

Review

# Business Model Innovation toward Sustainability and Circularity—A Systematic Review of Innovation Types

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**Abstract:** Organizations increasingly build on business model innovation (BMI) to reinvent their business models in sustainable and circular ways. This is reflected by a surge in academic research and business practice on sustainable and circular business model innovation. In this article, we take stock of the current literature to clarify which types of innovations contribute to the transformation to sustainable and circular business models. Building on a systematic literature review on sustainable and circular business model innovation using Systematic Reviews and Meta-Analysis (PRISMA), our primary contributions include (1) the identification, categorization, and discussion of various innovation types that lead to sustainable and circular business model innovation, (2) the identification of a research gap, and (3) avenues for future research.

**Keywords:** business model innovation; circular business model; sustainable business model; sustainable innovation; circular innovation



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## 1. Introduction

Fueled by climate change, achieving ecological, economic, and social sustainability has become a dominant imperative for policy and management agendas worldwide [1,2]. As conventional business activities threaten to breach planetary boundaries, interest in the nexus of sustainability, business models (BM), and innovation surged. Increasing awareness of the negative environmental impacts of traditional business models has promoted the realization of more sustainable business models (SBM) worldwide [3,4]. A business model describes how an organization proposes, creates, and captures value for its business, customers, and stakeholders [5,6]. Organizations are under growing pressure to incorporate sustainability into their business logic, disclose their environmental goals and performance, and reconfigure their business models more sustainably [7,8]. By doing so, businesses need to proactively consider the entire life cycle of their products or services while simultaneously adapting to evolving customer needs [9,10]. Hence, business model innovation (BMI) has emerged as a key to integrating sustainability into conventional business model logic [11].

Technological advancements, digitalization, and innovation drive the transition to a circular and sustainable economy [12–14]. At the same time, sustainability policies direct toward a more regenerative economic system [15,16]. Consequently, a sustainable business model (SBM) is a conventional business model that has been adjusted to incorporate sustainability into the organization through innovation [17,18]. Similarly, circular innovation refers to the process by which the circular production model is perceived as “new,” involving a comprehensive analysis cycle starting from the materials and energy used in production to how production waste or end-of-life products are managed [19]. The literature on sustainable and circular business models gained momentum in recent years and has produced several review articles, i.e., [20–22]. While existing literature underscores the importance of innovation for transforming to a more sustainable or even circular business model, previous research has not been able to clearly explain how business model innovation (BMI) contributes toward the creation of sustainable or circular business models

(CBM) and which types of innovation are crucial for the transformation process. We argue that managers and scholars alike would benefit from a comprehensive overview of the state of the art of innovation types that enable sustainable (SBMI) and circular business model innovation (CBMI). Thus, this paper aims to systematically investigate this gap by answering the following research questions:

**RQ 1.** *How do business model innovations lead to sustainable or circular business models?*

**RQ 2.** *Which types of innovation contribute to transforming business models into sustainable or circular business models?*

To address these questions, we screened 440 papers dealing with BMI in the context of sustainability and/or circularity through a systematic literature review and used content analysis to analyze 71 papers in detail. This paper is divided into six sections. Following the introduction, Section 2 describes the broader theoretical background of BMI in general and SMBI and CBMI in particular. Section 3 describes our research methods. Section 4 provides the detailed literature review results and categorization of the identified innovation types relevant to SMBI and CMBI. Section 5 discusses the results in some detail. Lastly, Section 6 identifies research gaps, lays out avenues for future research, and points to vital implications for managers, policymakers, and practitioners.

## 2. Background on Business Model Innovation

Business models (BM) outline how organizations create, deliver, and capture value for the organization, its customers, and its stakeholders [5] and have been discussed in the literature for some decades [23]. A value proposition describes a company's offer to potential markets to increase competitive advantage, while value creation covers what is necessary to create value for customers. Finally, value capture deals with how companies generate revenues and profits to cover their costs [6]. According to Foss and Saebi [24], a BMI encompasses "designed, novel, and non-trivial changes to the key elements of a firm's BM and/or the architecture of these elements" (p. 216). BMI can be defined as a process that involves creating an entirely new BM as a startup, transforming an existing BM into a new one, diversifying the current BM by adding another one, or acquiring a new BM and integrating it into the existing one [25] and is viewed as pivotal for success and performance of firms [26]. BMI promotes sustainability by evaluating traditional BMs based on the triple bottom line [27] and maximizing long-term benefits for society, the environment, and the organization [10]. Therefore, to create a successful BMI, an organization must outline how it will generate value in the market [28]. So, organizations can identify new sources of value creation and gain a strategic advantage over their competitors [29,30]. BMI can take two primary forms: (1) radical innovation, which is creating a brand-new business model, or (2) incremental innovation, by adjusting elements of an existing one [31,32]. Drivers of BMI are increasingly shifting from economic revenue and profit maximization to prioritizing environmental protection and social capital [33].

### 2.1. Sustainability-Oriented Business Model Innovation

Sustainable Business Model Innovation (SBMI) aims to incorporate economic, social, and environmental considerations in the value creation and capture activities of BMs perspective [10,34,35]. SBMI seeks to integrate economic, environmental, and social aspects of sustainability into an organization and embrace a long-term perspective [36,37]. SBMI uses a triple-bottom-line approach that evaluates an organization's social, environmental, and economic impact to measure its performance [28,38,39]. The primary aim was initially to encourage businesses to transition towards a more sustainable economic system and integrate sustainability considerations into their organizational practices [40,41]. The concept has developed over time, and current definitions in the literature commonly view SBMs as a modified version of the conventional BM, integrating characteristics and goals

of sustainability [2]. These definitions encompass concepts, principles, or objectives that promote or integrate sustainability into the organization's value proposition, creation, delivery, and/or capture mechanisms [42]. SBMI can help to transition towards more SBM and is therefore seen as a way to minimize negative impacts on environmental, social, and governmental aspects [28,43].

Reshaping a BM that incorporates economic, social, and environmental aspects is highly demanding and requires substantial organizational improvements and cultural support across various levels [44]. Creating an SBM involves four dimensions: what, why, when, and how [45,46]. Organizations must determine what type of SBM to develop based on their corporate values (what and why). SBMs must balance short- and long-term objectives (when), and the organization must select the best approach to implement such models (how) [46]. Smart technologies included in the design and implementation of SBMs can speed up and improve the creation process [40,45]. In general, SBMs are defined as those that involve actively managing multiple stakeholders, creating monetary and non-monetary value for a broad range of parties, and adopting a long-term perspective [15,47]. SBMs challenge traditional financial value creation by closing material loops and achieving zero-waste goals [48]. Ecological value is created by extending stewardship for materials and products and replacing traditional models [22]. The opportunity for sustainability can be described as a concept or innovation that has the potential to generate one or more economic benefits, which can be realized through the implementation of those ideas [49,50].

