.3. Literature Analysis and Synthesis

The descriptive analysis and content analysis steps were employed to review the articles. The descriptive analysis aimed to reveal research trends among the 35 articles: the journals that publish the most articles, the articles published each year, and the most frequent keywords were analyzed. In addition, the 35 articles were identified according to the theoretical perspective they addressed: circular economy or sustainability. The results are presented in Section 3.

The second part of this literature review consists of qualitative content analysis following the precepts of Miles; Huberman; Saldaña [26], in which the revised articles were coded to extract CE and sustainability strategies. The two-cycle coding method was applied in the coding process. The MAXQDA software, a tool that allows coding, categorizing and analyzing qualitative research data [27], was used in the analysis.

2.1.4. Coding Process

All selected articles were coded in the first coding cycle following Miles; Huberman; Saldaña’s [26] in-vivo coding process. The first coding cycle resulted in 519 in-vivo codes of textual segment reporting strategies. Prior to the second cycle of coding, the codes were thoroughly analyzed and merged to improve the quality of the identified data.

In the second round of coding, the codes were refined, and consequently, patterns were revealed. Grouping of similar in-vivo codes was performed, and then a common title

was defined, as can be seen in Table 1. This step resulted in the 50 identified SCE strategies that were organized into nine categories, created from analysis of the revealed patterns.

Table 1. Coding process examples.

First Cycle Coding	Second Cycle Coding		
In-vivo	In-vivo group	Strategies written	Category
“develop the circular culture” “circular economy principles” “rethink business model”	“develop the circular culture”, “circular economy principles”, “rethink business model”	Rethinking the business model from a circular culture	
“product as a service” “access provision” “result provision”	“product as a service”, “access provision”, “result provision”	Establishing product as a service systems	Business Model
“redistribution” “resale of used parts or components” “resell”	“redistribution”, “resale of used parts or components”, “resell”	Establishing resell and redistribution	

2.2. CS Reporting Content Analysis

The reporting database was built containing 51 CS Reporting from 17 companies operating in Brazil from different industries, from the years 2016, 2018 and 2020. All companies were listed on the Brazilian Stock Exchange, B3 (Table 2).

Table 2. Selected company profiles.

Name	Sector	GRI Version		
		2016	2018	2020
Altona	Industrial Machines and Equipment	G4	Std	Std
Ambev	Beers and Soft Drinks	G4	Std	Std
Braskem	Petrochemicals	G4	Std	Std
CSN	Steel and Metallurgy	Std	Std	Std
Duratex	Wood	G4	Std	Std
Hering	Clothing	Std	Std	Std
Irani	Packaging	G4	Std	Std
JBS	Meat and Derivatives	G4	Std	Std
M. Dias Branco	Miscellaneous Food	G4	Std	Std
Natura	Personal Use Products	Std	Std	Std
Ouro Fino	Veterinary Medicines	G4	Std	Std
Portobello	Construction Products	G4	Std	-
Raia Drogasil	Medicines and Other Products	G4	Std	Std
Renner	Fabrics, Clothing and Footwear	G4	Std	Std
Suzano	Cellulose Paper	G4	Std	Std
Weg	Engines, Compressors and Others	G4	G4	G4
Whirlpool	Home Appliance	G4	Std	Std

CS Reporting was selected from 2016 by virtue of the fact that the CE100 Brazil program, which acts to transition the circular economy in Brazil, was launched in October 2015 [28], representing the milestone of CS in the country. Two years later, in 2018, the first document on the circular economy in Brazil was published by the National Confederation of Industry [29]. Finally, the year 2020 refers to the last year of publication found in the period in which CS Reporting was analyzed.

All selected CS Reporting followed Global Reporting Initiative (GRI) precepts. GRI is an international organization that develops sustainability reporting guidelines worldwide [30], acting as a facilitator for the dissemination of sustainability performance [31].

The GRI versions followed by the selected companies were the G4 Guidelines (G4) and the GRI Standards (Std)—see Table 2. The G4 was a guidelines version published in

2013. Moreover, the GRI Sustainability Reporting Standards (GRI Standards) were the first global standards for sustainability reporting, published in 2016 [30].

The GRI Standards (abbreviation Std in Table 2), the version most widely followed by CS Reporting, are composed of “Universal Standards” and “Topic-specific Standards”. As specific, there are three series: GRI 200 for the “Economic” pillar, divided among seven standards (GRI 201, GRI 202, GRI 203, etc.), GRI 300 for the “Environmental” pillar, divided among eight standards (GRI 301, GRI 302, GRI 303, etc.), and GRI 400 for the “Social” pillar, divided among 19 standards (GRI 401, GRI 402, GRI 403, etc.) [32].

Initially, the 51 CS Reporting and the strategies originating from the SLR were entered into a new MAXQDA project for qualitative and quantitative content analysis [26]. A full reading of the CS Reporting was performed to identify the strategies from the textual, graphic, and/or image segments provided in these documents. For each strategy found, the document was coded only once, even if the same strategy appeared several times in the CS Reporting.

In cases of strategies with the word “reduce”, for example, “Reducing water consumption”, only results where there was, in fact, a reduction in consumption compared to the previous year were coded, since the CS Reporting inform, almost always in tables, results referring to the year of analysis and two previous years.

In the case of data in which specific actions of the company by countries where it operates were commented on, only those referring to Brazil were analyzed. For example, in the JBS CS Reporting, there are highlights of the units in Brazil, the United States, and Canada.

2.3. Building the Structure of Conceptual Framework

The framework proposed in this research is designed to facilitate business decision-making in the transition to circularity by providing SCE strategies organized according to companies’ processes. It guides how companies should employ their SCE strategies in their processes, helping in visualizing these processes and their responsible parties. The framework proposal is one of the ways found to answer the two research questions.

Despite the availability of frameworks for CE in the academic literature (e.g., the framework developed by Guzzo et al. [33]), there is still a lack of frameworks related to SCE, especially linking to operational processes. An example framework for SCE was recently developed by Velenturf [34] to integrate a sustainable circular economy into offshore wind energy. In contrast, the framework proposed in this research is theoretically based on business process management [20], as well as Morais et al. [35], Bernardo; Galina; Pádua [36] and Rentes et al. [37], and mirrors the focus on internal company activities and processes given by models, such as Porter’s value chain [21], and frameworks, such as the APQC Process Classification Framework (PCF) [22].

Following a hypothetical deductive methodological approach, the BP4SCE was built based on the knowledge generated from the SCE strategies identified and, afterwards, from the empirical knowledge generated from the content analysis of CS Reporting from 17 companies operating in Brazil. This process was employed to verify if the theoretical and practical perspectives ensure the structural elements of the framework. This approach is similar to previous studies that proposed frameworks. For example, Bocken et al. [38] built their framework based on the literature review and demonstrated its validity using practical examples. Kristoffersen et al. [39] proposed the Smart CE framework based on a theory and practice review approach. After the theoretical phase, they identified and mapped examples from practice to validate and further develop the framework. As a typical hypothetical deductive work, after we built the framework and verified its applicability, future works must empirically evaluate, validate or refute our proposal [40–42].

