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Critical Success Factors for Circular Business Model Innovation from the Perspective of the Sustainable Development Goals

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Abstract: Circular business model innovation offers a path for the transformation of companies, enhancing resource productivity and efficiency, while also contributing to sustainable development. These fundamental changes in business are accompanied by a variety of challenges and barriers. To support companies on their journey, only a few studies have investigated the critical success factors for circular business model innovation through literature analysis. To contribute to this research, in this study, a methodological approach, mainly based on expert interviews, is proposed to gain in-depth insight into critical success factors for circular business model innovation. As a result, a framework covering critical success factors for circular business model innovation is developed, comprising nine top-codes and 37 sub-codes, and an analysis of each factor's contribution to the UN's Sustainable Development Goals is performed. The study thereby extends the theoretical basis for further research on circular business model innovation, as well as identifies their practical implications.

Keywords: circular economy; SDGs; sustainable production and consumption; expert interviews; innovation

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1. Introduction

The circular economy (CE) is gaining popularity among researchers and practitioners [1,2], with a variety of perspectives covering different understandings of the concept [3]. The aim of the CE is to enhance resource productivity as well as efficiency [4], mainly by preserving the environmental and economic value inherent in the products [5] by closing, slowing, intensifying, dematerializing, or narrowing the loop [6,7]. This approach also has a positive effect on the company's realization of sustainability ambitions [8], as well as contributing to the UN's Sustainable Development Goals (SDGs) [9]. In order to support companies in their transition toward the CE, the concept of circular business models has been created [10], also driven by a need for the orchestration of the different necessary capabilities to create and capture value from the CE [11–13]. To integrate circular principles on an organizational level, various approaches for circular business model innovation (CBMI) have been developed [14–16] within a research stream connecting innovation and the CE [17]. Thereby, innovation research offers tools and mechanisms supporting the highly complex process of creating circular business models [18–20]. For example, frameworks have been developed connecting innovation factors and business model innovation [21,22]. The importance of connecting the research streams is strengthened, among other factors, by the central significance of an innovation strategy for circular business model innovation [23].

Based on this intertwining of factors, a wide range of authors state that a radical and systemic innovation of business models is the key to speeding up the development of the CE [24–26], particularly from an ecosystem perspective [27]. According to Bianchini et al. [28] and Hofmann [29], there is a break between the CE concept and the practical implementation in particular, among other reasons, caused by various barriers [30–32]. To overcome these barriers, and to support the implementation of CE programs

from a company's perspective, recent research has focused on the drivers of change and critical success factors (CSF) for CBMI [33].

As is also highlighted by Aloini et al. [33], research dealing with CSF for CBMI focuses either on specific business functions (e.g., reverse logistics [34] or waste management [35]), has an emphasis on specific sectors and/or economies (e.g., leather manufacture [36], agriculture [37], or the construction industry [38,39]) or deals with specific countries/perspectives (e.g., SMEs in Australia [40], material reuse firms [22], or Industry 4.0 and circular supply chain integration [41]). There have already been some studies focusing on the collection, analysis, and evaluation of CSF for CBMI from an overall perspective. An overview of the previously published, most relevant studies in this field is presented in Table 1.

Table 1. Overview of the most relevant published studies.

Authors	Year	Methodological Approach	Main Objective
Sehnem et al. [42]	2019	Multiple case study	Analyzation of critical success factors for the adoption of the CE
Aloini et al. [33]	2020	Systematic literature review	Identification and classification of the main drivers and critical success factors of CE initiatives
Khan et al. [43]	2020	Systematic literature review, DANP method	Identification of critical success factors for the transition to the CE
Lahane et al. [44]	2020	Content analysis methodology	Review on circular supply chain management (also covering drivers/enablers/critical success factors)
Goyal et al. [45]	2021	Literature review, expert input, fuzzy DEMATEL	Identification and analysis of critical success factors for sustainable consumption and production, linked with the CE
This study		Expert interviews	Cross-industry and multi-stakeholder-based identification and interpretation of critical success factors for circular business model innovation, supplemented by their connection to the SDGs

To the best of the author's knowledge, there is as yet no study that comprehensively investigates CSF for CBMI, especially one based on data from a large panel of experts across various industries and stakeholders. Furthermore, there is no connection made between CSF for CBMI and the SDGs. To contribute to this research, also following the call for further research building a cross-industry baseline for benchmark creation [44], as well as for deeper insights into the connection of CE practices with the SDGs [9], this article addresses the following main research objectives:

1. What critical success factors exist for circular business model innovation?
2. How are the UN's Sustainable Development Goals connected with the critical success factors for circular business model innovation?