## 2.2. Circularity-Oriented Business Model Innovation

Given that the present economic system is not viable in terms of economic, environmental, and social sustainability, business models need to be transformed to become circular [51,52]. A circular business model (CBM) is a specific type of SBM that holds to the principles of circular economy (CE) [19,53]. The CE approach provides environmental, social, and financial benefits when it replaces the traditional linear-economy model [54]. Scholars have proposed organizing frameworks, such as 6 Rs or 9 Rs [22]. The 9 Rs framework has three subdomains: R strategies for smarter product use or production (refuse, rethink, reduce), R strategies for product lifespan extension (reuse, repair, refurbish, remanufacture), and R strategies for the effective application of materials [4,22,53]. The CE principles demand a constant flow of technical, digital, and biological materials for minimizing, recycling, or avoiding waste whenever possible [52].

Circular business model innovation (CBMI) involves an iterative process with various phases, such as ideation, implementation, and evaluation [53,55]. Depending on the scope of innovation, CBMI can lead to minor adjustments or substantial changes to various business model elements. By reimagining how value is created, delivered, and captured [56], CBMI can align a company's value creation with circular principles [54,57]. While CBMI is a relatively new field, there has been a surge in sustainability tools that support the business model innovation process [32]. Numerous methods and tools have been created to aid business developers in overcoming challenges encountered when designing and innovating CBMs [32]. These challenges include effectively communicating offers, optimizing reverse logistics, and addressing the time lag between product availability and demand [38]. Tools come in different forms, such as guidelines, checklists, or analytical tools, and primarily focus on conceptual design, supply chain involvement, and incorporating stakeholder and managerial considerations [38]. Both literature and practice acknowledge that the innovation process needs structure and guidance to direct circular thinking in supporting business model design.

Internal and external factors drive circular economy strategies. Internal factors include organizational culture, a commitment to circularity, stakeholder goal alignment, collaborations, product development, innovation, material and production efficiency, quality enhancement, customer satisfaction and loyalty, risk management, production process stability, and financial gains [33]. Adopting a CBM requires innovation which involves a holistic view that goes beyond merely changing the supply chain but also involves scrutiniz-

ing the value creation process through multiple cycles to minimize the disposal of products at the end of their life [47,58]. CBMI can manifest in various forms, such as designing a new business model from scratch, transforming an existing model, acquiring a new model, and diversifying through additional models [52]. Two popular innovation approaches, effectuation (learning from entrepreneurial practice) and lean startup (testing new ideas rapidly in practice), have been used as foundations for recent CBMI approaches [59]. Creating and implementing successful BMs for CE can be challenging due to various factors such as costs, availability of raw materials, cultural differences, stakeholders' interests, economic policies, and the business environment. These challenges may hinder the implementation of CE and its impact on sustainability [22,50,60].

### 3. Methods

We conducted a systematic literature review to answer our research questions and to present an overview of the status of BMI and its role in facilitating the transition towards sustainable and circular business models. This method ensures reliable, replicable, and synthetic results and follows a rigorous, clear, and transparent method for data collection and analysis [61]. It enables the investigation, synthesis, and evaluation of the literature for any specific research area. It expands the existing knowledge base, draws robust conclusions and implications, generates initial conceptualization, recognizes and addresses research gaps, and promotes future research. The PRISMA 2020 method, consisting of a 27-item checklist and flow diagram, was adapted to provide transparent, accurate, and comprehensive reporting of systematic reviews [62]. The process of selecting studies followed the PRISMA 2020 flow diagram and checklist to identify how business model innovations lead to sustainable or circular business models and which types of innovation are used.

The search strings were applied through the categories of "abstract", "title", and no time limitation, peer-reviewed, and the outcomes were merged using the AND operator (Table 1). The databases searched include Ebsco, Web of Science, and ProQuest. The first search on Web of Science used the combination "business model innovation" resulting in 1134 studies. The second search on Web of Science used the combination "business model innovation" AND "sustainab\*", resulting in 503 studies. The third search on Web of Science used the combination "business model innovation" OR "business model" AND "sustainab\*" OR "circular\*", resulting in 54 studies. Finally, the combination "business model innovation" OR "business model" AND "sustainab\*" OR "circular\*" was used in Ebsco and ProQuest as well, resulting in 158 and 232 studies between 2012 and 2022.

**Table 1.** Literature search string protocol.

Search Field	Number of Non-Exclusive Results			
	Ebsco	Web of Science	ProQuest	Last Updated
Topic/Article title, Abstract, Keywords	637	1134	3438	23 August 2022
Topic/Article title, Abstract, Keywords	244	503	2233	23 August 2022
Topic/Article title, Abstract, Keywords	158	50	232	23 August 2022

Initially, we identified a total of 440 publications for detailed evaluation. After eliminating 42 duplicates and performing an initial screening, an additional 220 publications were eliminated as they were not relevant to the research topic or did not focus on business models related to sustainability or circularity. All the publications found were in English. In a subsequent screening step, 126 publications were additionally excluded if they mentioned sustainability or the circular economy but did not refer to innovation or failed to identify the innovation focus of the transition towards sustainability or circularity. A narrative literature search was conducted carefully by following the snowballing approach and using the keywords "sustainable business model innovation" AND "literature review"/"review". Following this, 16 relevant research papers were chosen as additional literature. The final

literature corpus is thus composed of 71 entries. Figure 1 illustrates the identification of studies via a flow diagram.

