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Review

Roadmap to a Circular Economy by 2030: A Comparative Review of Circular Business Model Visions in Germany and Japan

Laura Montag

Chair of Production Management, Ruhr University Bochum, 44801 Bochum, Germany; laura.montag@rub.de; Tel.: +49-234-32-25346

Abstract: Circular business models operate differently from traditional linear models: by developing products designed for disassembly, reuse, and recycling; by using materials and products for as long as possible; and by replacing physical products with virtual ones, they aim to reduce the environmental impact of their operations and facilitate the creation of a more sustainable future. In this article, the framework for circular business models is discussed from two perspectives: first, a systematic literature review is conducted to explore the academic point of view; second, a comparative policy review is conducted to analyze the past, present, and future visions of Germany and Japan in relation to their circular transition, particularly with regard to each country's vision of circular business models. A first outcome is a synthesis of current circular business model archetypes and the developed circular business model matrix, which adds value to the literature by providing information on circular goals, strategies, the actors involved, and the social and political implications of each circular business model typology. A second outcome is a comparative, in-depth analysis of the current policy frameworks and strategies for circular business models in Germany and Japan. This article outlines the main ways in which both countries are currently making the transition to a circular economy, providing an important knowledge base for further development.

Keywords: circular economy; circular business model; circular economy policies; Germany; Japan

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1. Research Background

The year 2015 can be described as a milestone in the fight against climate change and for strengthening national and international sustainability efforts: First, on 25 September, the 2030 Agenda for Sustainable Development was adopted at a United Nations summit, providing the first international agreement and political action plan to combine the principle of sustainability with poverty reduction and economic, environmental, and social development [1,2]. This global action plan contains 17 goals—dubbed the Sustainable Development Goals (SDGs)—that cover a wide range of topics and areas for sustainable development, addressing and involving all countries to making a national contribution [1,2]. A second breakthrough was the Paris Agreement, negotiated by 196 parties at COP 21 in Paris on 12 December 2015 [3]. This is a legally binding treaty aiming to limit "the global average temperature to well below 2 °C above pre-industrial levels" (Article 2 1 (a) [4])—if possible, even below 1.5 °C, taking into account the risks and harmful consequences of climate change [4]. Both the 2030 Agenda and the Paris Agreement aim to bring about a shift toward sustainable and low-emission lifestyles and economies around the world [5]. With less than seven years remaining until 2030 and therefore less than seven years to achieve the SDGs and cut emissions by roughly 50%, time is pressing to achieve systemic and holistic change versus business as usual.

The circular economy has attracted much attention in the last decade as an economic paradigm that can address the challenges of sustainable development and climate

change [6,7]. Although the ideas of circular flows and closed systems have existed in various forms for decades [8], recent attention and thus pressure and developments from academia, policy makers, and business has led to a new understanding of the possibilities that a circular economy has to offer. From an academic point of view, a distinct and very active research field around the circular economy and other related fields such as circular supply chains and circular business models was able to develop; from a political point of view, the circular economy was recognized as a paradigm-changing way of doing business and as such was included in political agendas. Nevertheless, the real figures speak a different, sobering language: our global economy is only 7.2% circular at the moment, with the tendency of circularity going down while resource extraction rates go up [9]. In order to serve as a building block for sustainable development and climate neutrality, and to live up to the possibilities attested to it, a paradigm shift must take place.

Circular business models and the corresponding research field have developed almost in parallel with the developments of the overarching concept and are considered the gateway to successful circular economy implementation [10]. Nevertheless, circular business model research struggles with a clear theoretical conceptualization—similar to how the circular economy field has struggled and still struggles with definitional ambiguities [11]—hindering the provision of clear guidelines and principles for start-ups and incumbents to implement circular business model initiatives [12]. Another influencing factor that has a leverage effect on the implementation of the circular economy in the form of circular business models is the existing political framework, such as adequate policies, laws, economic incentives, and supporting regulations that a (future) business is involved in [13].

The aim of this study is to shed light on the current state of the circular economy and its corresponding field of circular business models within the framework of the aforementioned triangle between science, politics, and business. In doing so, current research gaps—particularly within the circular business model field and on the political level—are addressed in order to create conceptual clarity and to present the current state of political framework for the circular economy. For this reason, the paper is divided into two parts: First, an academic perspective is taken, focusing on the circular economy paradigm, in particular and in more detail on circular business models. Within this part, the following research question is addressed:

RQ1: How are circular business models defined, understood, and conceptualized among researchers?

To answer this first research question, a systematic, string-based literature search was conducted that primarily includes scientific literature on the circular business model framework. This database search was supplemented by additional research found via cross-reference snowballing, as well as some gray literature that provided additional conceptual knowledge. As a result, a new typology and circular business model matrix, which complements the different typologies with configuration details, is consolidated. This first part of the research paper is presented in Section 3.

The second part of this study takes a political view on the circular economy and the circular business model framework, comparing the past, present, and future visions of Germany and Japan regarding their circular transition, especially regarding their transformation towards circular business models. The reason for selecting these two countries is that, firstly, this research project was developed with German–Japanese research cooperation (the majority of this research was conducted as part of the Summer Program (4 August 2022–7 October 2022) of the Japan Society for the Promotion of Science (JSPS), with the author receiving a scholarship to visit the Institute for Environmental Strategies (IGES), Hayama, Kanagawa, Japan as an international research fellow). Secondly, both countries, as early pioneers of the circular economy, are ideally suited for a comparison of their political framework [14]. Within the second part, the following research question is addressed:

RQ2: What policies do Germany and Japan have regarding the transition toward the circular economy and especially circular business models?

To answer this second research question, a systematic desk research and policy review was conducted. This review included online databases such as Google Scholar, Web of Science, and Scopus, as well as government databases and their published papers and reports. The result is a comparative analysis of Germany's and Japan's circular economy and circular business model policies, frameworks, and perceptions. This second part of the research paper is presented in Section 4.

The remainder of this study is organized as follows: After this introduction, Section 2 elaborates on the methodology used. Section 3 starts by presenting the academic perspective before explaining the policy framework of the circular economy in Section 4. A brief discussion of the results, concluding remarks and an outlook for future research are given in Section 5. Figure 1 illustrates the above-described research and analysis process and outcomes. Table 1 summarizes a selected set of recent research papers on the circular economy framework and its political implementation on the national and international levels. This study stands out from previous studies in that it does not focus exclusively on the circular economy but also on circular business models, filling an important research gap. To the author's knowledge, this is the first combined work on circular business model implementation and policy frameworks in Germany and Japan. The relevance of this study lies in the further development of the research field. By contributing to the body of knowledge on circular business models, the study provides important conceptual clarity that will enable further study and research on the concept. The review and assessment of the policy framework on the circular economy visions in Germany and Japan provides relevant insights into the current state of the transition to a circular economy in both countries. The study is a systematic and rigorous research effort that adds a new layer to the research field of circular economy models.

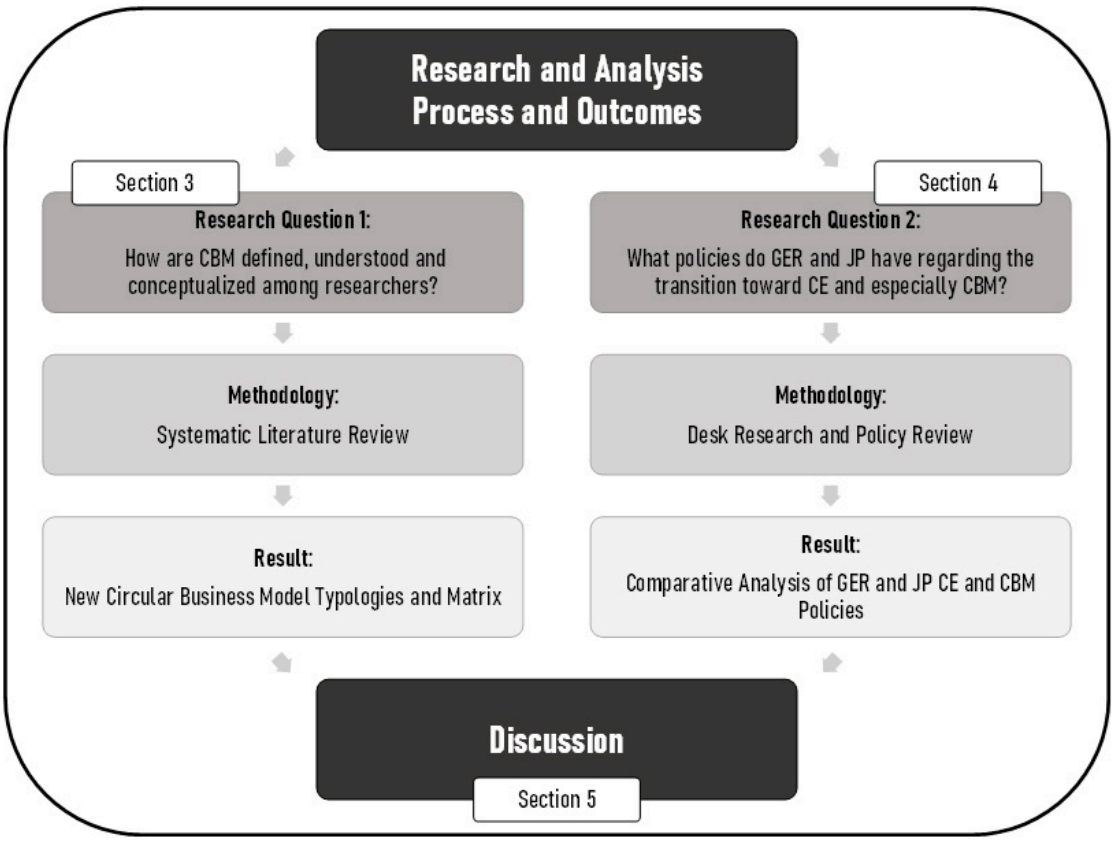

Figure 1. Research procedure (source: author).

Table 1. Selected recent research articles on circular economy policy (source: author).

#	Author(s)	Year	Title	Framework of Analysis
1	Ogunmakinde [14]	2019	A Review of Circular Economy Development Models in China, Germany and Japan	■ Literature and desktop study review ■ Identification and comparison of CE implementation, policies, and laws in China, Japan, and Germany
2	Mazur-Wierzbicka [15]	2021	Circular economy: advancement of European Union countries	■ Literature and CE indicator review ■ Analysis of advancements of EU-28 countries towards CE
3	Herrador et al. [16]	2022	Circular economy and zero-carbon strategies between Japan and South Korea: A comparative study	■ Desk research and interview study ■ Comparison of Japanese and South Korean CE policies and actions
4	Marjamaa and Mäkelä [17]	2022	Images of the future for a circular economy: The case of Finland	■ Interview study and qualitative content analysis ■ Future image of CE in Finland
5	Chioatto and Sospiro [18]	2023	Transition from waste management to circular economy: the European Union roadmap	■ Analysis of EU legislative framework and current state of CE transition in EU countries
6	**This study**	**2023**	**Roadmap to a Circular Economy by 2030: A Comparative Review of Circular Business Model Visions in Germany and Japan**	■ **Academic and political viewpoint on CE and CBM** ■ **Comparative Review of GER and JP**

2. Methodology

As explained in the first section, this study is divided into two parts: the academic and the political view on circular business models. The first part is intended to provide an up-to-date overview of conceptualizations, definitions, and understandings. Therefore, the method of choice is a systematic literature review that follows a three-step review process (planning, conducting, and reporting) [19,20], illustrated in detail in Figure 2.