3. Results and Discussions

3.1. Descriptive Analysis

As shown in Table 3, the research topic covered in this article has been attracting increasing interest since 2018. The first two relevant papers were published in 2014. Sustainability Switzerland and Journal of Cleaner Production published the most papers among the journals, with five each. Sustainable Production and Consumption and Business Strategy and The Environment published two each. In all, these journals published 14 papers out of the 35 selected. All the other journals published a single article, such as the Journal of Industrial Ecology, Resources Conservation and Recycling, Benchmarking, and others.

Table 3. Journal and conference publication each year.

Journal/Conference	Year of Publication								Total
	2014	2015	2016	2017	2018	2019	2020	2021	
Sustainability Switzerland	-	-	-	-	-	2	2	1	5
Journal of Cleaner Production	1	-	-	-	1	2	-	1	5
Sustainable Production and Consumption	-	-	-	-	-	-	-	2	2
Business Strategy and the Environment	-	-	-	-	1	-	-	1	2
Journal of Industrial Ecology	-	-	-	-	-	1	-	-	1
Resources Conservation and Recycling	-	-	-	-	1	-	-	-	1
Benchmarking	-	-	-	-	-	-	1	-	1
Others	1	2	1	1	1	2	5	5	18
Total	2	2	1	1	4	7	8	10	35

Among the 35 selected articles, 20 conducted their literature reviews with the circular economy theoretical perspective. The first year of publication of this set of articles is 2018 (2 articles). After that, there was a constancy of SLR publication of circular strategies, with publications in 2019 (7 articles), 2020 (4 articles), and 2021 (7 articles). The other 15 articles conducted their literature reviews with the sustainability perspective. The first year of publication of this set of articles is 2014 (2 articles), followed by 2015 (2 articles), 2016 (1 article), 2017 (1 article), 2018 (2 articles), 2020 (4 articles), and 2021 (3 articles). Table 4 shows the authors among the theoretical perspectives.

The co-occurrence of all keywords in the set of articles from each theoretical perspective was examined. Keyword networks were constructed based on keywords that appear at least three times in an article. In the circular economy article set, Figure 2a shows the 12 keywords identified and the connections between them. In the sustainability article set, Figure 2b shows the four keywords identified and the connections between them. It is possible to identify that sustainability and sustainable development are recurrent topics in the CE literature. On the other hand, the circular economy is not a recurring keyword in the sustainability literature. In both figures, it is possible to identify that the use of sustainability is more recent than sustainable development.

3.2. Sustainable Circular Economy (SCE) Strategies

The SCE strategies were grouped in nine different categories, namely Products and Materials (PM), Production and Operations (PO), Digitalization (DI), Logistics and Transportation (LT), Stakeholders' Networks (SN), Environmental Management (EM), Business Model (BM), Environmental Compliance (EC), Social Responsibility (SR). The description of each category is presented as follows:

3.2.1. Products and Materials (PM)

The strategies gathered in this category act on product design, which can encompass the development of product-service systems [33], packaging development [43] and choice of new materials [44,45]. To make them sustainable, it is necessary to consider aspects such

as multiple cycles of product use [44], their environmental particularities [46] and life cycle extension for longer longevity [47].

Table 4. Author’s theoretical perspective.

Theoretical Perspective	
Circular Economy	Sustainability
Alcayaga; Wiener; Hansen (2019)	Baumgartner (2014)
Awan; Sroufe; Shahbaz (2021)	Comin et al. (2020)
Dantas et al. (2021)	Giuffrida; Mangiaracin (2020)
Fontana et al. (2021)	Govindan et al. (2020)
Garza-Reyes et al. (2019)	Goyal; Rahman; Kazmi (2015)
Gaustad et al. (2018)	Gupta; Singh (2020)
Guzzo et al. (2019)	Islam et al. (2017)
Ingemarsdotter et al. (2019)	John; Narayanamurthy (2015)
Karman (2020)	Klewitz; Hansen (2014)
Khan; Heleem (2020)	Lathabhavan (2021)
Khan; Heleem (2021)	Malesios et al. (2021)
Konietzko; Bocken; Hultink (2020)	Mani; Gunasekaran; Delgado (2018).
Kravchenko; Pigosso; McAlloone (2019)	Miranda et al. (2021)
Kühl et al. (2020)	Naidoo; Gasparatos (2018)
Lopes; Farinha (2019)	Schoormann et al. (2016)
Martins et al. (2021)	
Mhatre et al. (2021)	
Salvador et al. (2021)	
Schroeder; Anggraeni; Weber (2019)	
Stewart; Niero (2018)	

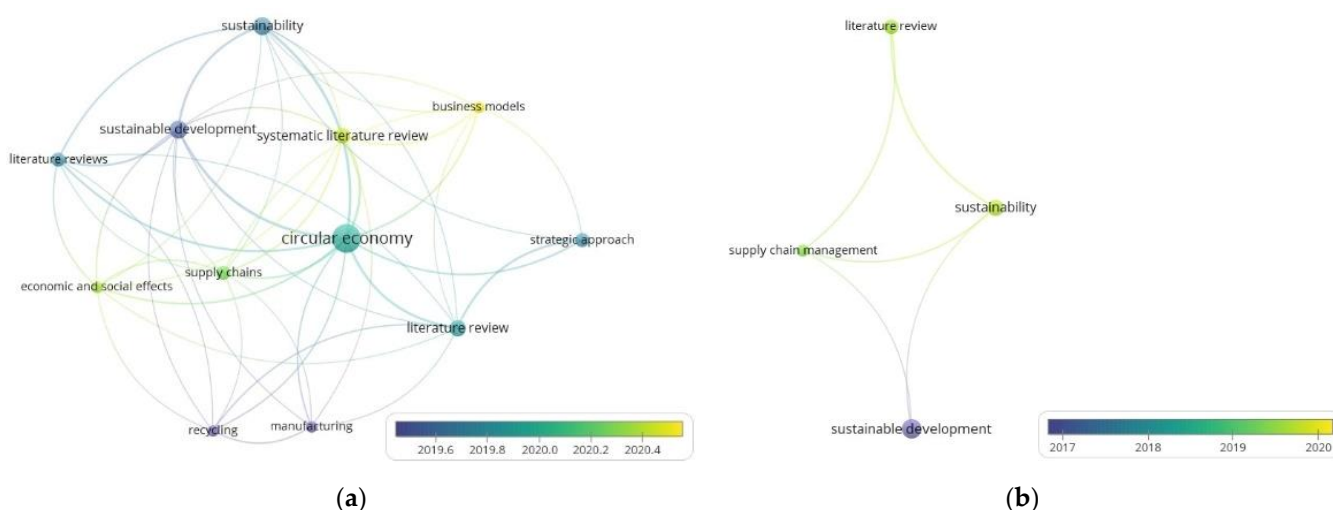


Figure 2. Co-occurrence network of all keywords: (a) Co-occurrence network of all keywords in the circular economy perspective; (b) Co-occurrence network of all keywords in the sustainability perspective.