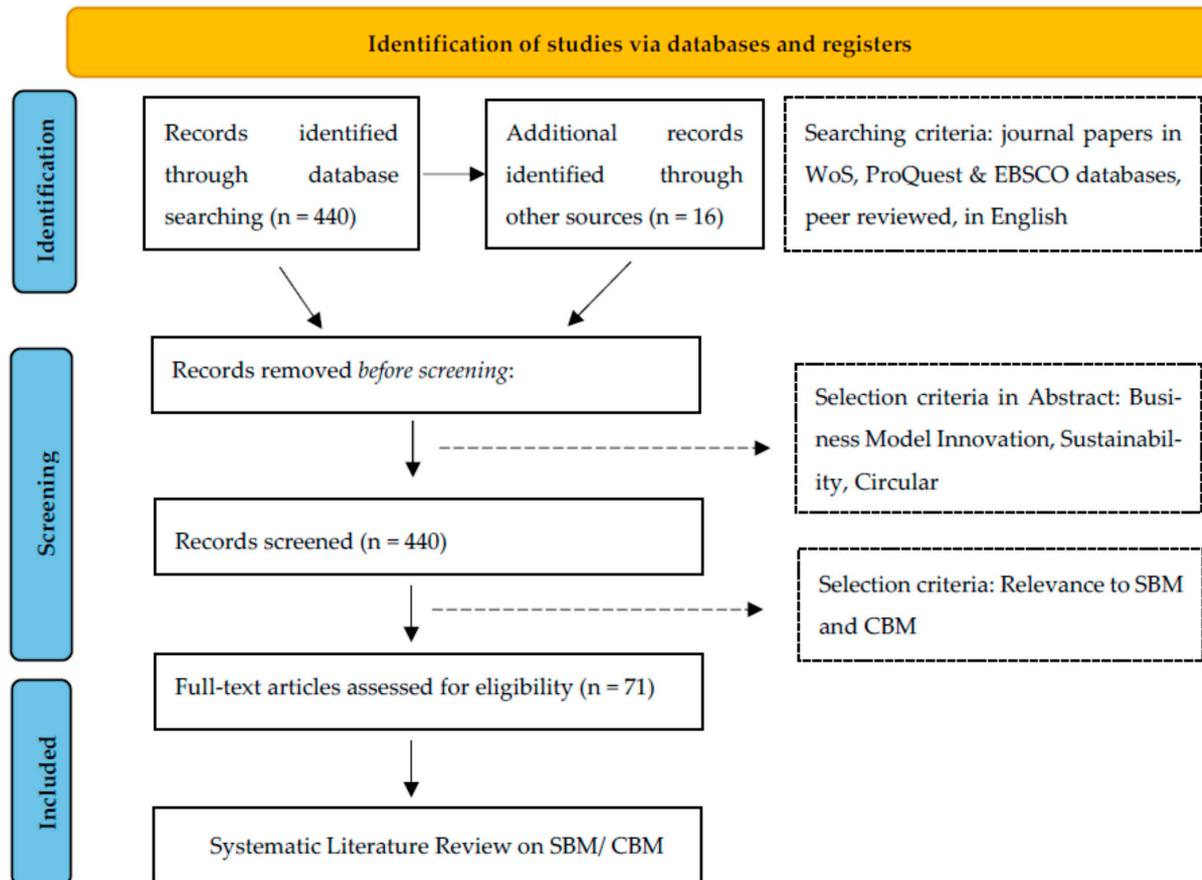
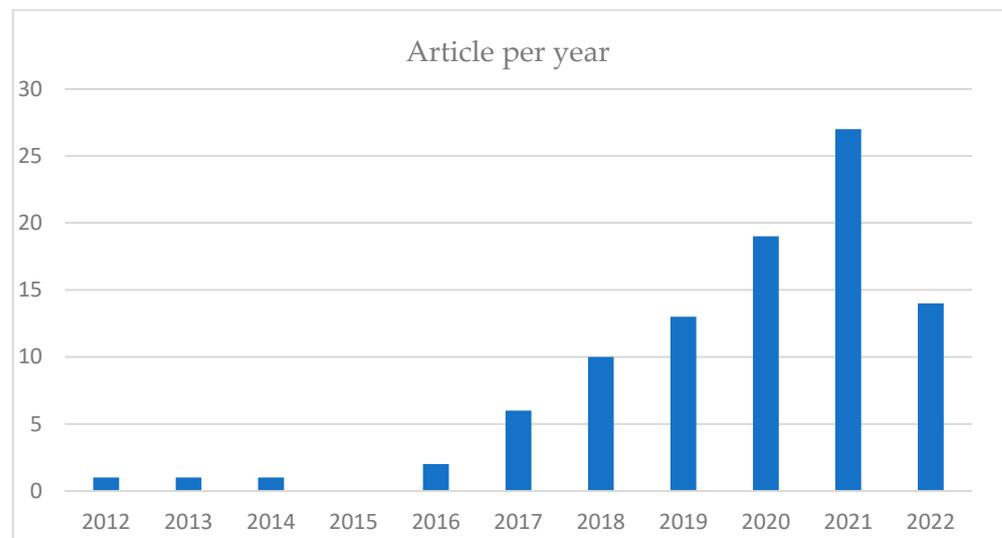


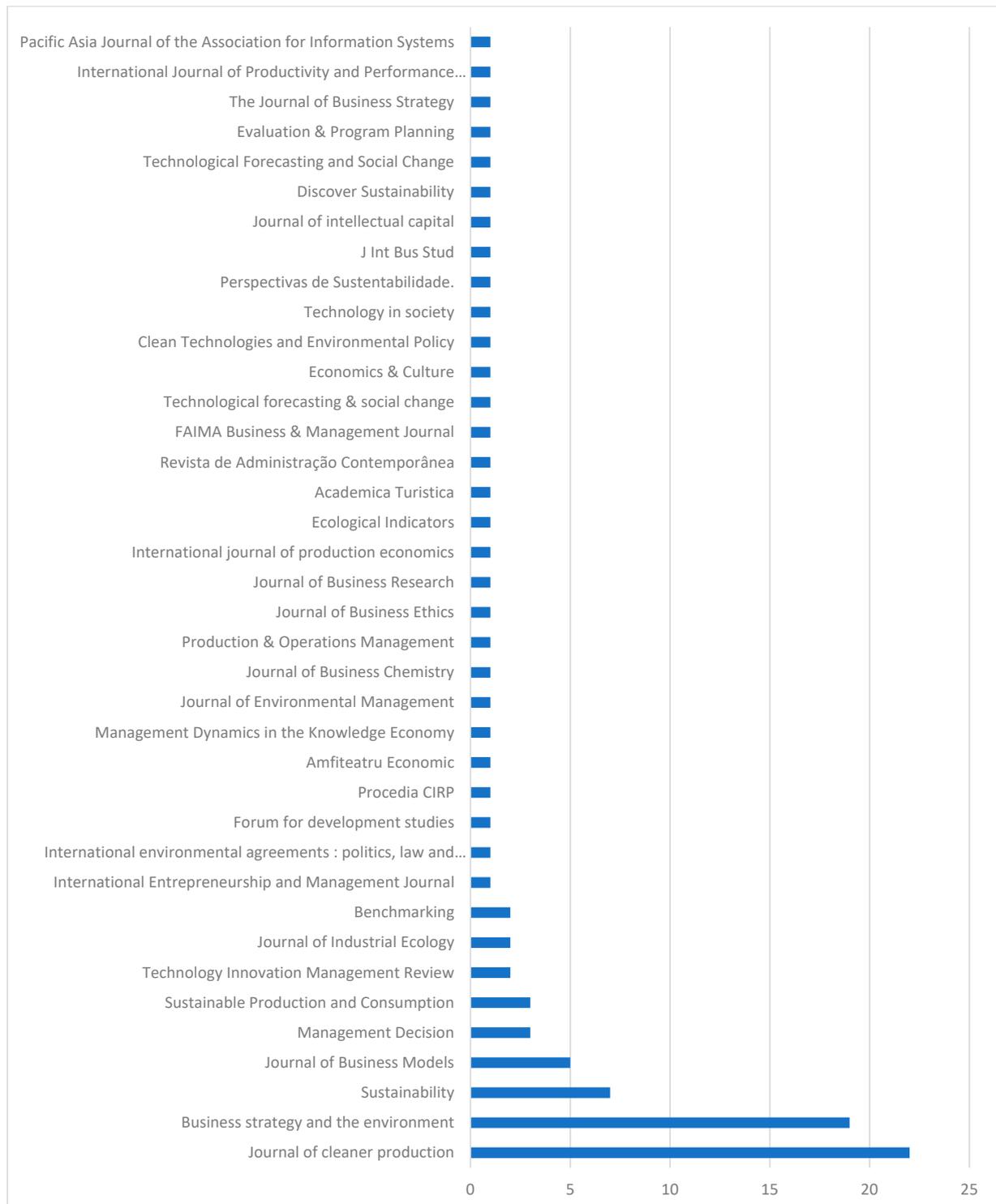
Figure 1. PRISMA 2020 flow diagram.