The planning phase was essentially concerned with defining the search terms. Since the goal of the present literature review was to find tangible definitions of the "circular business model" concept, this term was chosen as the search string. This was then applied in the search fields of title, abstract, and keywords of two major databases (Web of Science and Scopus). After deleting duplicates, 547 publications were identified as the initial set, which was then scanned for eligibility. By screening titles, abstracts, and keywords for content and quality, 113 publications were chosen for full-text reading to detect definitions, conceptualizations, and theoretical frameworks. The final set consists of 69 articles, 7 of which were hand-picked (and found by snowballing) and 4 published in the gray literature. Data reporting included the collection, synthesis, and analysis of circular business model definitions and theoretical frameworks. The results are explained and outlined in Section 3.

The second part, on the political viewpoint on the circular economy and circular business models in Germany and Japan, can be categorized as a desk research and comparative policy review. In order to compare German policies and political frameworks on the circular economy and circular business model implementation with those of Japan, the first step was an exhaustive analysis of each country's past and current laws, strategies, and vision. In addition to written materials from governmental bodies, such as national ministries for the environment and economy, the author had face-to-face discussions with experts from the circular economy field. During a two-month research stay in Japan, funded by the Japan Society for the Promotion of Science, the author was given the opportunity to

conduct research at the Institute for Global Environmental Strategies (IGES) and make contact with leading experts on circular economy policy. The results and political viewpoint are explained and outlined in Section 4.

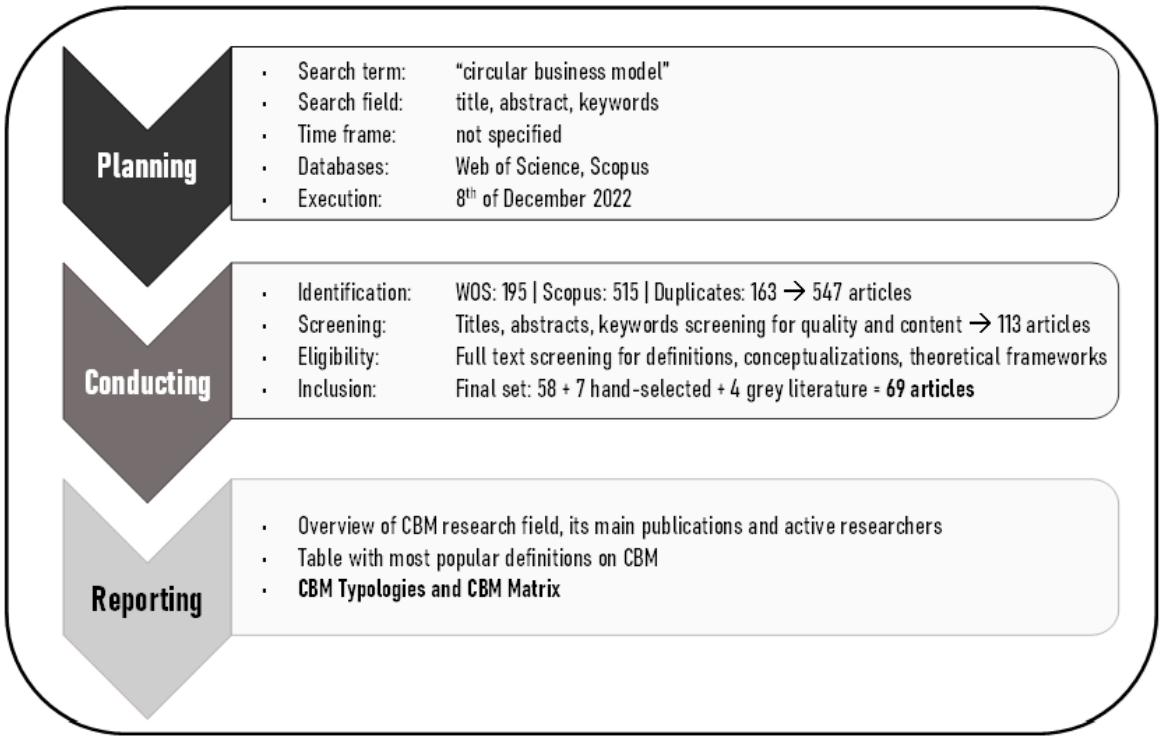

Figure 2. Literature review process (source: author).

3. Academic Viewpoint

The remainder of this section is divided into two subsections. In Section 3.1, the written definitions of the term circular business model found within the articles of the final set are gathered and then further analyzed (using MAXQDA software). Section 3.2 develops an adapted typology for circular business models that is a synthesis of the preceding theoretical and conceptual frameworks. A circular business model matrix, with additional information on each archetype, then builds on these to provide conceptual clarity for future research.

3.1. CBM Definitions

To understand a concept and its field of research, definitions can be an important building block. Kirchherr et al. (2017) [11], for example, performed a comprehensive study of the parental concept to create transparency regarding the understanding of the circular economy by analyzing 114 definitions. Despite the potential weaknesses of such a focused analysis, this approach is also taken in this paper because it provides a solid basis for general conceptualization and thus can serve as a starting point for further developments.

In the final set (69 publications), 16 definitions were found and are presented in Table 2. They range in time from 2014 to 2022 and differ in length and depth of content. The first definition (Mentink (2014) [21]) is a special case as it was developed as part of a Master's thesis and has been quoted quite often since then [10]. This is partly because it is a very early definition of the concept of circular business models, from before the actual field of research could develop around it. Within the systematic literature search, there was no publication found before 2014 and only five from 2014 to 16 (Mentink (2014) [21] was included into the final set via snowballing due to its early and widely cited definition). The publication of Bocken et al. (2016) [22] was and still is one of the major circular business model conceptualizations. The research paper has been viewed almost 150,000 times and has been cited over 1200 times (in Scopus alone). The authors are among the first to define

fundamental strategies for businesses in a circular economy context. According to Bocken et al., two strategies for the recycling of resources are applicable: (1) slowing the resource loop and (2) closing the resource loop. A third strategy is reducing the resource flow by narrowing and thus increasing the resource efficiency [22].

Another very active research team is that of Geissdoerfer et al. They provided, over time and with consideration of the latest developments in the research field, three definitions of the circular business model framework and presented in 2020 one of the main literature reviews [10,23,24]. While the first (and earliest) definition [23] places the circular business model concept within the framework of the sustainable business model, the second and third definitions are more stand-alone, based on four circular strategies: (1) cycling, (2) extending, (3) intensifying, and (4) dematerializing [10,24]. In addition, Geissdoerfer et al. discuss the various possible units of analysis that can be used in the context of circular business models. Besides the distinction between an internal and an external view, they also distinguish between the business focus, the corporate focus, and the ecosystem focus, and predict a shift from a narrow, solely business-focused view to a more systemic, ecosystem view [10]. Other definitions similarly refer to this shift and concretize the unit of analysis. De Angelis (2018) [25], for example, provides the longest (96 words) and thus one of the most comprehensive definitions in this set. She refers to "circular offerings" and "circular relationships" that increase the value and go beyond traditional business boundaries. Zucchella and Previtali (2019) [26] even use the term ecosystem in their definition and stipulate that this ecosystem must be as large as necessary to fill critical gaps.

The relationship to sustainability is also explicitly addressed in some definitions. The one from Geissdoerfer et al. (2018) [23] was already mentioned. Frishammar and Parida (2019) [27] and Ünal et al. (2019) [28] both understand the circular business model as one that creates sustainable value and thus supports sustainable development in terms of economic, environmental, and social benefits. A similar understanding is shared by Rovanto and Bask (2021) [29], who refer to the three sustainability dimensions that a circular business model addresses and the systemic component of the circular economy at the three hierarchical implementation levels (micro, meso, and macro). Salvador et al. (2020) [30] and Bocken and Ritala (2022) [12] also refer to the fact that circular business models go beyond a purely economic perspective and approach. The former definition mentions the regenerative character that the circular business model must adopt from the overarching concept in order to stay within planetary boundaries. The latter addresses the major challenge of businesses shifting from linearity to circularity, as both economic and environmental feasibility must be present.

Table 2. Selected definitions on the CBM term (source: author).

#	Authors	Year	Definition CBM
1	Mentink [21]	2014	"A **circular business model** is the rationale of how an organization creates, delivers and captures value with and within closed material loops." (p. 24)
2	Bocken et al. [22]	2016	"**Circular business models** thus can enable economically viable ways to continually reuse products and materials, using renewable resources where possible" (p. 308) "The taxonomy of slowing, closing, and narrowing resource loops was introduced [. . .]." (p. 317)
3	Linder and Williander [31]	2017	"We define a **circular business model** (CBM) as a business model in which the conceptual logic for value creation is based on utilizing economic value retained in products after use in the production of new offerings. Thus, a circular business model implies a return flow to the producer from users, though there can be intermediaries between the two parties. The term circular business model therefore overlaps with the concept of closed-loop supply chains, and always involves recycling, remanufacturing, reuse or one of their sibling activities (e.g., refurbishment, renovation, repair)." (p. 183)