Twelve strategies make up the Products and Materials category (Table 5). Among these strategies, R’s strategies are the most popular in the CE literature [48], heavily

employed during product design [33] and can be considered as fundamental to achieving sustainable products. However, they should not be considered as the only strategies that can be adopted. It is noteworthy that, although authors have expanded the R's (e.g., Potting et al. [49] proposes 9R's), the meta-analysis identified only six classic R's that actually target the product design level that was therefore grouped into this category. They are: PM8—Reducing materials consumption; PM9—Reusing products and materials; PM10—Repairing and maintaining products; PM11—Refurbishing or remanufacturing products; and PM12—Recycling products and materials.

Table 5. Number of articles per thematic unit of each SCE strategy in the category of Products and Materials. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
PM1	Designing environmentally safe products	6	7	[43,44,46,50–59]
PM2	Designing products for durability	11	2	[33,43,45,47,54,56,57,60–65]
PM3	Designing products for upgradability	7	-	[33,53–55,57,61,63]
PM4	Eliminating hazardous and toxic substances	2	2	[43,46,54,61]
PM5	Using bio-based materials	8	3	[33,44,45,47,48,51,54,57,62,64,66]
PM6	Offering or using green packaging	2	2	[43,57,64,67]
PM7	Offering customization and made to order	2	-	[57,60]
PM8	Reducing materials consumption	6	5	[33,43,46–48,51,55,59,61,64,67]
PM9	Reusing products and materials	14	3	[43,44,46,48,53–58,60,63,64,68–71]
PM10	Repairing and maintaining products	11	1	[33,44,46,54–57,60,63,68,70,72]
PM11	Refurbishing or remanufacturing products	16	2	[33,43,44,46,48,53–57,60,63,64,68–72]
PM12	Recycling products and materials	17	5	[33,43,44,47,48,50,51,53–57,59,60,63,64,68–73]

In the circular economy literature, all 20 papers mention at least 1 of the 12 identified strategies, totalling 147 coded segments. In the sustainability literature, 11 of the 15 papers mentioned at least 1 of the 12 strategies (totalling 45 coded segments), with the exception of PM3—Designing products for upgradability and PM7—Offering customization and made to order, which were not reported by any of the papers from this theoretical perspective. One difference that stands out between the theoretical perspectives is that the circular economy literature has a strong tendency to suggest the strategies that encompass the R's, as illustrated by the strategy PM12—Recycling products and materials, which was cited by 17 circular economy articles but only by 5 sustainability articles.

3.2.2. Production and Operations (PO)

The strategies gathered in this category address industrial production processes. Sustainable production requires the incorporation of strategies associated with principles such as cleaner production and eco-efficiency [51,62,73], achieved by minimizing the use of natural resources or energy and properly treating emissions and waste [55], in order to achieve environmental performance [58] and reduced operating costs [69].

Eight strategies make up the Production and Operations category (Table 6). Reduction strategies stand out in this category, especially reducing gas emissions (PO2), energy consumption (PO3), water consumption (PO4) and reducing waste generation (PO5). Strategies in this category are more representative in the sustainability literature, as 13 of 15 papers mention at least 1 of the 8 identified strategies (totalling 32 coded segments). The only exception is OP9—Implementing composting, which was not mentioned by any of the articles from this theoretical perspective. In the circular economy literature, 15 of 20 papers mention at least 1 of the 8 strategies identified, totalling 40 coded segments. The analysis by these theoretical perspectives reveals that in the sustainability literature, the classic strategy PO3—Reducing gas emissions is the most mentioned, as it is also one of the most mentioned in the EC literature, along with PO1—Consuming renewable energy.

Table 6. Number of articles per thematic unit of each SCE strategy in the category of Production and Operations. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
PO1	Consuming renewable energy	7	5	[25,33,47,48,52,54,62,64,66,67,70,72]
PO2	Reducing gas emissions	7	9	[43,46,48,56,57,59,61,62,64,66,67,70,71,73–75]
PO3	Reducing energy consumption	5	3	[45–48,57,58,64,66]
PO4	Reducing water consumption	1	2	[46,60,62]
PO5	Reducing waste generation	5	5	[43,44,48,50,54,56,59,64,73,74]
PO6	Reusing water	2	2	[46,48,64,66]
PO7	Recovering wastes to energy generation	6	2	[33,43,47,52,54,55,57,71]
PO8	Implementing composting	1	-	[70]

3.2.3. Digitalization (DI)

The strategies gathered in this category address the adoption of digital technologies. Digitization is intrinsically connected to the paradigm of a more service-based economy [71]. Moreover, digitalization provides greater connectivity between actors in the circular ecosystem [76,77], and enables preventive maintenance of equipment or operating systems to reduce the likelihood of failure [63]. From the adoption of technologies such as IoT, it is possible to monitor the condition of products, helping to predict when it will be necessary to make a repair and maintenance, for example [54].

Three strategies make up the Digitalization category (Table 7). In the circular economy literature, 8 of 20 papers mention at least 1 of the 3 identified strategies, totalling 18 coded segments. In the sustainability literature, 3 of the 15 papers mention 1 of the 3 identified strategies, totalling 4 coded segments. The difference that stands out between the theoretical perspectives is that digitization strategies are more widespread in the circular economy literature.

Table 7. Number of articles per thematic unit of each SCE strategy in the category of Digitalization. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
DI1	Virtualizing products or process	7	2	[33,43,44,50,54,57,65,70,71]
DI2	Establishing product traceability	1	1	[25,54]
DI3	Monitoring and controlling process	3	1	[25,44,54,63]

3.2.4. Logistics and Transportation (LT)

The strategies gathered in this category address the areas of logistics and transportation. The need for sustainable logistics systems is met by the adoption of strategies such as reverse logistics, which is essential to fit a circular business model [48], as well as being a strategy that enables value reintegration [56]. The need for sustainable distribution systems is reinforced by a shift to more sustainable modes of transportation (e.g., electric) and route optimization (e.g., shared fleet) [60].

Three strategies make up the Logistics and Transportation category (Table 8). In the circular economy literature, 11 of 20 studies mention at least 1 of the 3 identified strategies (totalling 16 coded segments), with the exception of LT3—Reducing fuel consumption, which was not mentioned by any of the articles from this theoretical perspective. In the sustainability literature, 8 of the 15 papers mention at least 1 of the 3 identified strategies, totalling 14 coded segments. The analysis of the theoretical perspectives reveals that the reverse logistics strategy (LT1) is more widespread in the circular economy literature than in the sustainability literature.