Figure 2 shows the distribution of the 71 publications according to their chronological order. The earliest publication within this sample dates to 2012. From 2012 to 2017, a consistently low number of publications was recorded. However, there was a notable rise in the number of publications in 2021. For this paper, publications up until August 2022 were considered for the literature review. It is evident from Figure 2 that research output on this topic surged starting in 2020, underscoring the rising significance and relevance of this topic.



**Figure 2.** The number of publications from 2012–August 2022.

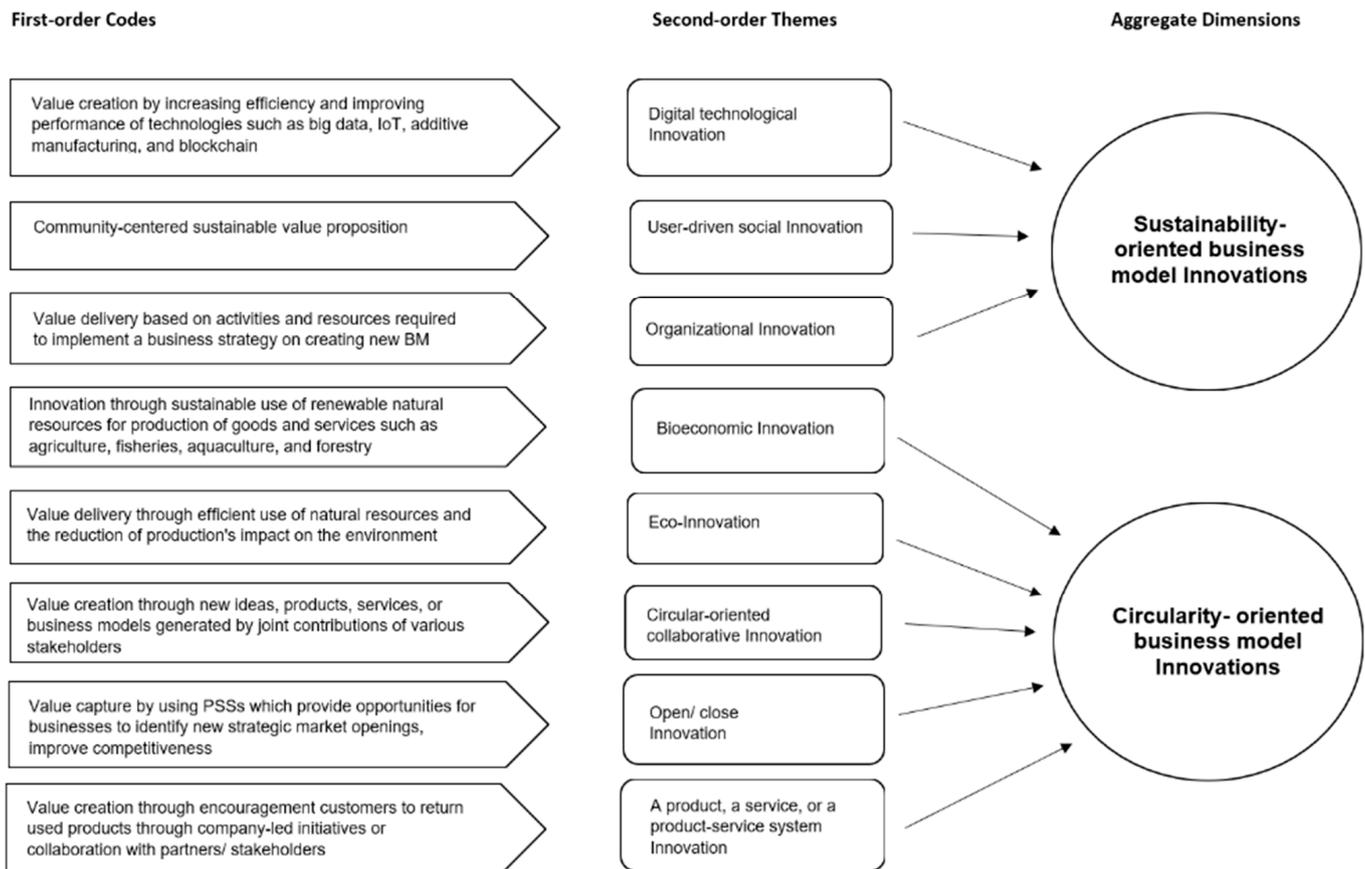
The distribution of publications across different journals is illustrated in Figure 3. Notably, the Journal of Cleaner Production surpasses other journals, presenting the largest number of publications that adhere to BMI, SBM, and CBM criteria. This distinctive position can be credited to the journal’s focus on sustainability-related subjects and the circular economy, which are characterized by their practical applicability. This thematic focus likely contributes to the substantial quantity of papers published within the Journal of Cleaner Production.



**Figure 3.** The publications among various journals from 2012–August 2022.

Data analysis was conducted using qualitative content analysis [63]. First-order codes were developed to capture information about innovation approaches and value types, providing a foundation for organizing the data. Comparative analysis of the coded data revealed similarities, differences, patterns, and trends. Second-order categories were then created to classify the data into broader themes, allowing for a more comprehensive view. These categories were further condensed into aggregate dimensions, forming multidimensional innovation types, as shown in Figure 4. This systematic approach enabled data