Table 2. *Cont.*

#	Authors	Year	Definition CBM
4	Nußholz [32]	2017	"**A circular business model** is how a company creates, captures, and delivers value with the value creation logic designed to improve resource efficiency through contributing to extending useful life of products and parts (e.g., through long-life design, repair and remanufacturing) and closing material loops." (p. 12)
5	De Angelis [25]	2018	"**Circular business models** are business models wherein enhanced customers' value is produced as a result of more comprehensive 'circular offerings' (e.g., products as services; greater convenience; dematerialised products; superior product durability and ecological performances; product upgradability; take-back schemes) and 'circular relationships' (access over ownership, e.g., leasing, renting, sharing). In circular business models diffused forms of value are created, local/regional supply chains are implemented, maximisation of resources value across the activity system is pursued, boundaries spanning relational competences for the adaptation or development of 'circular' resources and capabilities are developed, and idiosyncratic value capture mechanisms are observed." (p. s65)
6	Geissdoerfer et al. [23]	2018	"**CBMs** can be defined as SBMs—which are business models that aim at solutions for sustainable development by creating additional monetary and non-monetary value by the pro-active management of a multiple stakeholders and incorporate a long-term perspective—that are specifically aiming at solutions for the Circular Economy through a circular value chain and stakeholder incentive alignment." (p. 713 f.)
7	Geissdoerfer et al. [24]	2018	"**Circular business model**: Business models that are closing, slowing, intensifying, dematerialising, or narrowing resource loops" (p. 408)
8	Bianchini et al. [33]	2019	"**CBMs** are business models designed on the CE paradigm, characterized by a new approach to generate economic value and devise products and services, since they strive for: (i) employing fewer materials and resources for products and/or services; (ii) extending their life; and (iii) closing the loop with the recovery of waste value, maintaining and/or improving company's competitiveness." (p. 3)
9	Frishammar and Parida [27]	2019	"we define a **circular business model** as one in which a focal company, together with partners, uses innovation to create, capture, and deliver value to improve resource efficiency by extending the lifespan of products and parts, thereby realizing environmental, social, and economic benefits." (p. 6)
10	Ünal et al. [28]	2019	"A **circular business model** represents a holistic system of co-evolving managerial practices for collective value creation, delivery and capture, which provide solutions for sustainable development." (p. 291)
11	Zucchella and Previtali [26]	2019	"A **circular business model** is an economic and operational architecture, encompassing the organizational boundaries of different actors (ecosystem). Its scope is determined by the resources committed, both tangible and intangible, trust and knowledge flows, and the involvement of different partners, all of which enables the loop to be closed. Both formal and informal mechanisms provide the governance architecture of the ecosystem." (p. 283)
12	Geissdoerfer et al. [10]	2020	"Based on this analysis of the literature, **circular business models** can be defined as business models that are cycling, extending, intensifying, and/or dematerialising material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organisational system. This comprises recycling measures (cycling), use phase extensions (extending), a more intense use phase (intensifying), and the substitution of products by service and software solutions (dematerialising)." (p. 7)

Table 2. *Cont.*

#	Authors	Year	Definition CBM
13	Salvador et al. [30]	2020	"they **[CBM]** are business models that enable systems that are regenerative by nature. CBMs seek maintaining resource value at its maximum for as long as feasible, and eliminating or reducing resource leakage, by closing, slowing, or narrowing resource flows. Moreover, when resources leave the system, they should be in forms the Earth is capable of metabolizing." (p. 3)
14	Rovanto and Bask [29]	2021	"A **circular business model** is the company-level application of a CE. It is the logic of slowing and/or closing material loops, by which an organization creates, delivers and captures value with long-term environmental, economic and social implications in a systemic manner on the micro, meso and macro levels to accomplish sustainable development." (p. 1157)
15	Bocken and Ritala [12]	2022	"The circular economy is a new economic paradigm that aims to break free from the destructive and wasteful industry practices dependent on high sales volumes and fast-paced consumption. This change will eventually affect every industry and company, posing a major challenge for both startups and incumbents to develop new types of **circular business models** that are both financially but also ecologically feasible." (p. 3)
16	Coscieme et al. [34]	2022	"Similarly, they **[CBM]** can assist in the implementation of the 9R strategies for increasing circularity of the economy introduced by Potting et al. (2017), as they are based on smarter product use and manufacture (refuse, rethink, and reduce), extended lifespans of products (reuse, repair, refurbish, remanufacture, and repurpose), and useful application of materials (recycle and recover)." (p. 453)

One of the most commonly studied implementation strategies in the circular economy is the so-called R-imperatives. They range from the 3Rs (most commonly standing for reduce, reuse, and recycle) to the 10Rs, including seven additional R-imperatives, usually arranged in a hierarchy [6,35]. Therefore, it is only logical that these also play a role in defining circular business models. In order to systematically check the collected definitions for applied R-imperatives, MAXQDA software was used to detect and illustrate which definition refers to which R-imperative. Figures 3 and 4, as well as Table 3, were all created with this software.

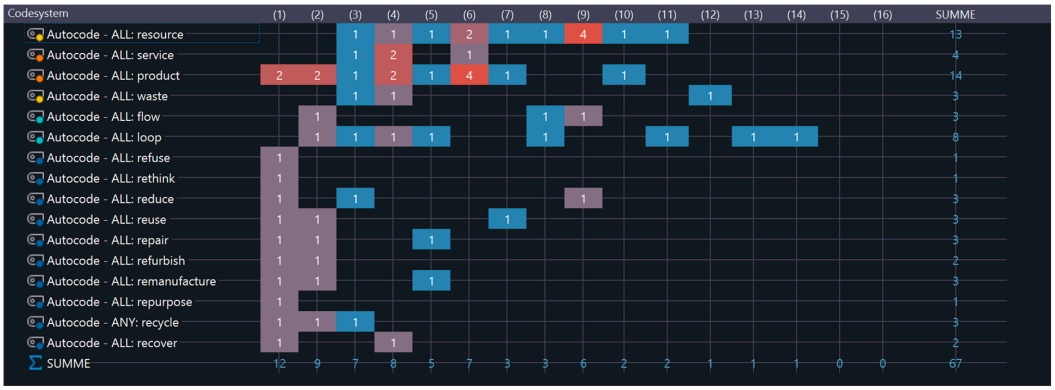

Figure 3. Code matrix (R-imperatives) (source: author, via MAXQDA). (1) Coscieme et al. 2022 [34]; (2) Linder and Williander 2017 [31]; (3) Geissdoerfer et al. 2020 [10]; (4) Bianchini et al. 2019 [33]; (5) Nußholz 2017 [32]; (6) De Angelis 2018 [25]; (7) Bocken et al. 2016 [22]; (8) Zucchella and Previtali 2019 [26]; (9) Salvador et al. 2020 [30]; (10) Frishammar and Parida 2019 [27]; (11) Geissdoerfer et al. 2018b [24]; (12) Bocken and Ritala 2022 [12]; (13) Mentink 2014 [21]; (14) Rovanto and Bask 2021 [29]; (15) Geissdoerfer et al. 2018a [23]; (16) Ünal et al. 2019 [28].

Figure 4. Word cloud (based on definitions) (source: author, via MAXQDA).

Table 3. Words used in circular business model definitions (source: author, via MAXQDA).

Word	Word Length	Frequency	%	Rank	Definitions	Definitions %
business	8	28	5.36	1	16	100.00
circular	8	28	5.36	1	16	100.00
model	5	28	5.36	1	16	100.00
value	5	17	3.26	4	10	62.50
product	7	13	2.49	5	8	50.00
resource	8	13	2.49	5	9	56.25
close	5	7	1.34	7	7	43.75
loop	4	7	1.34	7	7	43.75
material	8	7	1.34	7	7	43.75
capture	7	6	1.15	10	6	37.50
create	6	6	1.15	10	6	37.50
economic	8	6	1.15	10	6	37.50
extend	6	6	1.15	10	5	31.25
use	3	6	1.15	10	5	31.25
economy	7	5	0.96	15	5	31.25
system	6	5	0.96	15	4	25.00
company	7	4	0.77	17	4	25.00
define	6	4	0.77	17	4	25.00
deliver	7	4	0.77	17	4	25.00
dematerialize	13	4	0.77	17	3	18.75
development	11	4	0.77	17	4	25.00
new	3	4	0.77	17	3	18.75
service	7	4	0.77	17	3	18.75
solution	8	4	0.77	17	3	18.75
sustainable	11	4	0.77	17	3	18.75

Figure 3 is the result of the coding framework applied with MAXQDA. The first six codes in the matrix were created out of general interest, in which terms related to the circular economy were used in the different definitions. The dark blue shaded codes refer to the R-imperatives according to Potting et al. (2017) [35]. The matrix was then sorted so that the definition containing the most codes created was listed first. Coscieme et al. (2022) [34], who created the newest definition set, define circular business models by the 9R-imperatives and even cite Potting et al. (2017) [35] within their definition. Linder and Williander (2017) [31] apply five R-imperatives (reuse, repair, refurbish, remanufacture, and recycle) but do not explicitly refer to them as such, using the term "sibling activities". Within the remaining definitions, the R-imperatives do not play a decisive role.

Figure 4 and Table 3 are included to provide further information about the words used in the collected definitions. While the first shows a graphical representation in the form of a word cloud, the second simply gives an overview of which (individual) words were used in the definitions and with what frequency. After the three most important words, namely circular, business, and model, the word "value" occurs most frequently, in 10 out of 16 definitions. This reflects the fact that circular business models need to be understood from a clear value perspective, focusing on value proposition, value creation and delivery, and, most importantly, value capture [36].

In the list in Table 3, another important feature for the conceptualization of circular business models is recognizable: different circular business model typologies such as extend, use, dematerialize, and service. In particular, Nußholz (2017) [32], De Angelis (2018) [25], Geissdoerfer et al. (2020) [10], and Coscieme et al. (2022) [34] explicitly refer to possible implementations of a circular business model in their definitions. These typologies are the main focus of the following subsection.

3.2. CBM Typologies and Matrix

The transition from the linear to the circular economy confronts businesses with major challenges, for both established companies that are moving to a circular business model and start-ups that are aligning all their business units and strategies with the circular economy from the outset [12]. The holistic implementation of circular strategies, such as the 9R framework [34], and the systematic shift from linear to circular value creation in the form of circular products and circular relationships [25] while creating economic, environmental, and social feasibility [12,27] is a major obstacle to the comprehensive and sustainable implementation of circularity. Despite the dependence of the circular economy on its systemic implementation in business models and the fact that all actors in the circular economy rely on such business models [37], there is currently a lack of clear strategic guidelines on how these can be implemented in concrete terms [12]. Academic research on the circular economy too often lacks guidance, which prevents the concept from reaching its full potential [38]. Another reason that both the circular economy and circular business model frameworks have not yet been taken to a higher level is the lack of conceptual clarity [10].

The aim of this subsection is, therefore, the proposition of a synthesized view on existing typologies and archetypes for circular business models. In addition to definitions, which were the subject of interest in the previous section and provide an initial consensual basis of a relatively new research phenomenon, the conceptual framework in the form of a detailed typology is important for the successful establishment of the research field. Although research has been performed on this matter in the recent past (e.g., [10,39,40]), a review of the academic and gray literature has revealed that ambiguity remains regarding the specific configuration of circular business models. Accordingly, this research seeks to utilize existing conceptualizations and formulate them into a unified overview that can be understood as a foundation for both theory and practice going forward.

One aspect that has hardly been considered so far (only partially in [39], who used the distinction between upstream and downstream) is the classification of circular economy typologies according to the (circular) product lifecycle. As can already be seen from the

definitions, closing loops plays a central role for circular business models. Therefore, it makes sense to arrange the existing typologies along the circular product lifecycle. This enables not only an initial differentiation, but also a holistic view of the various circular business model archetypes. Figure 5 illustrates this arrangement.