Table 8. Number of articles per thematic unit of each SCE strategy in the category of Logistics and Transportation. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
LT1	Implementing reverse logistics systems	11	5	[25,33,44,46–48,50,54,56,57,62,64,65,70,71,75]
LT2	Using green or alternative transportation	2	4	[43,51,54,56,67,75]
LT3	Reducing fuel consumption	-	2	[46,67]

3.2.5. Stakeholders' Networks (SN)

The strategies gathered in this category address the relationship with stakeholders, such as suppliers, employees, industries, research institutes, and customers. A proactive approach with stakeholders is essential for social, economic, and environmental sustainability within business models for value creation and delivery [56].

Eight strategies make up the Stakeholder Networks category (Table 9). In the circular economy literature, 13 of 20 papers mention at least 1 of the 8 identified strategies, totalling 40 coded segments. In the sustainability literature, 11 of 15 papers mention at least 1 of the 8 identified strategies, totalling 38 coded segments. The analysis of the theoretical perspectives reveals that strategies linked to stakeholders are representative in both theories. While SN1—Evaluating suppliers using environmental criteria is the most mentioned strategy in the sustainability literature, SN7—Establishing industrial symbiosis is the most mentioned in the EC literature.

Table 9. Number of articles per thematic unit of each SCE strategy in the category of Stakeholders' Networks. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
SN1	Evaluating suppliers using environmental criteria	6	7	[43,46–48,52,54,57,59,61,64,67,73,75]
SN2	Collaborating with stakeholders for eco-improvements	5	3	[43,44,48,52,56,64,65,78]
SN3	Collaborating with stakeholders for reverse flows	2	2	[43,54,58,72]
SN4	Communicating circular issues to stakeholders	6	4	[43,45,46,48,57,58,61,64,65,73]
SN5	Enabling and incentivizing suppliers to take eco-actions	1	2	[43,46,65]
SN6	Enabling and incentivizing users to consume less	3	1	[33,54,57,75]
SN7	Establishing industrial symbiosis	7	1	[33,43,44,54,57,64,70,72]
SN8	Training employees for ecological conduct	2	5	[43,46,48,51,62,64,75]

3.2.6. Environmental Management (EM)

The strategies gathered in this category address sustainable corporate management inside and outside the organization. To this end, the strategies rely on corporate governance structures [25] for resource, water, energy, and waste management [62,75], which directly enable internal environmental performance. Externally, the focus should be on concern for ecosystem regeneration [54] and conscious exploitation of natural resources, aiming to conserve natural environments [58].

Three strategies make up the Environmental Management category (Table 10). In the circular economy literature, 5 of 20 papers mention at least 1 of the 3 strategies identified, totalling 7 coded segments. In the sustainability literature, 10 of the 15 papers mention at least 1 of the 3 identified strategies, totalling 16 coded segments. The difference that stands out between the theoretical perspectives is that management strategies are more widespread in the sustainability literature.

Table 10. Number of articles per thematic unit of each SCE strategy in the category of Environmental Management. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
EM1	Establishing eco-friendly governance systems	3	4	[25,48,50,59,64,65,73]
EM2	Managing natural resources internally	1	5	[43,52,61,62,66,75]
EM3	Managing and conserving natural ecosystems	1	1	[54,58]

3.2.7. Business Model (BM)

The strategies gathered in this category indicate what companies can do strategically in their business to incorporate circular principles. In a circular ecosystem, companies must rethink how they deliver value [55], adapting their portfolio and mode of operation in order to provide new products, solutions, or services [56]. Strategies in this category can influence the entire value chain, the relationships with stakeholders, and imply the adoption of all the other strategies listed for effective implementation.

Three strategies make up the Business Model category (Table 11). In the circular economy literature, 13 of 20 papers mention at least 1 of the 3 identified strategies, totalling 22 coded segments. In the sustainability literature, 6 of 15 papers mention at least 1 of the 3 identified strategies, totalling 8 coded segments. The analysis by theoretical perspectives reveals that the strategy of rethinking the business from a circular culture (BM1) is representative in both CE and sustainability. However, the products-as-a-service strategy (BM2) is more widespread in the circular economy literature.

Table 11. Number of articles per thematic unit of each SCE strategy in the category of Business Model. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
BM1	Rethinking the business model from a circular culture	5	4	[25,48,50,55,56,58,62,64,65]
BM2	Establishing product as a service systems	8	3	[33,44,45,54,56–58,62,64,70,74]
BM3	Establishing resell and redistribution	3	1	[43,57,60,63]

3.2.8. Environmental Compliance (EC)

The strategies gathered in this category address the adequacy of products and processes in environmentally accepted aspects. Respecting and complying with environmental legislation is the first step towards compliance. Next, some tools can be adopted. LCA, for example, provides a robust analysis of a product's life cycle, measuring resource consumption, environmental impacts, and waste disposal. Another tool that can support signalling at the product level is eco-labelling, dividing products into groups, such as “organic products”. In industrial processes, meanwhile, environmental certificates are essential tools for systematically managing environmental issues, such as ISO 14001, for example [51].

Four strategies make up the Environmental Compliance category (Table 12). In the circular economy literature, 5 of 20 papers mention at least 1 of the 4 identified strategies (totalling 13 coded segments), except EC2—Having eco-certification, which was not mentioned by any of the papers from this theoretical perspective. In the sustainability literature, 8 of the 15 papers mention at least 1 of the 4 identified strategies, totalling 12 coded segments. Except for EC2, the analysis by theoretical perspectives reveals that the strategies in the category are representative in both theories.

Table 12. Number of articles per thematic unit of each SCE strategy in the category of Environmental Compliance. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
EC1	Applying Life Cycle Assessment (LCA)	2	2	[50,51,56,57]
EC2	Having eco-certification	-	4	[43,46,51,75]
EC3	Having eco-labelling	2	3	[43,51,57,64,73]
EC4	Respecting legislations and policies	4	3	[43,48,57,62,64,66,71]

3.2.9. Social Responsibility (SR)

The strategies gathered in this category address respecting and attending to social issues. Diversity, health and safety, good labor relations, social inclusion, public relations, and ethical behavior [46,50] should be the focus of human resources sectors to effect social responsibility to their stakeholders.

Six strategies make up the Social Responsibility category (Table 13). Among the literature analyzed, only the sustainability literature mentions aspects linked to the social dimension. Of the 15 papers, 8 mentions at least 1 strategy of the 6 identified, totalling 37 coded segments. Although the category originated from the sustainability research field, the importance of including it in the set of strategies is evident since recent research has studied the importance of the social dimension for the circular economy and vice versa [1,79–81].

Table 13. Number of articles per thematic unit of each SCE strategy in the category of Social Responsibility. CE—Circular Economy and S—Sustainability.