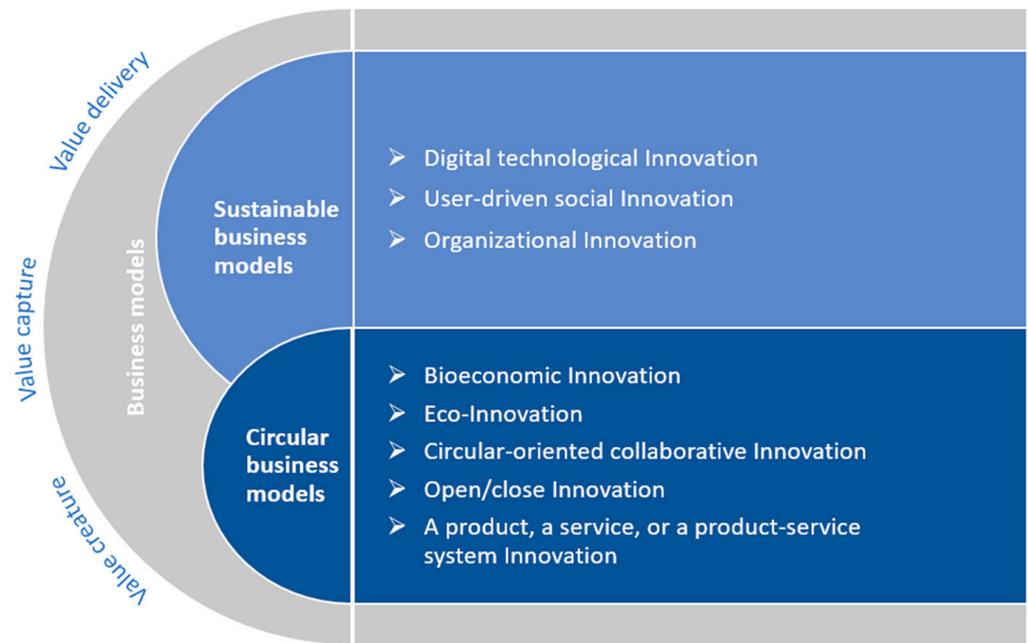
organization, analysis, and synthesis, leading to a comprehensive understanding of innovation approaches and types. The findings serve as a fundamental basis for decision-making and offer opportunities for further exploration within the academic domain of innovation. In the results section, we will elicit the single innovation types, as established in the second-order themes.



**Figure 4.** Data analysis and structure.

#### 4. Results

In this section, we present the results of our literature review and content analysis in some detail. Figure 5 gives a condensed overview of identified innovation types that drive sustainable and circular business model innovation. In sum, we found three types of innovation that lead to SBMs and five innovation types that lead to CBMs. In the following, Section 4.1 describes which types of innovation are used for SBMI, and Section 4.2 delineates which types of innovation are employed for CBMI.



**Figure 5.** Innovation types of business models.

4.1. Sustainable Business Model Innovation

We identified three types of sustainability-oriented business model innovations in our analyzed papers. Table 2 gives an overview of the sustainable innovation types in terms of definition, value-creation, delivery and capture strategies, and core innovation activities employed. We delineate all sustainable innovation types in detail below.

**Table 2.** Innovation Types of Sustainability-oriented business model innovations.

Innovation Types	Definition	Value Creation, Delivery, and Capture Strategies	Core Innovation Activities
Digital technological Innovation	Innovations based on technological advancements and digitalization.	high impact on all value dimensions	e.g., SMART technologies such as app-based smart-sharing systems (expanded electric vehicle use, bike-sharing); increased energy efficiency; digital infrastructure
User-driven social Innovation	User-driven innovation offers solutions through an iterative process that involves engaging potential customers in designing the value proposition. The process of designing a sustainable business model entails creating tangible and intangible social value.	High impact on value creation	e.g., social enterprises, focus on achieving social goals by fostering relationships and mutual interactions between market participants.
Organizational Innovation	Organizational innovation focuses on reorganizing an organization’s purpose, goals, processes, and value creation and delivery to achieve sustainability goals while maintaining profitability.	High impact on all value dimensions	e.g., business modeling, risk assessment, financial management on CEO/Finance/HR level

#### 4.1.1. Digital Technological Innovation

Adopting a holistic view, such as a shared value perspective on how an organization creates, delivers, and captures value that prioritizes stakeholder concerns, is fundamental to promoting sustainability in organizations [42]. Technological innovation is recognized as a critical component of sustainable development, and some companies worry that becoming more environmentally friendly will be costly and harm their competitiveness. However, as the literature shows, innovation can be a significant tool for promoting sustainability and gaining a competitive advantage [36]. Using technologies such as big data, IoT, additive manufacturing, and blockchain, value creation can be optimized by increasing efficiency and improving performance [64]. The BM's value delivery aspect focuses on executing activities and procedures that can deliver the promised value [65,66]. Therefore, value delivery encompasses the necessary resources and capabilities, such as technical support systems and digital infrastructure [41]. Value capture focuses on a company's revenue streams and cost structure [67]. To capture value for the business model, firms can use digitalization to increase profits through various actions, such as optimizing resource utilization, managing product life cycles, tracking residual value, and reducing transportation costs [67,68].

Additionally, companies can develop new revenue streams by targeting a new customer base [69]. The emergence of Industry 4.0 requires the implementation and integration of various information, digital, and operation technologies (IDOT). These technologies range from basic to advanced, including industrial sensors, controllers, robots, data analytics, cloud computing, and AI, and they are necessary to achieve the design principles of Industry 4.0 [17,70]. Industry 4.0's digital transformation involves digitizing and integrating the entire product lifecycle value chain, which supports environmental sustainability through sustainable energy and resource transformation [49]. It fundamentally changes how societies produce, trade, consume, and live. The digitization of energy systems and the widespread use of IDOT, including wireless networks and blockchain technologies, have created significant opportunities for advancing the energy sector [64]. The emergence of Industry 4.0 and digital transformation is altering the nature of work for human resources [17]. According to industrial reports, Industry 4.0 has significantly impacted the recruitment industry. In this environment, industrial robots, automated vehicles, and intelligent machines increasingly replace humans in activities like inventory tracking, quality control, and product distribution [41]. While it is expected that Industry 4.0 will eliminate many low to medium-skilled jobs, it is also predicted that it will create new employment opportunities in areas such as IT or process engineering [70]. In sum, we found that digital technological innovation to be highly relevant for value creation, deliver, and capture.

#### 4.1.2. User-Driven Social Innovation

The concept of user-driven innovation suggests that innovation is driven by users' needs, ideas, and opinions and is often the outcome of a collaborative process between users and innovators [71]. It offers solutions to simultaneously create benefits for society and business through an iterative process engaging potential customers in co-designing the value proposition. User-driven innovation includes creating a community-centered sustainable value proposition [32,71]. It may involve integrating principles from SBMI and user-driven anti-consumption and well-being habits to create a sustainable business model that promotes sustainable and even anti-consumption behaviors [52].

Social business models, also called social enterprises, focus on achieving social goals by fostering relationships and mutual interactions between market participants. Thus, these models prioritize creating both tangible and intangible social value over economic value [72]. Trust is a fundamental aspect of these business models. Their governance framework ensures the organization meets its obligations to its stakeholders, including the larger society and the environment [73]. Social business models prioritize creating tangible and intangible social value over economic value and combine a social mission with market value to create a social value proposition that benefits people, the planet, and profit [17].