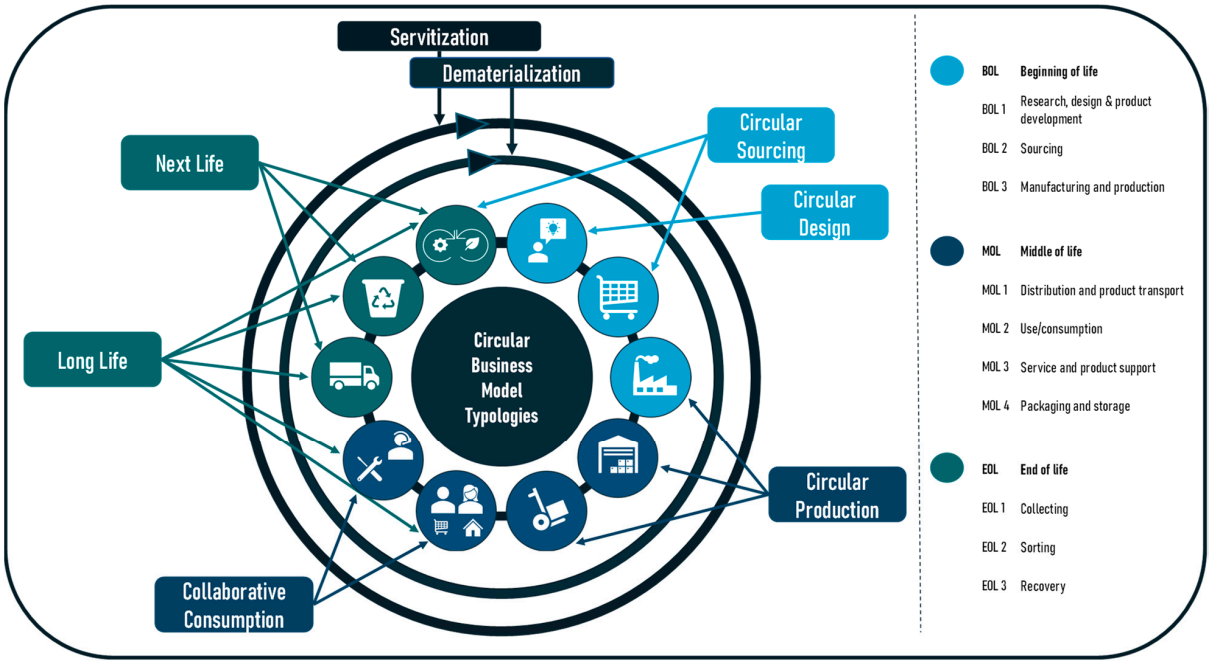

Figure 5. Typologies along the product lifecycle (source: author, adapted with permission from [41]. 2021, Laura Montag).

The eight adapted circular business model conceptualizations are not new in the sense that they have not yet been described the literature; however, their compilation, along with the detailed information that now follows in Table 4 as a circular business model matrix, adds important value to the literature. In addition to the product lifecycle mapping, information on circular economy strategies, goals, key actors and partnerships, key technologies, and social and political impacts has been developed for each typology.

Table 4. Circular business model matrix (source: author).

Circular Business Model Typologies [39,42,43] and Other Circular Business Model Archetypes from Literature	BOL MOL EOL	Circular Economy Strategies [42]	Circular Economy Goals [13]	Key Actors and Partnerships [13]	Key Enabling Technologies [44]	Social Impacts (Workers, Users, Communities)	Policy Impact [11]
Circular Design Design Model [42], Design for CEBM [45], Design for X [22]	BOL 1	refuse, rethink, reduce, (redesign)	• design for circularity • design for R-strategies • design for modularity • standardization	• manufacturing companies • users/consumers	Technologies to push innovative designs (e.g., 3D printing, virtual and augmented reality, modeling and simulation, big data)	• workers: safer working conditions • users: active role of consumers (prosumer), societal mind shift, structural support for EOL activities • communities: emergence of innovation hubs	• eco-design directives • minimum durability and producer responsibility, duty of care regulations • standards to design out hazardous substances
Circular Sourcing Circular Supply [46], Circular Supplies [47], Asset management [39], Industrial Symbiosis [39], Circular Inputs [48]	**BOL2** EOL3	rethink, reduce, reuse, refurbish, remanufacture, repurpose, recycle	• reduce resources and production waste • reduce raw material use and production volume • recycle waste to secondary materials • close material loops • increase material substitution	• waste collection and waste processing companies • manufacturing companies (to incorporate secondary materials)	Technologies to process secondary material, to improve efficiency and integrate waste (e.g., smart materials, 3D printing, blockchain technology, robotics, digital platforms)	• workers: employment opportunities • users: reduced environmental impact of new products • communities: waste reduction, new collaborations opportunities	• taxation schemes and economic incentives for secondary materials • clear waste policy measures and targets • laws to foster industrial symbiosis • waste disposal fees
Circular Production Optimize actions [40], Industrial Symbiosis [22], Cleaner production and eco-efficiency [43], On demand [39], Symbiotic Ecosystems [37]	BOL3 MOL2 MOL2	refuse, rethink, reduce, reuse	• increase resource efficiency and efficient distribution of products • reduce resource use • (re)use of secondary materials • increase circularity in distribution	• remanufacturing and recycling companies • circular suppliers • distributors • users/consumers	Technologies to increase efficiency, cleaner production and modularity (e.g., additive manufacturing, 3D printing, lightweight products, clean technology, blockchain technology)	• workers: safer working conditions • users: product individualiza-tion/personalization • communities: emergence of innovative production hubs, fostering eco-innovation	• product standards and quality labels • (extended) producer responsibility • take-back schemes (esp. on packaging) • laws to foster industrial symbiosis

Table 4. *Cont.*

Circular Business Model Typologies [39,42,43] and Other Circular Business Model Archetypes from Literature	BOL MOL EOL	Circular Economy Strategies [42]	Circular Economy Goals [13]	Key Actors and Partnerships [13]	Key Enabling Technologies [44]	Social Impacts (Workers, Users, Communities)	Policy Impact [11]
Dematerialization Product-as-a-Service models [42], Virtualize actions [40], Dematerialized services [39], Demand reduction services [39], Encourage sufficiency [39], dematerializing [10]	all	reduce	• reduce the need for physical products • replace physical with digital/virtual	• users/consumers • product designers	Technologies to dematerialize (e.g., cloud computing, digital platforms, internet of things, virtual and augmented reality, big data)	• workers: collaboration with users/consumers • users: stimulation of conscious behavior, high product performance • communities: digitization of public life	• public procurement of performance instead of products
Servitization Lifecycle model [42], Product-as-a-Service models [42], Product-Service-Systems [46], Access and performance model [22], Extending product value [47], Access model [39], Performance or result model [39], Materials-as-a-service Model [13], Effective product-service loop [37], product as a service [48]	all (esp. **MOL3**)	rethink, reduce, reuse, repair, refurbish, remanufacture, repurpose, recycle	• deliver (temporary) access • retain product ownership • close lifecycle loop	• users/consumers • platform operators/service providers • repair/service companies	Technologies to facilitate successful implementation of servitization, esp. tracking and monitoring (e.g., big data, datafication, digital platforms, smart product (use), blockchain, predictive maintenance)	• workers: collaboration with users/consumers, direct partnerships • users: enhanced customer experience, product availability, changed consumer behavior • communities: emergence of service networks	• legal regulations/incentives for reuse, repair, refurbishment • measures that internalize lifecycle costs
Collaborative Consumption Access Business Model [13], Sharing [46], Platform [sharing] models [42], Share actions [40], Sharing Platforms [47], Social-collaborative Loops [37], Sharing Platforms [48], intensifying [10]	MOL3 MOL4	rethink, reduce, reuse	• share and co-own products, assets and services • intensify utilization of products, assets and services • eliminate waste and duplication	• users/consumers • platform operators/service providers	Technologies to support sharing and co-ownership (e.g., digital platforms, datafication, smart product (use), blockchain)	• workers: collaboration with users/consumers, direct partnership, changed role • users: increased involvement, stimulation of conscious behavior • communities: strengthened community sense	• legal regulations incentives for sharing models • government involvement as sharing entity

Table 4. *Cont.*

Circular Business Model Typologies [39,42,43] and Other Circular Business Model Archetypes from Literature	BOL MOL EOL	Circular Economy Strategies [42]	Circular Economy Goals [13]	Key Actors and Partnerships [13]	Key Enabling Technologies [44]	Social Impacts (Workers, Users, Communities)	Policy Impact [11]
Long life Longevity–Durability BM [13], Product Lifetime Extension [46], Lifetime Extension Models [42], Extending product value [22], Classic long life [22], Long Life [39], Product life extension [47], Product Use Extension [48], extending [10]	MOL3 MOL4 EOL1 EOL2 EOL3	reuse, repair (upgrade) (update)	• prolong product life by reuse, repair, services and upgrades • slowing of the resource loop • reduce the need for (new) material/products	• users/consumers • service entities • repair companies	Technologies to efficiently extend product life (e.g., predictive maintenance, artificial intelligence, internet of things, digital platforms)	• workers: employment opportunities/new business creation • users: direct involvement, environmental awareness and conscious (usage) behavior, loyalty • communities: facilitating a sense of value and repair culture (e.g., repair cafes)	• directives to avoid planned obsolescence • regulations on stricter producer responsibility
Next Life Collection and Resell BM [13], Recycling and Upcycling BM [13], Resource Recovery [46], Resource Model [42], End-of-Life models [42], Regenerate actions [40], Loop actions [40], Extending resource value [22], Resource Value [47], Efficient material-technical loops [37], Resource Recovery [48], cycling [10]	EOL1 EOL2 EOL3	reuse, repair, refurbish, remanufacture, repurpose, recycle, recover	• use of highest R-strategy to capture highest value and create new value • collection and sorting for R-strategies	• users/consumers • manufacturing companies • designers and suppliers	Technologies that facilitate EOL activities, esp. efficient sorting and separation (e.g., track-and-trace software, blockchain, artificial intelligence, digital platforms, internet of things, big data)	• workers: employment opportunities • users: support at the EOL through easy take-back-systems • communities: new business developments, reduction in materials and waste	• user and producer incentives to return/collect EOL products (extended producer responsibility schemes) • implementation of product passports within a track-and-trace system • monetary incentives to collect, sort, and recover

To summarize, the eight typologies for circular business models and some exemplary cases can be described as follows:

- Circular Design: a first key leverage point for enabling circular strategies along the lifecycle [49]; the focus is to design products and processes so that they integrate perfectly into a circular environment [42].
  - ➢ Example: businesses that offer modular products to enable easier repair, upgrades, and dismantling (computers, PV-panels, printers, etc.).
- Circular Sourcing: aims at reducing resource extraction and waste generation by efficiently using waste and offering secondary materials through R-strategies and thus closing the material loop.
  - ➢ Example: businesses that ex post increase the circularity in provided materials and inputs by using recovered waste.
- Circular Production: dedicated to eliminating inefficiencies in the production and distribution process (e.g., through on-demand production and waste reduction) [39].
  - ➢ Example: businesses that ex ante increase circularity, e.g., by collaboration in eco-industrial parks.
- Dematerialization: has the goal of reducing the need for the physical product and ideally replacing it with a virtual one, thus reducing overall demand [10,43].
  - ➢ Example: businesses that offer digital solutions instead of physical products.
- Servitization: delivers (temporary) access to consumers while (often) retaining product ownership and responsibility and thus closing the loop [39]; enables long and next life of products.
  - ➢ Example: businesses that offer sharing, subscription, and on-demand models.
- Collaborative Consumption: enables the sharing and co-owning of products, assets, and services [39] and thus reduces the overall need for (new) materials and products.
  - ➢ Example: (community-based) businesses that offer sharing, subscription, and on-demand models.
- Long Life: aims at prolonging product life beyond the conventional end of use through high-value products and extension services [39].
  - ➢ Example: businesses that offer services such as maintenance, updates, and upgrades.
- Next Life: has the goal of efficiently collecting and sorting in order to apply the highest R-strategy to capture and create new value.
  - ➢ Example: businesses that enable reuse (such as (online) marketplaces and platforms) and the efficient application of R-strategies and cascading.