ID	SCE Strategies	Number of Articles		References
		CE	S	
SR1	Establishing healthy working conditions	-	6	[46,50,51,62,73,78]
SR2	Maintaining a relationship with customers	-	3	[46,50,59]
SR3	Providing diversity and work opportunities	-	4	[46,50,62,78]
SR4	Respecting and supporting the community	-	6	[46,50,62,73,74,78]
SR5	Respecting and supporting the employees	-	3	[46,50,78]
SR6	Supporting research and development	-	3	[46,59,78]

3.3. Current Adoption of SCE Strategies in Brazil

The analysis of CS Reporting reveals the occurrence of SCE strategies in companies operating in Brazil. From the qualitative and quantitative content analysis [26], 1206 occurrences of the strategies were identified in the 51 CS Reporting analyzed, with 355 records in 2016, 385 in 2018, and 466 in 2020. Table 14 presents the summary of the quantities of strategies by categories identified in the 17 companies analyzed.

In the table, the colors highlight the growth/decrease in the occurrence of strategies in each category at the individual company analysis level, considering the total number of strategies in each category. It is possible to see that the categories of Environmental Management and Social Responsibility are the two categories that the companies gave greater continuity in the adoption of total strategies throughout the analyzed period. For example, Altona showed a constancy in adopting strategies from both categories in 2016, 2018, and 2020. Business Model is the category with the fewest records found, and JBS, Renner and Whirlpool stand out with two strategies implemented. In the Products and Materials category, a category with median adoption of the strategies by the 17 companies, Renner stands out with a high increase in records of these strategies (the company in 2016 presented 2 records and increased to 9 in 2018 and 8 in 2020) and Weg that increased from 4 records in 2016 and 2018 to 7 records in 2020. The analyses of the strategies by categories are presented below.

Table 14. Amount of SCE strategies identified by category per year in each analyzed company.

Company	Products and Materials (12 Strategies)			Production and Operations (8 Strategies)			Digitalization (3 Strategies)			Logistics and Transportation (3 Strategies)			Stakeholders' Networks (8 Strategies)			Environmental Management (3 Strategies)			Business Model (3 Strategies)			Environmental Compliance (4 Strategies)			Social Responsibility (6 Strategies)		
	2016	2018	2020	2016	2018	2020	2016	2018	2020	2016	2018	2020	2016	2018	2020	2016	2018	2020	2016	2018	2020	2016	2018	2020	2016	2018	2020
Altona	4	3	3	4	2	3	1	1	1	0	0	1	1	3	3	2	2	2	0	0	0	2	2	2	5	5	5
Ambev	4	3	6	4	6	6	2	2	2	2	2	2	6	5	7	2	2	3	0	0	1	1	2	2	5	6	6
Braskem	4	5	3	5	3	5	0	0	1	0	2	1	4	6	5	2	1	2	0	1	1	1	1	2	5	5	6
CSN	2	2	2	5	6	5	1	1	2	1	0	0	5	5	4	3	3	3	0	1	1	2	2	2	4	2	6
Duratex	4	3	5	7	4	4	1	2	1	0	2	0	5	5	3	3	3	3	0	0	0	3	3	3	5	5	6
Hering	5	3	4	2	3	5	0	1	1	0	0	0	2	4	6	2	2	2	1	0	0	1	1	1	4	5	5
Irani	4	4	3	6	7	7	0	0	1	1	2	1	6	7	7	2	3	3	0	0	0	4	3	3	5	6	6
JBS	3	4	5	5	5	7	2	2	2	1	1	2	4	7	6	2	2	2	0	2	2	2	3	4	5	4	6
M Dias Branco	5	5	6	4	6	6	1	0	0	1	1	2	4	4	3	3	3	3	0	0	0	2	2	2	4	4	6
Natura	6	6	6	7	4	6	1	3	3	1	2	1	4	5	6	2	2	3	0	1	1	1	4	3	5	5	6
Ouro Fino	1	2	2	5	3	4	0	1	2	0	0	1	1	1	2	1	1	1	0	0	0	2	1	2	6	3	6
Portobello	3	2	4	2	3	2	0	0	0	0	1	1	2	1	3	3	2	3	0	0	0	1	0	0	6	3	5
Raia Drogasil	1	2	3	0	1	1	0	2	1	2	2	1	1	1	3	0	1	3	0	0	0	0	1	1	5	5	5
Renner	2	9	8	2	4	6	0	2	2	1	1	2	4	5	7	3	3	3	1	2	2	2	2	3	4	4	6
Suzano	0	3	3	3	4	5	0	1	1	1	0	2	3	1	5	3	3	2	0	0	1	1	3	4	3	3	6
Weg	4	4	7	5	2	4	1	0	2	1	0	0	5	3	2	3	3	3	0	0	0	2	2	2	3	5	6
Whirlpool	4	2	6	3	5	6	0	2	1	1	0	1	3	6	6	2	0	2	0	0	2	2	1	2	4	4	5
Overall Total	56	62	76	69	68	82	10	20	23	13	16	18	60	69	78	38	36	43	2	7	11	29	33	38	78	74	97

The colors in the table indicate the occurrence of the strategies. Dark green indicates a higher occurrence, and dark red a minor occurrence, with intermediate tones between these two colors.

3.3.1. Products and Materials (PM): Occurrences of Strategies

The 17 companies analyzed have adopted strategies from this category since 2016 (Table 15). The strategies most adopted by companies since 2016 are: PM9—Reusing products and materials (71% of companies) and PM12—Recycling products and materials (94% of companies). This expressiveness can be explained given that GRI has a specific standard for materials (GRI standard 301) and waste (GRI standard 306) within the environmental series. Organizations must report the raw materials or recycled materials used (301-2) and the waste destined for reuse and recycling (306-4) [32]. Furthermore, as widely recognized [43,46,51,56], during product design, design decisions are made that impact the generation and treatment of this waste, which PM9 and PM12 strategies have a high relationship.

Table 15. Occurrences of the SCE strategies in the category of Products and Materials in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
PM1	Designing environmentally safe products	5	7	11
PM2	Designing products for durability	2	2	3
PM3	Designing products for upgradability	0	0	0
PM4	Eliminating hazardous and toxic substances	4	3	3
PM5	Using bio-based materials	5	7	10
PM6	Offering or using green packaging	8	8	13
PM7	Offering customization and made to order	1	1	2
PM8	Reducing materials consumption	4	5	3
PM9	Reusing products and materials	12	12	12
PM10	Repairing and maintaining products	0	0	2
PM11	Refurbishing or remanufacturing products	0	1	1
PM12	Recycling products and materials	15	16	16

Other highlights of the table are the strategies that gained attention from companies in 2020: PM1—Designing environmentally safe products, PM5—Using bio-based materials and PM6—Offering or using green packaging). The only strategy that was not adopted in any year analyzed is PM3—Designing products for upgradability.