#### 4.1.3. Organizational Innovation

Sustainable organizational innovation requires analyzing an organization's purpose, core goals, underlying processes, and value creation in relation to social and environmental issues [73]. Thus, the strategic objective is to encourage organizations to think beyond their products and services by redefining their purpose and economic and operational functions and pursuing sustainability goals while still making a profit [74]. Implementing sustainable organizational innovation involves developing a business model and overseeing financial management, including forecasting a profit and loss statement [75]. Risk assessment is also necessary to evaluate the risks associated with introducing a sustainable business model. In addition to the previous level's activities, core activities at this level include business modeling, financial accounting, and risk assessment [30]. Value delivery is based on activities and resources required to implement a business strategy [76]. Therefore, organizations need specific competencies to adapt to sustainability [45] successfully. The literature categorizes four competencies: soft skills, skills-based, tech-based, and mixed competencies [77]. Skills and knowledge-based competencies involve acquiring specialized knowledge or abilities, such as hiring employees with specific skill sets, training employees to develop CE-related expertise, and educating managers about SBM [40]. Tech-based competencies include proficiency in IT or software to support circularity within the organization or expertise in innovative circular manufacturing technologies [45].

#### 4.2. Circular Business Model Innovation

We identified five types of circular-oriented business model innovation in our analyzed papers. Table 3 provides an overview of the circular innovation types, a definition, their impact on BM value-creation, delivery, and capture strategies and core innovation activities employed. We describe and differentiate all circular innovation types in some detail below.

##### 4.2.1. Bioeconomic Innovation

Bioeconomic innovation is based on using renewable resources to create goods and services. Transitioning to a bioeconomy requires innovation in both technology and BMs. Many bioeconomic innovation products lack profitability due to low demand, so rethinking value creation, delivery, and capture is essential. CBMI is a viable option for transitioning to a bioeconomy, allowing a holistic approach to value proposition with a circular perspective [52,78]. Bioeconomic innovation encompasses traditional sectors such as agriculture, fisheries, aquaculture, and forestry and modern sectors such as biotechnology or bioenergy [64]. Based on Merli, Preziosi, and Acampora [29], there are still significant gaps in knowledge, particularly in the development of bioeconomic CBMs. For example, according to Fraccascia, et al. [79], it is vital to support research on circular bioeconomic innovation for using agricultural waste to create new products, as waste is generated at every stage of the agrifood supply chain, often due to inefficient or poorly adapted processes and handling methods. Nevertheless, converting agricultural waste and by-products into valuable resources makes it possible to create new, value-added biobased products such as bioenergy and biomaterials [31,79]. While bioeconomic innovation is most prominently discussed with regard to value creation, literature on value delivery and -capture is still scarce.

##### 4.2.2. Eco-Innovation

Eco-innovation is a key driver in the transition towards a CE. Eco-innovation refers to any technological or non-technological innovation that promotes sustainable development by using natural resources more efficiently and reducing the environmental impact of production methods. It involves the development or adoption of new products, processes, services, or management methods that result in reduced environmental risk, pollution, and negative impacts on resource use compared to existing alternatives [40,48,52,56]. To drive the transition to a CE, various practices are needed, including eco-innovation; adoption of new BMs, applying the principles of reduce, reuse, and recycle (3Rs); and effectively managing material flows. These practices enable materials to be reused, recycled, or reman-

ufactured, closing the loop and promoting sustainability [48]. Six types of eco-innovation can facilitate the implementation of a CBM: product design, process, organizational, marketing, social eco-innovation, and system eco-innovation [52]. Many companies are adopting eco-innovation as a strategy to create both economic and environmental value as they become more aware of the environmental impact of their resource transformation processes [48,52]. In sum, eco-innovation can impact all BM value-dimensions.

#### 4.2.3. Circular-Oriented Collaborative Innovation

Circular-oriented collaborative innovation is the process whereby new ideas, products, services, or business models are generated through the joint contributions of various stakeholders [22]. The principles of collaborative ecosystems in business are no longer limited to individual firms but instead involve the broader industries and markets within which they function [30]. This is a new area of research in CE literature, focusing on the combination of product design, business models, and value network configurations to implement circular economy strategies. The ultimate objective of such strategies is to extend product lifetime by preserving the product characteristics as long as possible or restoring them, thus reducing the use of novel resources and disposing of obsolete goods. Included are product design, business model modifications, and various value network arrangements [52]. The shift towards new economic and societal systems like the circular economy demands the intentional design of new products, services, and BMs and experimentation with them. Successful implementation of these new BMs requires collaborative capacity across organizations. Critical factors include circular-oriented innovation, the recognition of interconnection within diverse networks of actors, and collaboration across organizations and sectors [30,40]. We find that circular-oriented collaborative innovation can impact all BM value dimensions.

#### 4.2.4. Open/Close Innovation

Innovation strategy can be categorized as “closed” or “open” based on the level of collaboration. In a closed strategy, circularity principles are implemented within the company, such as resource reuse and product quality improvements, for example, organization-driven initiatives to encourage customers to return used products. An open strategy involves collaborating with external partners, customers, and user communities to increase circularity in the CBM [80]. According to Chesbrough [81], closed innovation is becoming less sustainable in today’s dynamic business environment, but as Bocken and Ritala [80] show, a closed innovation strategy can still lead to CBM. Open Innovation is a concept that encourages organizations to leverage both internal and external ideas, as well as internal and external strategies, to drive technological advancements. It involves integrating internal and external ideas into BM that create value. Open Innovation acknowledges that companies can benefit from commercializing their internal ideas through external channels to generate profits [81]. Three open innovation-based CBM strategies are open-narrowing, open-slowning, and open-closing [80]. The open-narrowing strategy involves companies in the same sector working together to reduce the environmental impact of their production processes. They focus on optimizing resource use and communicating their ecological practices to consumers. The open-slowning strategy aims to extend the product’s lifetime through innovative solutions to delay disposal.

In contrast, the open-closing strategy aims to reduce waste by integrating external ecosystems to recover and reintroduce resources into the system after use [38,52,80]. Closed approaches provide greater control over the circular process and value capture, thus reducing uncertainty. Open approaches enable the flexible integration of new capabilities such as product return services, repair, and maintenance services, leveraging user and producer ecosystems. Many leading organizations adopt multiple approaches within their BMs [80]. Open/close strategies can significantly impact all BM value dimensions.