Table 4 can be understood as the second main result of the previously conducted literature review, which investigated, systematized, and adapted the current archetypes, conceptualizations, and understanding of circular business models. In addition, the adapted typologies were organized into a circular business model matrix that provides valuable information and clarity for the research field. Although the matrix—especially regarding the other typologies that may exist in the literature—does not claim to be exhaustive, it provides a sense of how dispersed the understanding of the circular business model is. While Servitization and Next Life are archetypes found in almost every research paper on the topic, Circular Design, despite being seen as a key leverage point for implementing the circular economy, has not been covered very often.

4. Political Viewpoint

The last column of the presented circular business model matrix now connects the academic, conceptual first part of this paper with the policy-oriented second part. First, a brief description is given of the policy agendas relevant to the circular economy that Germany and Japan have pursued in the past and are currently pursuing. The author then

examined whether circular business models play a role in current policy frameworks and, if so, which of the archetypes presented can be identified in them.

4.1. Circular Economy Policy Frameworks

Figures 6 and 7 outline the most important policy frameworks and strategies formulated by the Japanese and German government or ministries. The first figure concentrates on those issued by the according ministries for environment. The second figure presents those of other ministries and governmental bodies.

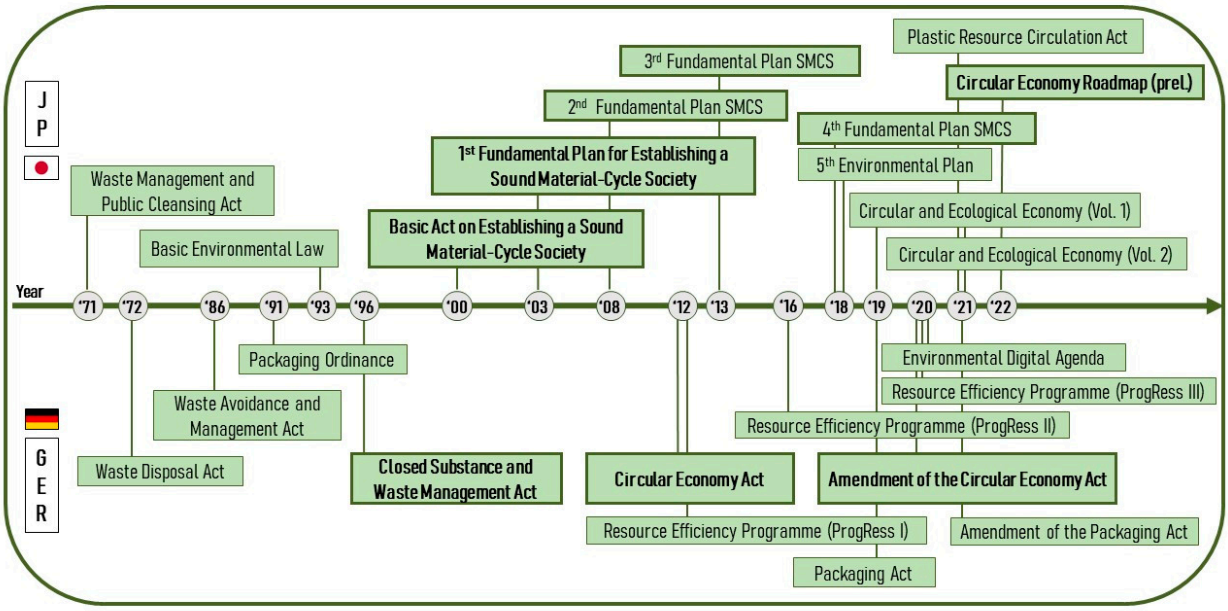

Figure 6. Timeline of circular economy policies and strategies (environmental ministries) (source: author).

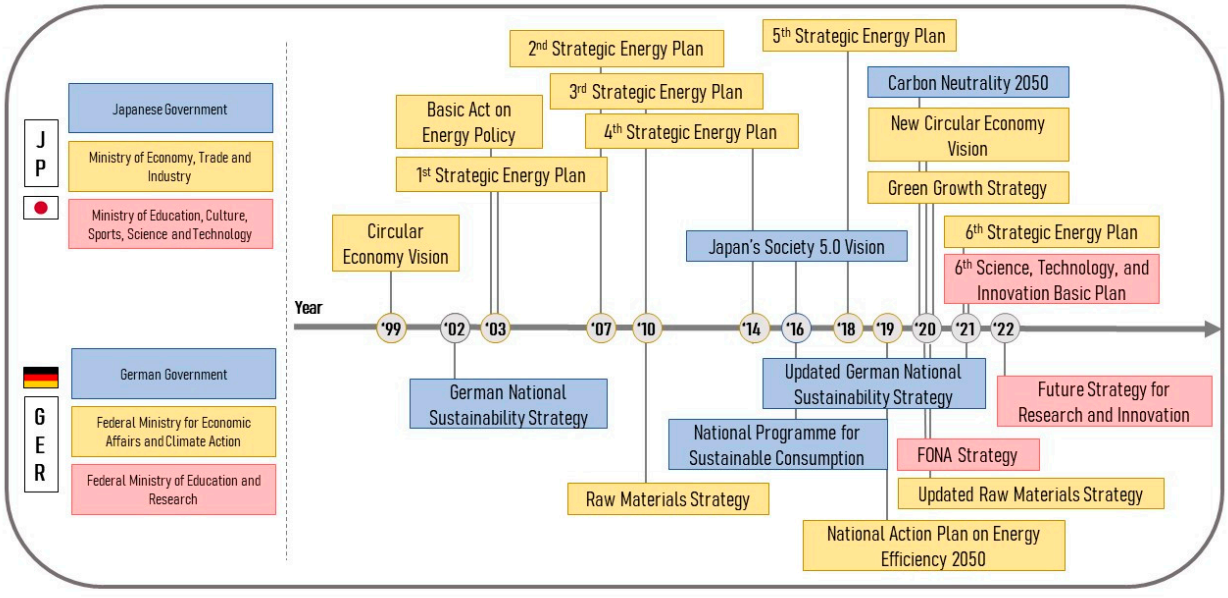

Figure 7. Timeline of circular economy policies and strategies (other ministries and governmental bodies) (source: author).

4.1.1. Japan

Japan's economic and environmental policy—in particular, its legislation for realizing a circular economy—was significantly shaped by the effects of the bursting of the so-called economic bubble of the early 1990s [50]. Between 1985 and 1990, Japan experienced

an economic boom of unprecedented prosperity [51]. During this period, the Japanese stock market index reached its all-time high of nearly 39,000 points [52]. When this bubble around spiraling prices in the real estate and stock markets then burst due to various monetary policy measures, Japan plunged into a recession and a long period of economic stagnation [53]. In August 1992, the Nikkei stock average fell to 14,309, a decline of more than 62% compared to the all-time high three years previous [54]. The years after the bubble burst are often referred to as the lost decade [55]; because of persistent stagnation, this characterization has also been applied to the 2000s [50]. Although Japan has experienced a moderate recovery since 2012, today's economy is still affected by this long stagnation [50]. In addition, Japan faces other challenges due to a low birth rate, an aging population, threats and constraints from natural resource depletion and degradation, and recent recovery from the COVID-19 pandemic [50,56].

One response to these challenges was the idea of creating a **Sound Material-Cycle Society** (**SMCS**) (detailed documents regarding the SMCS can be viewed on the MOE website: https://www.env.go.jp/en/recycle/smcs/index.html (accessed on 16 March 2023)) that aims to comprehensively reduce natural resource consumption and environmental impacts [50]. Due to their interdisciplinary nature, both the Ministry for the Environment (MOE) and the Ministry of Economy, Trade, and Industry (METI) have developed policy frameworks for implementing a circular economy. METI developed a **Circular Economy Vision** (detailed documents regarding the CE Vision can be viewed on the METI website: https://www.meti.go.jp/shingikai/energy_environment/junkai_keizai/pdf/20200522_03.pdf (accessed on 16 March 2023)) as early as 1999 (the latest, updated version was issued in 2020). However, the main political framework around the SMCS was outlined by the MOE in 2000, followed by a 1st Fundamental Plan in 2003. In 2008, 2013, and 2018 (and expected in 2023), updated and revised plans for establishing the SMCS were issued. Another main political plan that relates to realizing a circular economy is the **Basic Environmental Law** (detailed documents regarding the Basic Environmental Law can be viewed on the MOE website: https://www.env.go.jp/en/policy/index.html (accessed on 16 March 2023)) from 1993. Based on this, in 1994 the MOE issued a 1st Basic Environmental Plan, which is updated every six years (2000, 2006, 2012, and 2018). In the 5th Environmental Plan (2018), the MOE proposed the concept of a **Circular and Ecological Economy (CEE)** (detailed documents regarding the CEE can be viewed on the MOE website: https://www.env.go.jp/en/policy/cee/index.html (accessed on 16 March 2023)) as a strategy to realize the decarbonization and the implementation of the SDGs, to which Japan also committed in 2015. The first volume of the CEE was issued in 2019, with a second volume in 2021. Other important political strategies include Japan's announced plan to achieve carbon neutrality by 2050 and the underlying Green Growth Strategy from 2021. Closely related to this are the **Basic Act on Energy Policy** (detailed documents regarding the Basic Act on Energy Policy can be viewed on the METI website: https://www.enecho.meti.go.jp/en/category/others/basic_plan/ (accessed on 16 March 2023)) and the Strategic Energy Plans, which were first announced in 2002 and formalized in the form of an initial plan in 2003. Updates followed in 2010, 2014, 2018, and, most recently, 2021. In 2016, the Japanese government announced a **Society 5.0** (detailed documents can be viewed at https://www8.cao.go.jp/cstp/english/society5_0/index.html (accessed on 16 March 2023)) program (within the 5th Science, Technology and Innovation Basic Plan) that is also closely related to the SMCS in terms of addressing urgent matters in an integrated way and thus from an economic, environmental, and social perspective [50].