3.3.2. Production and Operations (PO): Occurrences of Strategies

The 17 companies analyzed have adopted strategies from this category since 2016 (Table 16). The strategies referring to “reduce”, such as reducing emissions (PO2), energy consumption (PO3) and water (PO4), and waste generation (PO5), were coded when evidence was found that the ratio of consumption in the year of analysis was lower than the previous year. For example, Ambev consumed 2.43 L of water for each liter of beer produced in 2020, compared to 2.55 L consumed in 2019 [82]. Thus, there was a reduction in water consumption in the year of analysis when compared to the previous year. Given this, the number of companies that adopted the strategies varied unsteadily according to the analysis of the years, as is the case of PO3—Reducing energy consumption that went from 10 companies in 2016 to 6 in 2018 and 9 in 2020.

Other highlights of the table are the strategies most adopted by companies in 2020, such as PO1—Consuming renewable energy (94% of companies), PO4—Reducing water consumption (64% of companies), PO5—Reducing waste generation (59% of companies), and PO6—Reusing water (76% of companies). The GRI environmental series (GRI 300) brings GRI standards linked to energy (GRI 302), water (GRI 303), emissions (GRI 305), and waste (GRI 306). Organizations are required to report renewable energy consumption (302-1), energy consumption reduction (302-4), water capture and consumption sources (303-3 and 303-5), emissions reduction (305-5), and waste generated (306-3) [32]. The high occurrences of the strategies in 2020 suggest a relationship with the GRI Standards.

Table 16. Occurrences of the SCE strategies in the category of Production and Operations in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
PO1	Consuming renewable energy	11	15	16
PO2	Reducing gas emissions	8	6	9
PO3	Reducing energy consumption	10	6	9
PO4	Reducing water consumption	10	7	11
PO5	Reducing waste generation	7	9	10
PO6	Reusing water	12	12	13
PO7	Recovering wastes to energy generation	6	6	8
PO8	Implementing composting	5	7	6

3.3.3. Digitalization (DI): Occurrences of Strategies

The 17 companies analyzed have been adopting the category's strategies since 2016 (Table 17). All three strategies (DI1—Virtualizing products or processes, DI2—Establishing product traceability, and DI3—Monitoring and controlling process) gained attention from companies in 2020. However, more than half of the companies adopt virtualization (DI1) and monitoring (DI3), but only 3 companies attend to product traceability (DI2).

Table 17. Occurrences of the SCE strategies in the category of Digitalization in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
DI1	Virtualizing products or processes	2	6	9
DI2	Establishing product traceability	1	3	3
DI3	Monitoring and controlling process	7	11	11

3.3.4. Logistics and Transportation (LT): Occurrences of Strategies

The 17 companies analyzed have been adopting the category's strategies since 2016 (Table 18). The strategy LT1—Implementing reverse logistics systems gained the attention of the companies in 2020, which was adopted by 76% of the companies. LT3—Reducing fuel consumption, as well as the practices related to “reduce” from the PO category, was only coded when consumption was lower in the year of analysis. For example, Irani consumed 4,730,735.97 L of fuel (diesel and gasoline) in 2018, whereas in 2017 the consumption was 5,188,935.82 L [83]. However, this strategy was not adopted by any company in 2020.

Table 18. Occurrences of the SCE strategies in the category of Logistics and Transportation in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
LT1	Implementing reverse logistics systems	7	10	13
LT2	Using green or alternative transportation	5	4	5
LT3	Reducing fuel consumption	1	2	0

3.3.5. Stakeholders' Networks (SN): Occurrences of Strategies

The 17 companies analyzed have been adopting the category's strategies since 2016 (Table 19). With the exception of strategies SN6—Enabling and incentivizing users to consume less and SN7—Establishing industrial symbiosis, 59% or more of the companies have adopted the category's strategies by 2020.

Table 19. Occurrences of the SCE strategies in the category of Stakeholders' Networks in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
SN1	Evaluating suppliers using environmental criteria	14	11	15
SN2	Collaborating with stakeholders for eco-improvements	13	13	12
SN3	Collaborating with stakeholders for reverse flows	10	10	10
SN4	Communicating circular issues to stakeholders	1	7	10
SN5	Enabling and incentivizing suppliers to take eco-actions	12	11	12
SN6	Enabling and incentivizing users to consume less	1	2	1
SN7	Establishing industrial symbiosis	3	5	3
SN8	Training employees for ecological conduct	6	10	15

Other highlights of the table are the strategies that gained attention from companies in 2020: SN4—Communicating circular issues to stakeholders (from 1 company in 2016 increased to 10 in 2020) and SN8—Training employees for ecological conduct (from 6 companies in 2016 increased to 15 in 2020). The growth of companies with explicit reporting on circular economy (SN4) may be a result of the popularization of CE, not only worldwide, but also in Brazil. The reports in CS Reporting are based on issues related to the R's (reduce, reuse, and recycle), packaging, waste management, carbon-neutral, low environmental footprint products, the circularity of formulas, and plastics. The growth of SN8 suggests an increase in the concern of companies with regard to the behavior of their employees in environmental aspects.

3.3.6. Environmental Management (EM): Occurrences of Strategies

The 17 companies analyzed have been adopting the category's strategies since 2016 (Table 20). The EM1—Establishing eco-friendly governance systems gained attention from companies in 2020. This result is due to the increase in the number of companies that created specific committees for sustainability issues. For example, Hering and Weg created their "Sustainability Committee" in 2020. At Hering, the committee meets monthly to address the issue, ensuring a systemic management of Environmental, Social and Governance (ESG) aspects [84]. According to Weg, the importance, complexity and dynamism of the sustainability/ESG theme drove the company in strengthening its governance processes [85].

Table 20. Occurrences of the SCE strategies in the category of Environmental Management in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
EM1	Establishing eco-friendly governance systems	10	9	14
EM2	Managing natural resources internally	16	15	17
EM3	Managing and conserving natural ecosystems	12	12	12

Another highlight of the table is the constancy of adoption of the strategies EM2—Managing natural resources internally and EM3—Managing and conserving natural ecosystems by the companies in the analysis period, with EM2 being adopted by 100% of the companies in 2020.

3.3.7. Business Model (BM): Occurrences of Strategies

Some companies out of the 17 analyzed have adopted one of the three category strategies since 2016 (Table 21). Strategy BM1—Rethinking the business model from a

circular culture gained attention from companies in 2020, which is also the most adopted by companies (47% of the companies). Renner, for example, has rethought its business model considering different aspects, from the store's physical infrastructure to more circular products and raw materials [86].

Table 21. Occurrences of the SCE strategies in the category of Business Model in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
BM1	Rethinking the business model from a circular culture	0	5	8
BM2	Establishing product as a service systems	0	0	1
BM3	Establishing resell and redistribution	2	2	2

Other highlights of the table is the only adoption of the BM2 strategy—Establishing product as a service systems in 2020. Whirlpool has a water purifier with a rental system, which includes maintenance service and filter change [87].