**Table 3.** Innovation Types of Circularity-oriented business model innovations.

Innovation Types	Definition	Value Creation, Delivery, and Capture Strategies	Core Innovation Activities
Bioeconomic Innovation	Bioeconomic innovation is based on using renewable resources to create goods and services. It encompasses traditional sectors such as agriculture, fisheries, aquaculture, and forestry, as well as modern sectors such as biotechnology and bioenergy.	Not clear	e.g., Business model innovation as many bioeconomy products lack profitability, and therefore, companies must rethink their value creation, delivery, and capture strategies.
Eco-Innovation	Eco-innovation refers to any technological or non-technological innovation that promotes sustainable development by using natural resources more efficiently and reducing the environmental impact of production methods.	High impact on all value dimensions	e.g., Product design, process optimization, improving energy efficiency, organizational, marketing, social eco-innovation, system eco-innovation, green innovation
Circular-oriented collaborative Innovation	Circular-oriented collaborative innovation is the process whereby new ideas, products, services, or business models are generated through the joint contributions of various stakeholders. It includes the combination of product design, business models, and value network configurations to implement circular economy strategies.	High impact on all value dimensions	e.g., Product design, modifications to the business model, and various arrangements of the value network
Open/close Innovation	Innovation strategy can be categorized as “closed” or “open” based on the level of collaboration. An open strategy involves collaborating with external partners, customers, and user communities to increase circularity in the CBM.	High impact on all value dimensions	e.g., Open/close-narrowing, open/close-slowness, and open/close-closing
A product, a service, or a product-service system (PSS) Innovation	A product, a service, or a product service system (PSS) BM prioritizes sustainability by reducing the negative environmental impacts of consumption and incorporating circularity benefits.	High impact on all value dimensions	e.g., sales of products with additional service components such as lifetime warranties and maintenance services, recycled products, do-it-yourself and do-it-together products, green products and services, and sustainable service innovation.

#### 4.2.5. Bioeconomic Innovation

Bioeconomic innovation is based on using renewable resources to create goods and services. Transitioning to a bioeconomy requires innovation in both technology and BMs. Many bioeconomic innovation products lack profitability due to low demand, so rethinking value creation, delivery, and capture is essential. CBMI is a viable option for transitioning

to a bioeconomy, allowing a holistic approach to value proposition with a circular perspective [52,78]. Bioeconomic innovation encompasses traditional sectors such as agriculture, fisheries, aquaculture, and forestry and modern sectors such as biotechnology or bioenergy [64]. Based on Merli, Preziosi, and Acampora [29], there are still significant gaps in knowledge, particularly in the development of bioeconomic CBMs. For example, according to Fraccascia, et al. [79], it is vital to support research on circular bioeconomic innovation for using agricultural waste to create new products, as waste is generated at every stage of the agrifood supply chain, often due to inefficient or poorly adapted processes and handling methods. Nevertheless, converting agricultural waste and by-products into valuable resources makes it possible to create new, value-added biobased products such as bioenergy and biomaterials [31,79]. While bioeconomic innovation is most prominently discussed with regard to value creation, literature on value delivery and -capture is still scarce.

#### 4.2.6. Eco-Innovation

Eco-innovation is a key driver in the transition towards a CE. Eco-innovation refers to any technological or non-technological innovation that promotes sustainable development by using natural resources more efficiently and reducing the environmental impact of production methods. It involves the development or adoption of new products, processes, services, or management methods that result in reduced environmental risk, pollution, and negative impacts on resource use compared to existing alternatives [40,48,52,56]. To drive the transition to a CE, various practices are needed, including eco-innovation; adoption of new BMs, applying the principles of reduce, reuse, and recycle (3Rs); and effectively managing material flows. These practices enable materials to be reused, recycled, or remanufactured, closing the loop and promoting sustainability [48]. Six types of eco-innovation can facilitate the implementation of a CBM: product design, process, organizational, marketing, social eco-innovation, and system eco-innovation [52]. Many companies are adopting eco-innovation as a strategy to create both economic and environmental value as they become more aware of the environmental impact of their resource transformation processes [48,52]. In sum, eco-innovation can impact all BM value-dimensions.

#### 4.2.7. Circular-Oriented Collaborative Innovation

Circular-oriented collaborative innovation is the process whereby new ideas, products, services, or business models are generated through the joint contributions of various stakeholders [22]. The principles of collaborative ecosystems in business are no longer limited to individual firms but instead involve the broader industries and markets within which they function [30]. This is a new area of research in CE literature, focusing on the combination of product design, business models, and value network configurations to implement circular economy strategies. The ultimate objective of such strategies is to extend product lifetime by preserving the product characteristics as long as possible or restoring them, thus reducing the use of novel resources and disposing of obsolete goods. Included are product design, business model modifications, and various value network arrangements [52]. The shift towards new economic and societal systems like the circular economy demands the intentional design of new products, services, and BMs and experimentation with them. Successful implementation of these new BMs requires collaborative capacity across organizations. Critical factors include circular-oriented innovation, the recognition of interconnection within diverse networks of actors, and collaboration across organizations and sectors [30,40]. We find that circular-oriented collaborative innovation can impact all BM value dimensions.

#### 4.2.8. Open/Close Innovation

Innovation strategy can be categorized as “closed” or “open” based on the level of collaboration. In a closed strategy, circularity principles are implemented within the company, such as resource reuse and product quality improvements, for example, organization-driven initiatives to encourage customers to return used products. An open strategy

involves collaborating with external partners, customers, and user communities to increase circularity in the CBM [80]. According to Chesbrough [81], closed innovation is becoming less sustainable in today's dynamic business environment, but as Bocken and Ritala [80] show, a closed innovation strategy can still lead to CBM. Open Innovation is a concept that encourages organizations to leverage both internal and external ideas, as well as internal and external strategies, to drive technological advancements. It involves integrating internal and external ideas into BM that create value. Open Innovation acknowledges that companies can benefit from commercializing their internal ideas through external channels to generate profits [81]. Three open innovation-based CBM strategies are open-narrowing, open-slowing, and open-closing [80]. The open-narrowing strategy involves companies in the same sector working together to reduce the environmental impact of their production processes. They focus on optimizing resource use and communicating their ecological practices to consumers. The open-slowing strategy aims to extend the product's lifetime through innovative solutions to delay disposal.

In contrast, the open-closing strategy aims to reduce waste by integrating external ecosystems to recover and reintroduce resources into the system after use [38,52,80]. Closed approaches provide greater control over the circular process and value capture, thus reducing uncertainty. Open approaches enable the flexible integration of new capabilities such as product return services, repair, and maintenance services, leveraging user and producer ecosystems. Many leading organizations adopt multiple approaches within their BMs [80]. Open/close strategies can significantly impact all BM value dimensions.