In the following part, the most important frameworks, and their goals, developments, and future plans, will be discussed in brief to clearly present Japan's transition to a circular economy:

- **Sound Material-Cycle Society (MOE [50]):**
    - The 1st Outline (2000), 1st, 2nd, 3rd, and 4th Fundamental Plans (2003, 2008, 2013, and 2018).
    - Seven medium- to long-term directions for the successful establishment of a SMCS:

(1) Combining the SMCS with the efforts to create a sustainable society: moving away from mass production and consumption society to a SMCS with a high resource productivity; sustainable use of natural resources to secure food safety and health.
(2) Formation of diverse regional cycles and ecological environment: utilization of efficient circulative, renewable, and stock resources as well as regional human resources to match each region's specific characteristics.
(3) Circulation of resources throughout the entire lifecycle: each stage of the lifecycle of products and services needs to be thoroughly analyzed and optimized for systemic circulation; five focus areas: plastics, biomass, metals (base, rare, others), construction materials, and products and materials against global warming.
(4) Promotion of proper waste treatment and environmental restoration: utilization of IoT and AI for monitoring of waste treatment processes and increasing energy efficiency; reconstruction and restoration after natural disasters.
(5) Waste management framework for disaster cases: enhancement of the resilience of waste treatment systems in case of a disaster (due to the high risk of major catastrophes in Japan).
(6) International frameworks for circulation and overseas expansion: promote cooperations for international resource circulation, waste management, and recycling.
(7) Up-to-date infrastructure for recycling: develop necessary technologies to ensure circulation along the lifecycle.

- Indicators and numerical targets to track the development of the SMCS: Resource productivity, cyclical use rate (at inlet), cyclical use rate (at outlet), final disposal amount + additional indicator set on a more detailed level.
- Implementation: effective cooperation among responsible (governmental) agencies, business operators and outside actors; evaluation and review by the Central Environmental Council.

- **Circular Economy Vision (METI [57]):**
  - Circular Economy Vision (1999) achievements:
    - From 1R (recycle) to a systematic implementation of 3R (reduce, reuse, recycle);
    - Improvement of the waste legislation system: Act on the Promotion of Effective Utilization of Resources (2001); individual recycling acts for different product groups (e.g., containers and packaging, home appliances, end-of-life vehicles);
    - Cyclical use rates at inlet were raised from 10% (2000) to 15.4% in 2016;
    - Expansion of environment-related businesses: industry increased from JPY 58 trillion (2000) to JPY 105 trillion in 2017.
  - New Circular Economy Vision (2020):
    - Recognition of limitations regarding 3R (especially a stagnation of recycling efforts);
    - Advancements in digital technologies are perceived as the main driver for the shift towards a circular economy;
    - Need for businesses to (voluntarily) transition towards circular business models;
    - Urgent areas for circulation: plastics, textiles, carbon fiber-reinforced polymers, batteries, PV panels.
- **Basic Environmental Plan and Circular and Ecological Economy (MOE [58]/MOE [59]):**
  - Basic Environmental Law (1993), 1st–5th Basic Environmental Plan (revised every six years);

- Plan informs about long-term measures for environmental protection; recognition that Japan is facing economic, environmental, and social challenges that are inseparably linked and highly complex;
- Six priority strategies: (1) Green Economic System, (2) Value of National Land, (3) Sustainable Community Development, (4) Healthy and Prosperous Life, (5) Technologies Supporting Sustainability, (6) Strategic International Partnerships;
- Circular and Ecological Economy: development of self-reliant, decentralized societies that use regional resources in a sustainable manner to solve regional and local issues.

- **Strategic Energy Plan (METI [60]):**
  - Basic Act on Energy Policy (2002), 1st–6th Strategic Energy Plan (last revised in 2021);
  - Information on the Japanese energy policy, especially regarding the goal to reduce greenhouse gas emissions by 46% until 2030 and become carbon-neutral by 2050;
  - Major premise: energy security and economic efficiency of energy (while promoting climate change countermeasures);
  - Energy mix in 2030: renewable energy (36–38%), nuclear (20–22%), LNG (20%), coal (19%), oil (2%), hydrogen/ammonia (1%).
- **Science, Technology, and Innovation Basic Plan [61] and Society 5.0 Vision [62]:**
  - Science and Technology Basic Law (1995), 1st–5th Science and Technology Basic Plan, 6th Science, Technology and Innovation Basic Plan (2021, revised every five years).
  - Informs about steady promotion of science, technology, and innovation (STI) in Japan; reviews current STI policies;
  - Society 5.0 Vision:
    - ➢ Formulated within the 5th Basic Plan (2016);
    - ➢ Concept of a super-smart, human-centered society that solves challenges that Japan is and will be facing in the future through a fusion of cyberspace and physical space;
    - ➢ Society goals: securing sustainability and resilience, realization of economic and qualitative prosperity;
    - ➢ STI policies are considered to realize Society 5.0 (e.g., through digital twins, usage of AI and big data, data platforms).

4.1.2. Germany

The first federal regulations on waste disposal in Germany were also driven by economic developments. The economic miracle (the quick economic upswing in West Germany after World War II) and the associated increase in waste volumes in the 1950s and 1960s created a disposal problem that the first uniform federal law of 1972 was intended to counteract [63]. **The Waste Disposal Act (AbfG)** focused primarily on hazard prevention, increasing the safety of landfills, and keeping waste incinerators clean [64]. Based on the realization that closing material cycles and using secondary raw materials ameliorates the scarcity of resources and protects the environment, the first amendment to this law (and the first legal basis for the development of a circular economy) came into force in 1996, the **Closed Substance Cycle and Waste Management Act (KrW-/AbfG)** [64]. In 2012, this was then further developed into the **Circular Economy Act (KrWG)** due to the need to implement EU directives. The last amendment to date took place in 2020, also on the basis of the amended EU Waste Framework Directive (2018/851/EU), which was adopted in 2018 with the new circular economy package [64]. The document **German Standardization Roadmap Circular Economy**, which was funded by the Federal Ministry for Environment (BMUV), was recently published (2023) and is understood as the first step in the new government's national circular economy strategy, which is yet to be developed [65].

Another legal framework directly related to the circular economy is the Packaging Ordinance of 1991 and the **Packaging Act** of 2019, as well as its latest amendment from 2021. The introduction of an extended producer responsibility for packaging and its waste disposal complements the German waste policy [66]. Other strategies related to the implementation of the circular economy are the **German Resource Efficiency Program (ProgRess I)**, first adopted in 2012 and updated into ProgRess II (2016) and ProgRess III (2020). The overarching goal of ProgRess is to make the extraction and use of natural resources more sustainable and decouple economic growth from resource use to strengthen the competitiveness of the German economy [67]. Similar to Japan, not only the Federal Ministry for the Environment but also the Federal Ministry of Economics is involved in strategy and legislative development for the implementation of the circular economy. Particularly noteworthy here are the first and second **Raw Materials Strategy** (2010 and 2020), which review the German government's raw materials policy in order to ensure secure, responsible, and sustainable supply of raw materials [68]. In 2019, the BMWK adapted its comprehensive energy efficiency strategy (**National Action Plan on Energy Efficiency 2050**) [69]. The declared goal at the time was to reduce Germany's primary energy consumption by 30% by 2030 and by 50% by 2050 (compared with 2008) [69]. The German Federal Ministry of Education and Research has various research concepts and strategies to promote a circular economy and to accompany its successful implementation in the future. Worth mentioning here is the **FONA Strategy** (Research for Sustainability) published in 2020 and the associated research concept, the Resource-Efficient Circular Economy [70]. The ministry is currently developing a **Future Strategy for Research and Innovation**, which will develop research and innovation policies for important future fields (e.g., resource-conscious management).

The German government has formulated two other important interdepartmental strategies that have a significant influence on the circular economy: the **German Sustainability Strategy** [71] and the **National Program for Sustainable Consumption** [72]. The former was formulated in 2002 and revised in 2016 and 2021 to align with the UN 2030 Agenda. The latter was launched in 2016 and further developed in 2021 and aims to ensure that consumers are specifically encouraged to purchase ecologically and socially compatible products.

The most important legislative frameworks and strategies, in brief, are:

- **Circular Economy Act (BMUV [73]):**
    - Derived from the Closed Substance Cycle and Waste Management Act (1996), amendments in 2012 and 2020;
    - Introduction of a waste hierarchy: prevention, preparation for reuse, recycling, other recovery (especially energy recovery and backfilling), disposal;
    - Promotion of municipal waste recycling (by 2030 at least 60%);
    - Obligatory separate waste collection (biological waste versus plastic, metal, paper, glass, textile, bulk, and hazardous waste);
    - Amendment of the producer responsibility (towards a duty of care), e.g., resource-efficient and repairable products, use of secondary raw materials, especially recyclates, maintaining the usability of the product instead of disposal;
    - Focus on waste prevention measures and programs;
    - Tighter rules for public procurement (e.g., preference for products that are made from recycled waste or renewable materials).
- **German Standardization Roadmap Circular Economy [65]:**
    - Provides the groundwork for the yet-to-be-developed National Circular Economy Strategy (in the sense of the EU Circular Economy Action Plan);
    - Gives an overview of the status quo of standardization for the circular economy;
    - Describes requirements and challenges for seven key topics: (1) digitization, business models, management; (2) electrical engineering/IT; (3) batteries; (4) packaging; (5) plastics; (6) textiles; and (7) buildings/municipalities.