3.3.8. Environmental Compliance (EC): Occurrences of Strategies

The 17 companies analyzed have been adopting the category's strategies since 2016 (Table 22). Except for EC4—Respecting legislations and policies, the other three strategies in the category became more adopted by companies in 2020. Of these, the environmental product certification strategy (EC3) is the one that has gained the most attention from companies when compared to 2016.

Table 22. Occurrences of the SCE strategies in the category of Environmental Compliance in Brazilian CS Reporting in 2016, 2018 and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
EC1	Applying Life Cycle Assessment (LCA)	3	3	5
EC2	Having eco-certification	9	11	12
EC3	Having eco-labelling	3	5	7
EC4	Respecting legislations and policies	14	14	14

3.3.9. Social Responsibility (SR): Occurrences of Strategies

Most of the 17 companies analyzed have been adopting the category's strategies since 2016 (Table 23). In 2020, 76% or more of the companies adopt the six strategies of the category, with 100% of the companies adopting strategies SR1—Establishing healthy working conditions, SR3—Providing diversity and work opportunities, SR4—Respecting and supporting the community, and SR5—Respecting and supporting the employees. The high adoption of the category's strategies suggests a relationship with the GRI, since there are in the social series (GRI 400) specific standards related to employment (GRI 401), labor relations (GRI 402), occupational health and safety (GRI 403), diversity and equal opportunities (GRI 405), local communities (GRI 413) [32], among others.

3.3.10. SCE Strategies Adoption Summary

Overall, the analysis of the 51 CS Reporting for 2016, 2018, and 2020 indicates that multinational companies operating in Brazil are directing significant efforts towards a sustainable circular economy. In particular, the strategies of recycling, renewable energy consumption, internal resource management and social responsibility with employees, customers, and community were the ones that showed the highest adoption rates by companies (PM12, PO1, EM2, SR1, SR2, SR3, SR4, SR5). However, the results show that

greater actions need to be taken regarding the offering of products as services (e.g., rental), designing products for upgradability, remanufacturing and reconditioning of products, as well as regarding the reduction of fuel consumption and incentives for users to minimize consumerism (BM2, PM3, PM11, LT3, SN6).

Table 23. Occurrences of the SCE strategies in the category of Social Responsibility in Brazilian CS Reporting in 2016, 2018, and 2020.

ID	SCE Strategies	Occurrences in CS Reporting		
		2016	2018	2020
SR1	Establishing healthy working conditions	16	14	17
SR2	Maintaining a relationship with customers	10	12	16
SR3	Providing diversity and work opportunities	12	13	17
SR4	Respecting and supporting the community	17	16	17
SR5	Respecting and supporting the employees	16	14	17
SR6	Supporting research and development	7	5	13

Gunarathne et al. [14] highlight in their CS Reporting analysis results a possible influence of the GRI Standards on corporate disclosures of Sri Lankan companies. As found by the authors, it is possible that the most found strategies in the CS Reporting of Brazilian companies are the influence of correlation with the GRI Standards.

4. Synthesis: The BP4SCE Framework

Based on the SCE categories and strategies that emerged in the systematic literature review, as well as the qualitative and quantitative analysis of CS Reporting from multinational companies operating in Brazil, the Business Process for Sustainable Circular Economy (BP4SCE) framework was developed. It mirrors Porter's value chain model [21] and the APQC Process Classification Framework (PCF) [22].

As Figure 3 shows, the framework separates the categories of strategies to be implemented in the two levels of processes proposed by the APQC PCF, management and operational processes. The categories that should be explored by the operational processes are Business Model, Products and Materials, Production and Operations, and Logistics and Transportation. The management and support processes should focus on the categories of Environmental Management, Environmental Compliance, Digitalization, Stakeholders' Networks, and Social Responsibility. The relationships between the categories can be vertical or horizontal. In other words, the categories within Management and Support Processes serve as a basis for the operational processes categories. Empirical examples of these relationships are given from the data available in the analyzed CS Reporting.

The strategies in the Business Model category can influence the entire value chain, the relationships with stakeholders, and imply the adoption of all the other strategies listed for effective implementation. Natura, for example, seeking to achieve circularity in its products (BM1), established a reverse logistics program (LT1) that, with a solid relationship with consumers (SR2), collects empty packaging of its brands at its points of sale (SN3), destining them to a partnership with the company TerraCycle (SN2), which follows the recycling process (PM12) [88].

The categories Products and Materials, Production and Operations and Logistics and Transportation, according to the explicit indication of their names, should be explored by the operational processes within the companies as Develop and Manage Products and Service and Deliver Physical Products. Renner, through the reuse (PM9) and recycling (PM12) of 673 kg of jeans leftovers from the production process, developed jeans free of synthetic fibers and made with certified cotton (PM1), produced with 75% of the water consumed coming from reuse (PO6) [86]. The R's strategies (such as reuse and recycling) are not addressed separately in CS Reporting but rather as outcomes of their product development processes and industrial activities.