#### 4.2.9. Product or Service or Product-Service Systems Innovation

A product, a service, or a product service system (PSS) BM prioritizes sustainability by reducing the negative environmental impacts of consumption and incorporating circularity benefits [40,78,82]. They can be seen as types of innovation that enable CBM. Similarly, Rosa, Sassanelli, and Terzi [12] suggest that a sustainable focus must embrace a holistic perspective that considers products and services. This can benefit businesses by simultaneously improving competitiveness and promoting sustainability [30,83]. Providing products as services or a combination thereof with customizable maintenance contracts enhances value creation [84]. Also, smart technologies such as the Internet of Things, big data analytics, blockchain, and artificial intelligence affect sustainability in organizations [45]. Furthermore, PSS innovation creates value and promotes circularity [69] and can generate new revenue streams for organizations by meeting customer needs in an integrated and personalized manner or fostering customer loyalty [29]. Service-orientation BMI can be divided into three main types: product-oriented, use-oriented, and results-oriented business models [17,84]. Product-oriented innovation includes recycled products, do-it-yourself and do-it-together products, green products and services, and sustainable service innovation [17]. Use-oriented innovations have the potential to enhance and improve the consumption of material products by reducing the need for materials. Results-oriented innovations have the most significant potential to reduce material costs. Implementing them requires substantial changes in BM [85]. This makes it difficult to widely adopt and provide the benefits of resource efficiency and circularity in an industrial context [12]. Mignon and Bankel [86] mention eight types of services: (1) product-related services, (2) advice and consultancy, (3) product leasing, (4) product renting or sharing, (5) product pooling, (6) activity management or outsourcing, (7) pay-per-service unit, and (8) functional result. Product design plays a key role in shaping the logic of value creation and capture [51]. Thus, product design must fundamentally change to align with the shift toward CBMs [19,60]. Hence, PSS-innovation affects all three BM dimensions.

## 5. Discussion

Our review aims to synthesize the research on innovation types used for BMI to transition toward SBMs or CBMs. Understanding how innovation contributes to more sustainable or circular business models is crucial for providing long-term benefits for

society, the environment, and organizations. While previous literature on BMI points to the seminal role of innovation regarding the transition to more sustainable or even circular business models, it largely remains unclear which specific types of innovation are involved in SBMI and CBMI. We argue that scholars, managers, and policymakers would benefit from a comprehensive overview of the state of the art of innovation types that enable sustainable (SBMI) and circular business model innovation (CBMI). Our analysis adds some relevant contributions: First, we differentiate between two kinds of BMIs: sustainability-oriented and circularity-oriented BMIs. Second, we delineate that both are based on specific innovation types. Third, we categorize innovation types that foster a transition to SBMI and CBMI.

Our systematic review identified three types of sustainable innovation relevant to SBMI: (1) Digital technological innovation involves using technology to promote sustainability and increase competitive advantage. We found technological innovation equally relevant for all BM dimensions, including value creation, delivery, and capture. This includes developing technical support systems and digital infrastructure to create value, enhancing efficiency, automation, and resource utilization along the entire supply chain to deliver value, and optimizing revenue streams and costs to capture value; (2) User-driven social innovation involves incorporating user needs, ideas, and opinions into the innovation process. This aims to create a value proposition that enables both societal and business benefits, promoting sustainable and even anti-consumption behaviors; (3) Organizational innovation, which focuses on reorganizing the purpose, goals, processes, and value creation and delivery of an organization in relation to social and environmental issues.

CBMI is based on five innovation types: (1) Bioeconomic innovation applies renewable resources to create goods and services sustainably. It spans agriculture, fisheries, aquaculture, biotechnology, and bioenergy. Scholars mainly discuss bioeconomic innovation regarding value-creation; (2) Eco-innovation focuses on reducing environmental impact and using natural resources efficiently by developing or adopting new products, processes, services, or management methods. Consequently, it can impact all value dimensions; (3) Circular-oriented collaborative innovation involves collaboration among various stakeholders to generate ideas, products, services, or BMs that promote circularity; (4) Open/Closed innovation may impact value-creation, delivery, and capture where open innovation involves collaborating with external partners to increase circularity within the business ecosystem, while closed innovation focuses on implementing circular principles within the single company; (5) Product or Service or Product-service systems innovation prioritizes sustainability by reducing environmental impacts and incorporating circularity benefits. It aims to create value, promote circularity, and generate new revenue streams through integrated and personalized approaches.

All delineated types of innovation play a seminal role in promoting BM transition toward sustainability and circularity by simultaneously enhancing competitiveness and addressing environmental and societal challenges. Interestingly, most innovation types contribute to all three dimensions of value creation, delivery, and capture. Only user-driven social innovation foremost affects value creation.

In summary, we find that BMI is instrumental in assessing BMs from a triple-bottom-line perspective, aiming to maximize benefits for society, customers, the environment, and organizations. The findings from this research highlight the significance of innovation in driving sustainable practices within organizations, leading to more sustainable, effective, and actionable solutions for businesses.

## 6. Conclusions and Avenues for Further Research

Based on our review, we identified several gaps in the literature that are worthwhile avenues for future research. First, there is a limited understanding of potential synergies between different types of innovations. While our review hints that combining multiple types of innovation may result in sustainability benefits, there is little exploration of potential synergies or the interplay between diverse kinds of innovations, which may

hamper the potential for maximizing the benefits. Further research is needed to recognize how different types of innovation can complement each other in the context of sustainable and circular business models.

Second, the link between open innovation and circular business models calls for scholarly attention. Although open innovation has been extensively studied, its connection with the CE and CBMs remains largely unexplored. More research is required to investigate how open innovation practices can contribute to adopting CBMs and aid the transition toward a CE.

Third, we know relatively little about the process of how various types of innovations are developed and/or introduced to achieve more sustainable or circular BMs. We find that opening the process black box in terms of which processes are employed to introduce varying types of innovations, how those may be distinct or interconnected, and on which levels in the organization they are located holds great promise. At the same time, we know very little about the competencies required of the actors involved in successful innovation processes. Hence, we suggest applying the lens of the knowledge-based view, i.e., ref. [87] to investigate innovation processes for SBMI and CBMI. Addressing these research gaps will contribute to a deeper understanding of SBMs and CBMs, promoting their successful implementation.

Lastly, our findings have vital implications for managers, policymakers, and practitioners. Organizations face growing pressure to disclose their environmental goals and performance. Achieving sustainability requires a proactive evaluation of the entire life cycle of products and the responsiveness to customer demands. However, effectively measuring sustainable behavior and performance remains a challenge. Developing robust measurement frameworks and indicators tailored to specific industries can offer objective assessments of sustainable behavior and performance, enabling better comparisons and benchmarking.

Disseminating how different innovation types can facilitate the transition from conventional to sustainable or circular business models may help organizations adopt sustainable innovation in practice and identify which types of innovation to employ for their transformation path. Through innovation, organizations can embrace and integrate sustainability principles into their BMs, leading to more effective and actionable business solutions. They can also position themselves as leaders in promoting sustainability, gaining a competitive advantage, and contributing positively to achieving SDGs. These insights hold value for policymakers, practitioners, and researchers in the field of sustainability and innovation. By bridging these gaps, we can create a way for a more sustainable future, one where innovation and BMs work hand in hand to create positive environmental and societal impacts.

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