- **German Resource Efficiency Program (ProgRess I–III)** [68]**:**
  - State program for the protection of natural resources (2012/2016/2020);
  - Aims to make the extraction and use of natural resources more sustainable, to decouple economic growth from resource use as far as possible, while reducing the associated environmental impact, and to strengthen Germany's future viability and competitiveness;
  - Expansion and further development of an efficient circular economy as a guiding principle (e.g., in the form of waste avoidance and recycling, closing material cycles).
- **Raw Materials Strategy (BMWK)** [68,74]**:**
  - First strategy in 2010; updated strategy in 2020;
  - Regulatory framework for the procurement of raw materials;
  - Seventeen measures in the three pillars of raw material supply: domestic raw materials, imports, and recycling.
  - Key Issue Paper on Sustainable and Resilient Raw Material Supply [74]:
    - ➢ Realignment of raw materials policy (through the new federal minister);
    - ➢ One focus of the new alignment: interlocking of circular economy and raw materials strategy;
    - ➢ Measures: digital product passports, acceleration of the development of quality standards for recyclates, release of quality-assured waste products from waste legislation, definition of higher recycling quotas and a product-specific minimum quota for the use of recyclates and secondary raw materials at the European level;
    - ➢ Identification and removing of existing legal hurdles and obstacles that hinder the expansion of the circular economy (e.g., eco-design regulations, standardization of terms and definitions, better use of the opportunities offered by digitization, etc.).
- **FONA Strategy** [70]**:**
  - First strategy for research for sustainable development in 2005 (latest update in 2020);
  - Takes equal account of ecological, economic, and social interests; addresses current developments that affect sustainability (e.g., COVID-19 pandemic);
  - Outlines current status and future research needs;
  - Resource-efficient circular economy as one key research field with four planned actions:
    - ➢ Increasing overall raw material productivity;
    - ➢ Using bio-based raw materials and avoiding waste;
    - ➢ Closing plastics loops;
    - ➢ Phosphorus recycling (recovering waste streams, recovering resources).
- **German Sustainability Strategy** [71]**:**
  - First strategy in 2002, second strategy in 2016, last updated version from 2021;
  - Aligned with the UN 2030 Agenda for Sustainable Development and the 17 SDGs;
  - Area of transformation: circular economy and SDGs 8, 9, and 12;
  - Focus on resource efficiency, sustainable supply chains, secondary material use (especially recycling), avoidance of waste;
  - Fostering of sustainable public procurement, sustainable product design, and sustainable consumption;
  - Establishment of legal frameworks that enable circular economy and circular business models.
- **National Program for Sustainable Consumption** [72]**:**
  - First program formulation in 2016, updated program in 2021;
  - Important step for the implementation of the 2030 Agenda;

- Forty-five measures and goals in different fields of need: mobility, food, home, workplace/office, clothing, leisure/tourism;
- Cross-cutting approaches in relationship to a circular economy, such as: consumer information to expand consumer knowledge, strengthen environmental and social labels, legislation of an eco-design directive, and sustainable public procurement.

4.2. Circular Business Model

For the efficient and effective implementation of the circular economy, new business models are needed that consider the circular economy in a new and, above all, holistic and systemic way. Instead of simple products, new circular business models offer solutions and services that enable the circular economy and thus strengthen future competitiveness [66]. A political vision, a legal framework, and an integrated, systematic circular economy strategy are needed to stimulate such circular business models, which so far represent only a small minority. The extent to which the implementation and expansion of circular economy models is being advanced in the policy frameworks of Japan and Germany is analyzed in the following subsections.

4.2.1. Japan

Japan's main framework for the transition towards a circular economy is currently the 4th Fundamental Plan for Establishing a SMCS, which was issued in 2018. Within this plan, seven pillars were formulated in a strategic manner to support the goal to reduce the consumption of natural resources and minimize the environmental load. For each pillar, a concrete vision, indicators, and planned measures have been formulated. Within the pillar "Circulation of Resources throughout the Lifecycle of Goods and Services", the plan refers to new business model types that enable circulation at every lifecycle stage. It is envisioned that, in a circular future, business models that are optimized from the consumer's point of view will prevail. The addressed lifecycle stages are as follows [50]:

- **Use stage:** business models that create long-term and close relationships with individual consumers by providing the necessary maintaining services (repair, replace, reuse) to extend product life;
- **Distribution stage:** business models that utilize technologies and collected data to match supply and demand, optimize distribution, and manage sharing platforms;
- **Production stage:** business models that utilize data to improve production, distribution and use of products while at the same time fulfilling their extended producer responsibility by adopting designs for circularity (e.g., enabling repair, updating, replacing);
- **Resource-securing stage:** business models that enable efficient and safe circulation of (renewable) resources and restrict the use of natural resources and harmful inputs;
- **Overall lifecycle stage:** business models that not only optimize each stage separately but in an overall, holistic way by cooperating and information sharing along all stages;
- **Disposal stage:** business models that specialize in reusing, recycling, and recovering of materials that are no longer needed (at every stage).

Section 4 of the plan describes the roles and the associated responsibilities of each stakeholder to make the circular society work. In addition to citizens, who play a key role in creating that circular society and who are expected to change their behavior accordingly, the roles of the business operators are crucial for the circular (and sustainable) transition. It is expected that, in order to enable the thorough circulation of resources along the whole lifecycle, new business models will develop services such as repair, reuse, sharing, and replacement. Retailers, as the closest connection to consumers, should push for active sales of reused and recycled products, minimize packaging and waste generation, and encourage consumers to take an active role (e.g., by bringing their own packaging). Producers are expected to implement designs for circularity, replace disposable products, and efficiently use natural resources and energy.

Section 5 elaborates on state initiatives towards the establishment of a circular society. A key point here is the promotion and spread of those business models that are based on

the 2Rs, namely reusing and reducing, and thus foster servitization, sharing, product-as-a-service, and the expanded use of recycled materials.

METI's Circular Economy Vision (2020) [57] further emphasizes the importance of the transformation from linear to circular business models as a key factor of the overall transformation to a circular society; whereas before the first formulation, the focus was only on 1R (recycling), in the first vision (from 1999) it was primarily the 3Rs (reduce, reuse, and recycle) that had to be pursued. In the new vision, it was recognized that these factors have significant limitations and it is therefore essential to take a more holistic approach and thus transform economic activities systemically. As already formulated in the 4th Framework Plan, consumers and companies must take a more active role: consumers' choices have the greatest impact on production and sales decisions, so they need to adjust their consumption patterns according to environmental impacts. Businesses should voluntarily switch to the circular economy and consider it as a source of competitiveness. Depending on the business model, companies are expected to adapt in line with the circular economy. Manufacturers and service providers must establish a recyclable loop system so that servitization and provider-driven collection and recycling can take place. Waste management and recycling companies must become resource providers for recycled materials. The METI envisions that the transformations described above will take place on a mostly voluntary basis, with minimal introduction of regulatory measures. Urgent focus areas for resource circulation are as follows: plastics, textiles, carbon-fiber-reinforced polymers, batteries, and photovoltaic panels.

In the 6th Science, Technology, and Innovation Basic Plan [61], the Japanese government announced that it will continue to focus on achieving its Society 5.0 Vision, as stated in the previous basic plan. As a response to various threats that Japanese society is exposed to, Society 5.0 aims to provide a society that is sustainable and resilient in order to ensure safety and security for all people. The circular economy is a core element of this vision that can drive the economic and social transformation of society. Although circular business models are not directly addressed, it is acknowledged that a reform of business models and industrial structure has to take place. In the future, the Japanese government intends to promote research and development for innovative environmental technologies in particular, such as research and development on materials with low environmental impact or advanced recycling technologies. By integrating insights from the social sciences, humanities, and natural sciences, the Japanese government also aims to promote public understanding of the importance of individual efforts to achieve carbon neutrality and decarbonization, and to highlight the more active role of individuals in society described earlier.

4.2.2. Germany

The Circular Economy Act [73], as the most important legal framework for the circular economy in Germany, gives little to no indication that business models are to be primarily promoted in order to enable a circular economy. This is particularly evident from the fact that the word (German: Geschäftsmodell, English: business model) does not appear once in the entire text of the law. § 33 (3) (Part 4, Division 2) does mention sustainable production and consumption models that are to be promoted in order to achieve waste prevention. However, only relatively vague reference is made to promoting "development, production and use of products which are efficient in terms of resources, and also with regard to their technical durability, and ruling out planned obsolescence, are technically durable, repairable as well as reusable or updateable" (p. 37, [75]). As part of the waste-prevention program (which is one of the key amendments to 2020), it also supports systems that promote the use of R-strategies (here: repair and reuse), especially for the electrical and electronic equipment, textiles, furniture, packaging, and building materials and products sectors.

Another amendment that was implemented in 2020 is the previously mentioned transition from product responsibility to a duty of care (Part 4, Section 23 + 25) [73]. The main obligation of producers is now to maintain the serviceability of the product, in particular to avoid the destruction of returned goods and other consumer goods [76]

(BMUV 2020). However, both the duty of care and product responsibility are nothing more than a basic duty. It may influence the behavior of responsible producers, but enforceable obligations only arise when the federal government determines by specific ordinances who is explicitly responsible, which product is affected, and what specifically has to be done [76].

In summary, the law fails to implement clear aspirations for the transition to circular economy models. As often criticized from various sides, the law looks from the perspective of waste management and not from a holistic view of the circular economy, which aims to avoid waste through the systematic application of R-strategies and to preserve the material qualities of raw materials [77]. Circular business models and their opportunities are not comprehensively considered, but only individual aspects of such business models are referred to (e.g., aspects of the Next and Long Life archetypes).

In the context of the recently published German Standardization Roadmap [65], which was funded by the BMUV, circular business models play a central role as one of the seven key topics. A key need identified by this roadmap is the operationalization and monitoring of the integration of the circular economy into strategies, business models, and management systems. Maturity models that can support companies in the transformation from a linear to a circular business model should be mentioned here in particular. At this stage, the authors refer to circularity-relevant measures that apply across the entire life cycle: procurement, product and service design, internal production process, storage and transport, marketing and sales, after-sales measures, and product utilization phase. Another issue that has to be considered, especially when collaboration in a circular economy takes place, is conceptual clarity on business model types and the associated activities and contributions within a value cycle, so that misunderstandings among involved stakeholders are avoided. The actions they recommend (e.g., developing descriptions of circular economy models for classification) fit perfectly with what has already been described in the first part of this paper. It is expected—and, from an academic perspective, very much welcomed—that the results of this roadmap, which focus on circular business models and considers them as the main drivers for the transition to a holistic circular economy, will now serve as a basis for the development of a new National Circular Economy Strategy.

The National Program for Sustainable Consumption [72] refers to the implementation of circular business models in several places. First, the relevance of the circular economy for achieving sustainable consumption is anchored in the context of the clothing demand field. Innovative infrastructures and business models that enable the preservation, reuse, and recycling of clothing textiles are to be specifically promoted (e.g., the promotion of thrift stores, swap meets, and repair services). In addition to that, the use of recycled fibers, for example, through public procurement, should be increased. Second, the program clearly states that increased environmental awareness has changed the way people consume. This change in consumer behavior has influenced and changed business models, giving rise to new forms such as sharing models or collaborative use. Despite the mostly low market penetration to date, it is important to take advantage of the opportunities offered by these new service markets. The program also aims to promote eco-design at the EU level and thus increase the dissemination and labeling of resource efficiency (especially of household appliances in terms of repairability, durability, and recyclability) and to store further (environmental and social) product information on manufacturing in a digital product passport. The aim is to make sustainability-related information easily accessible to consumers and to support them in their decision-making. The Digital Environment Agenda [78] published in 2020 aims to achieve similar goals by presenting a comprehensive package of measures for the targeted dovetailing of environmental protection and digitization. One area of transformation focuses on linking Industry 4.0 and the circular economy. A central element here is again the EU-wide digital product passport, which collects and makes available all important environmental and material data. This creates transparency along the entire product life cycle, in particular information for consumers/users on production, repair options, and proper disposal. Reliable and comparable information on the social and envi-

ronmental impacts of production and the environmental characteristics of products and services is an important prerequisite for the circular economy and circular business models.