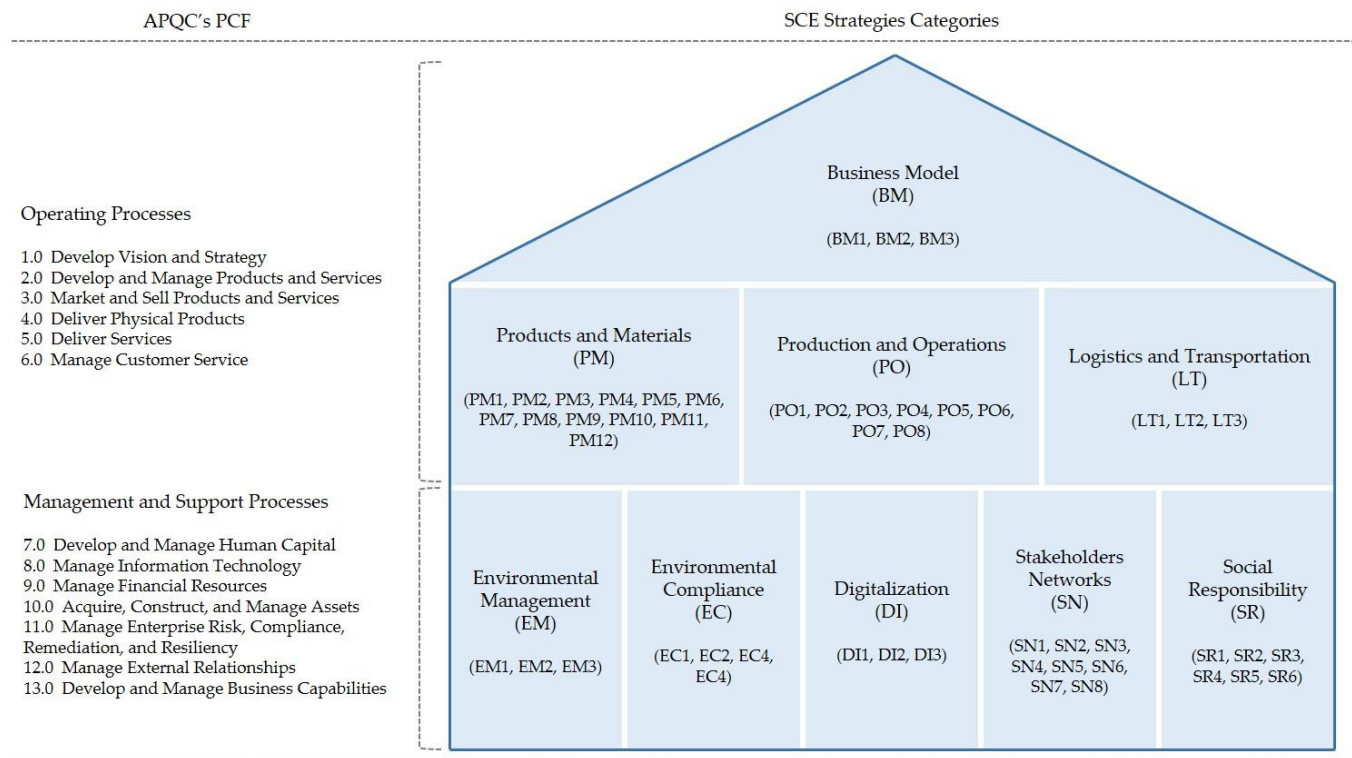


Figure 3. The Business Process for Sustainable Circular Economy (BP4SCE) framework.

The Environmental Management and Environmental Compliance categories should be explored together by management and support processes, which vertically relate to operational process categories. Whirlpool [87], Altona [89] and CSN [90] highlight that to generate less impact on the environment and reduce the environmental footprint, it is necessary to manage the use of natural resources (EM2) in conjunction with the use of mechanisms such as ISO 14001—Environmental Management Systems (EC2). Such actions drive reduced natural resource consumption (PM8, PO3, PO4), reduced air emissions (PO2) and reduced waste disposal (PO5) [89].

Digitalization should also be explored by management and support processes, such as Manage Information Technology. As a way of managing natural ecosystems (EM3), Suzano uses technologies to monitor (DI3) climate conditions, carbon capture, use of natural resources, forest health, and the presence of weeds. Through this information, the teams identify when, where, and whether there will be positive or negative impacts on the company's future productivity [91].

Another type of relationship can be found vertically between Digitalization and Products and Materials. Hering, for example, with automated equipment (DI1) and a Business Intelligence (BI) program, can monitor and analyze (DI3) the dyeing data and reduce the consumption of inputs (PM8) [84]. However, despite the implementations, digitalization strategies deserve greater attention given the digital transformation movement, which will certainly impact all management and operational processes of companies.

Also in the management and support processes, the Stakeholders' Networks and Social Responsibility categories together play an essential role to be explored by processes such as Develop and Manage Human Capital. Weg [85], seeking to promote a healthy and safe environment for its employees (SR1), is based on a workplace safety policy to structure programs that promote awareness, sensitization, and dissemination of a sustainable organizational culture (SN8).

Another type of relationship can be found vertically between Stakeholders' Networks and Logistics and Transportation. Through a collaboration with customers (SN3), Irani carried out the reverse logistics (LT1) of 6223.7 tons of corrugated cardboard scraps in 2020 [92].

The empirical data exemplifies how the strategies and categories of the management and support process and operating process are connected horizontally and vertically.

5. Conclusions

This study carried out three research approaches, which allowed the achievement of the objectives listed in Section 1. Initially, a systematic literature review (SLR) was carried out, where the articles were analyzed by the qualitative coding method. From this approach, fifty SCE strategies arranged in nine categories were identified. The second approach was a qualitative and quantitative content analysis of 51 CS Reporting from companies operating in Brazil, referring to the years 2016, 2018 and 2020, to identify the adoption of SCE strategies. The third and final approach comprised the construction of the conceptual framework—the Business Process for Sustainable Circular Economy (BP4SCE), which originated from the discussions generated in the first two research approaches and mirrors Porter’s value chain model [21] and the APQC Process Classification Framework (PCF) [22].

The differentiator of the strategies identified in SLR is the expansion of the strategies to the sustainable circular economy (SCE) vision. The CE literature is primarily biased towards R’s strategies. The sustainability literature is mainly biased towards emissions, water, energy, and waste. As presented, the list of SCE strategies encompasses both biases to achieve SCE. Therefore, the list itself is important for practitioners to adhere to the strategies and for academics to research the topic further. The organization of these strategies into categories is also a differentiator, as it unifies the academic view with the process management view.

The investigation of the adoption of SCE strategies in Brazilian CS Reporting was unprecedented. The analysis indicates that multinational companies operating in Brazil are directing significant efforts toward an SCE. However, more efforts need to be directed within categories such as Business Model, where low adoption of the strategy was found over the analyzed period. Furthermore, in Products and Materials, there is a median adoption of strategies by companies. These results indicate that, to achieve the effective circular design of products and services by 2030 in Brazil [7], there is still room for the country to grow in infrastructure, market and policies aimed at SCE. CS Reporting is the only and main database on the companies analyzed in this research and is an important means of diagnosing SCE strategies.

The proposed BP4SCE framework is unique. It integrates the circular economy and sustainability perspective into the companies’ process view, which is built upon the most widely used process framework, the PCF. The framework’s purpose is to facilitate business decision-making in the transition to circularity by providing SCE strategies organized according to companies’ processes. Therefore, it guides how companies should employ their SCE strategies in their processes, helping to visualize these processes and the people responsible for them. The framework also has high potential to assist in reporting SCE data in CS Reporting. The process view can be an important form of communication between sustainability departments, which are responsible for CS Reporting, and other company departments.

A limitation of the work was to investigate seminal SLR on SCE strategies. Future research needs to advance on new strategies that were not included in these SLRs, such as digitization strategies. Only three were found, but this category should be expanded. In CS Reporting, evidence of the adoption of strategies was sought, but the consistency of adoption by companies is still unclear. Do companies cancel the adoption of some strategies, or do they simply stop reporting? Future research analyzing current and new CS Reporting is needed, so that it is possible to identify if there is a constancy of adoption and if a sustainable circular economy is, in fact, growing in Brazil. Finally, although the framework developed is firmly based on academic and practical results, practitioners and unbiased experts have not validated it. Future research can be carried out to empirically

evaluate and systematize the correlations and dependencies between strategies within companies' processes.

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Abbreviations

The following abbreviations are used in this manuscript:

BP4SCE	Business Process for Sustainable Circular Economy
CE	Circular Economy
CS Reporting	Corporate Sustainability Reporting
GRI	Global Reporting Initiative
IR	Integrated Reporting
S	Sustainability
SLR	Systematic Literature Review
SASB	Sustainability Accounting Standards Board
SCE	Sustainable Circular Economy

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