The resource concept of the Resource-Efficient Circular Economy [79], published as part of the FONA strategy, identifies the research and development needs and priority research frameworks that will contribute to the realization of the circular economy in the future. The concept makes it clear that research can provide important incentives for the change from a linear to a circular economy, and that innovative business models suitable for the circular economy are needed. On the one hand, it makes clear how important it is to consider the entire life cycle, and on the other, it assigns a new and stronger role to the consumer. Priority research topics include IT-based solutions that contribute to the implementation of circular business models (especially Servitization and Collaborative consumption models), research into novel forms of cooperation, and acceptance research regarding circular business model archetypes (such as used or refurbished products). In addition, the (ecological and social) impacts and possible rebound effects resulting from novel business models and changed consumption patterns must be specifically investigated. In any case, this requires a holistic approach (across the entire product life cycle).

5. Discussion and Conclusions

5.1. Theoretical Contribution

The first part of this study aimed to provide transparency for the circular business model research field to contribute to its further development. In order to do so, a systematic literature review was conducted to identify current definitions, understandings, and conceptualizations of circular business models within the research community. This search was able to locate a final set of 69 documents that were thoroughly analyzed to expand the current knowledge base of the circular business model. The theoretical contributions are three-fold:

(1) This study provides an up-to-date collection of circular business model definitions and a detailed content analysis. MAXQDA software was used to illustrate the definitions in order to deepen the understanding of the circular business model concept. A key takeaway from this analysis is the fact that definitions and conceptualizations differ in their range and depth. While some (e.g., [31,34]) focus on the R-imperatives as the defining characteristic of the circular business model, other definitions (e.g., [25,33]) use possible archetypes or typologies to describe what a circular business model stands for. Although new definitions continue to be developed, many of the existing ones relate to an early conceptualization by Bocken et al. (2016) [22]. In their scope of investigation, a new taxonomy of resource loops within circular business models was introduced: slowing, closing, and narrowing. Regarding the sustainability of circular business models, there are six definitions that directly refer to it. This again shows that the understanding of the possibilities of circular business models in the context of the current challenges of sustainable development is not clear. While this is not surprising, as the overarching concept of circular economy is still struggling with this conceptual difference, this article follows those conceptualizations that understand circular business models as contributing significantly to more sustainable patterns of production and consumption (in terms of economic, environmental, and social sustainability).

(2) A second contribution, building on the insights from the conceptualizations described above, is a systematic synthesis of the existing archetypes around the circular business model. The literature review revealed that there is ambiguity around how circular business models can be designed and structured. The goal was to not only give an overview of which archetypes or typologies exist in the (academic and gray) literature at the moment, but also to provide a new classification of the circular business model. The main novelty is the classification along the (circular) product lifecycle that contributes to a holistic understanding of the circular business model concept and creates enhanced clarity for future research. The archetypes presented here clearly

show that, in the context of circular business models, the consumer—and therefore the use phase of products and services—must become central to entrepreneurial activities. In half of the archetypes presented, the consumers and the use phase play the essential role. Another interesting observation is that gray literature was perceived to be more focused on these circular business model archetypes and typologies than the academic literature. The authors of [42] and [13], for example, provide comprehensive discussions of the various typologies that can exist in the context of circular business models.

(3) The third contribution to creating conceptual clarity and advancing knowledge about the concept of circular business models is the matrix presented in Section 3.2. This matrix is based on the synthesized typologies and adds important value to each of these. One goal was to combine the concept of the circular business model with adjacent and influencing topics, such as digitization, ecosystem considerations, and social impacts and political interdependencies, into a comprehensive presentation. This novel perspective opens up research opportunities for other researchers within the circular business model and related research fields. As circular business models are considered to be a key to widespread circular economy implementation, this matrix provides important—though mainly theoretical—knowledge about the detailed design, the objective, the possible enabling technologies, and the social and political implications, which can be seen as a basis for further research, but also for the practical implementation of circular business activities, and thus answers various calls from the research community (e.g., [29,39]).

5.2. Implications for Policymakers, Business, and Society

The second part of this study focused on the political view of the circular economy and the circular business model, with an emphasis on a comparative view between Germany and Japan. The first step of this policy review was the presentation of the currently applicable legal and political framework regarding the circular economy. Both countries consider the circular economy as a future method of value generation that enables a sustainable economic society for this and future generations. Although both countries are often perceived as advanced pioneers for the implementation of the circular economy, their political and legal frameworks differ in their details and strategic visions.

In Japan, the path to a circular economy began at the turn of the millennium: in 1999, the METI formulated its first Circular Economy Vision; in 2000, the MOE published the first outline of the Fundamental Plan for Establishing a Sound Material-Cycle Society. Since then, as a response to growing challenges in terms of waste generation, climate change, and advancement in digitization, several updates and amendments have taken place. The MOE, METI, and other ministries and governmental bodies are involved in holistic strategy formulation and building a legal framework for the circular economy in Japan. A detailed examination of its strategies shows that Japan is pursuing a holistic and long-term vision. In the development from the first Circular Economy Vision (METI) in 1999 to the updated version from 2020, for example, it is recognized that Japan needs to shift from the 3R activities (reduce, reuse, and recycle) to more comprehensive circular economy activities. The current plan for creating a SMCS states that it is necessary to obtain an accurate picture of the resources extracted, consumed, and disposed of, in order to make the necessary improvements. Thus, it formulates a set of indicators to track and evaluate Japan's progress. Looking more closely at the figures presented here, it is clear that some progress has been made since the first plan was introduced. The cyclical use rate (most commonly used as an indicator for the circularity within an economy) rose by five points (from 10% in 2000 to 15% in 2015). Japan's next target is 18% by the year 2025, which would be an approximately 80% increase from 2000. Regarding other indicators in the SMCS plan, many are missing numerical targets; instead, only verbal goals, such as "improvement", "efforts", and "aimed to reduce", were formulated. Other indicators regarding the circular economy, such as municipal waste or plastics waste generation and their recycling, which are not included as

numerical targets within the SMCS plan, show that Japan is not making any major progress. The recycling rate of municipal waste, for example, has stagnated at around 20% for the last 10 years and remains one of the lowest among industrialized countries [80,81]. The plastics waste recycling rate in 2020 was 86% [82].

Germany's transition to a circular economy is mainly guided by the legal framework of the Circular Economy Act, first enacted as the Closed Substance Cycle and Waste Management Act in 1996 and adapted by amendments in 2012 and 2020. These amendments were mainly due to EU legislation and adjustments under the Circular Economy Action Plan. Although Germany has several strategy frameworks and individual laws that closely connect to the circular economy, such as the National Program for Sustainable Consumption or the German Resource Efficiency Program, it is missing a holistic and national circular economy strategy [65,77]. In the context of the new government formation, this point has already been acknowledged and it has been formulated as a goal that a holistic circular economy strategy should be created at the national level [65,77]. The urgent need for this is shown by the circular material use rate, the indicator of the circular economy recorded by Eurostat: Germany is currently stagnating on a relatively low level of around 12% and is falling behind other European countries (e.g., the Netherlands' rate was 33.8% in 2021) [83]. Regarding other indicators, Germany shows positive developments. The municipal waste recycling rate in 2021 was 69.8%, the best in the European Union [84]. With this recycling rate, Germany already fulfilled the EU recycling quota goals for 2035 [85]. Additionally, for plastics waste recycling, Germany achieved the top rate of 99.6% in 2019 [86]. Nevertheless, Germany lacks specific national targets for the circular economy. Therefore, comparable targets should be defined and introduced within the framework of a binding target system [77].

Another question was to what extent circular business models are included and specifically addressed in each country's policy frameworks and strategies. The analysis showed that both countries acknowledge the importance of new types of business models that embody the basic ideas of a circular economy and therefore can play an important role in successful implementation. Japan clearly recognized circular business models as a key pillar in the circular economy transition and referred to new business models that are needed at every lifecycle stage: from the use stage, to distribution, production, resource securing, and disposal; and even from an overall lifecycle stage. The METI assumes that this shift from linear to circular business activities will be mainly voluntary, and places particular emphasis on the consumer as an active part of circular business models. Again, specific targets regarding the establishment of circular business models are missing. The only target within the 4th Fundamental Plan is to double the market size of businesses related to the SMCS from the year 2000 by the year 2025.

As far as Germany is concerned, it was shown that, due to a missing national circular economy strategy, references to circular business models are scarce. The Circular Economy act lacks a clear and holistic circular business model vision. Other documents analyzed show some connection to circular business model archetypes, such as the promotion of eco- or circular design business models or new ways of consumption in the form of sharing or collaborative use. The German Standardization Roadmap offers hope for the future, as it recognizes the importance of circular business models as well as the introduction of circularity measures and indicators to evaluate German progress.

In summary, both countries still have many development steps ahead of them to become truly circular economies and societies. While Japan has a national circular economy strategy, Germany still lacks one. Both countries are behind on their main circular economy indicator, and their targets—if formulated at all—are not ambitious enough, especially compared to other countries, to be at the forefront of the industrialized world. Both countries see the need for circular business models as a stepping stone to a true circular economy, but have missed the opportunity to formulate holistic strategies to implement them, which would give them a boost.

5.3. Limitations and Future Research

A weakness of this paper is that, in the first section, a literature review was conducted that only searched for the term "circular business model" and therefore may have excluded research that addresses the topic of circular business models but does not accurately label it as such. Nevertheless, the goal of this academic section was to locate those research papers that explicitly address circular business models as a new and distinct research area in order to collect definitions, conceptualizations, and different understandings that currently define the research field. The aim of this study was to provide transparency for understanding and developing the concept of circular business models. Therefore, the collected definitions were analyzed and interpreted. A limitation of this approach may be that the view of the concept is too narrow and so additional dimensions of a complex concept could be neglected. Still, definitions are a valid representation of the understanding of a concept and provide a basis for further analysis.

In the second part of this paper, only the most important policies and regulations were analyzed, such as the two main circular economy regulations in each country. In addition, there are other far-reaching laws and regulations in both Japan and Germany that are more or less directly related to the circular economy. However, in the context of this paper, the focus is on overarching policies to provide an overview of the status of the circular economy in both countries. Second, the comparison made here between these two countries is not yet very meaningful. For future studies, it would be interesting to include in a comparison those countries that are pioneers in the transformation and implementation of circular economies (such as the Netherlands). From this comparison, one could identify possible transformation paths for Germany and Japan and thus further support a successful transition to a circular future.

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