The remainder of this paper is structured as follows: Section 2 gives an overview of the relevant literature, comprising the research connecting CBMI and the SDGs, the theoretical foundation of CBMI, and CSFs for CBMI. In Section 3, the methodological approach of the study is described. Afterward, the results of the current research are shown in Section 4. A discussion is held in Section 5 to connect the findings with the previous research on CSF for CBMI, and to build the framework for the connection of CSF and the SDGs. Finally, in Section 6, the conclusion and the contributions, as well as limitations and directions for further research are presented.

2. Literature Review

2.1. The Circular Economy and the UN's Sustainable Development Goals

In recent years, the connection between sustainability and the CE has been discussed in a variety of research studies [22]. Among other things, the SDGs, developed by the United Nations [46], are used to provide a framework for connecting the two subject areas, with various direct and indirect contributions of CE practices to the achievement of the SDGs [9,47–49]. For example, Dantas et al. [50] researched the connection between the CE, Industry 4.0 technologies, and the SDGs. Del Pérez-Peña et al. [51] identified the CE as an enabler to achieve specific SDGs, especially in terms of mitigating inequalities and climate change. Furthermore, the relationship between CE strategies and the SDGs was analyzed by Morales et al. [52].

Table 2 offers an overview of the most relevant studies dealing with the CE and the SDGs. Studies showing a direct or indirect link between CE practices and the achievement of the SDGs are included. A direct contribution is defined as a direct relationship between target achievement and CE practices, whereas an indirect contribution is characterized by the synergies that can possibly be created between goals, as already proposed by Schroeder et al. [9].

Table 2. Studies with direct or indirect links to the CE and the SDGs.

SDG	Description	Studies
1	No poverty	[50,51]
2	Zero hunger	[50]
3	Good health and well-being	[53,54]
4	Quality education	
5	Gender equality	
6	Clean water and sanitation	[9,53–56]
7	Affordable and clean energy	[9,50,55,56]
8	Decent work and economic growth	[9,50,53–55,57]
9	Industry, innovation, and infrastructure	[50,52,54–58]
10	Reduced inequalities	[50,51]
11	Sustainable cities and communities	[50,52,55,57,58]
12	Responsible consumption and production	[9,50,52–59]
13	Climate action	[50,51,53,54,56,57]
14	Life below water	[50,57]
15	Life on land	[9,50]
16	Peace, justice, and strong institutions	
17	Partnerships for the goals	[50,52,58]

As can be seen from the table, there are several studies showing a direct or indirect correlation between CE and SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure), SDG 11 (sustainable cities and communities), as well as SDG 12 (responsible consumption and production) and SDG 13 (climate action). SDG 12, in particular, is addressed by many researchers, showing a strong influence of CE [9,59]. Furthermore, the relationship between SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDGs 14/15 (life below water/on land), SDG 17 (partnerships for the goals), and the CE is confirmed by certain studies. SDG 1, SDG 2, SDG 3, and SDG 10 are also partially addressed.

In contrast, based on previous research, there is no direct or indirect connection between CE practices and SDG 4 (quality education), or with SDG 5 (gender equality) and SDG 16 (peace, justice, and strong institutions).

2.2. Circular Business Model Innovation

Instead of concentrating purely on creating economic value, the circular business model (CBM) and CBMI literature include a consideration of other forms of value for a broader range of stakeholders and, in this way, contribute to the sustainable development of both the company and society [60,61]. In order to create profitable CBMs, a variety of questions regarding the transformation of resources have to be answered [5]. Innovation research, intertwined with research on CBMs, offers a broad range of practices and tools to support the transition from a linear to a CE, with eco-innovation and innovation for business models as focus fields of research [20,62]. In this context, research has become increasingly important in recent years, which is also reflected in a rising number of publications [63,64]. In this regard, the importance of an innovation strategy is highlighted, among others, by Bocken and Ritala [23]. Regarding the strategy, Geissdoerfer et al. [16] proposed a classification into four business model innovation strategies, these being circular startups, circular business model diversification, circular business model transformation, and circular business model acquisition [64]. Following this study, the research spans a

wide range of industries, addressing different focal points [65–67]. For example, Awan and Sroufe [22] offer insights into enablers for the innovation of CBMs. Furthermore, to support companies in their transition, a variety of tools is available, among others summarized by Bocken et al. [15]. In this process of change toward CBMs, many identified challenges can be countered; at the same time, there are risks that must be overcome to successfully complete the business model innovation [68].

2.3. Critical Success Factors for Circular Business Model Innovation

As explained in the introduction, there have already been several researchers conducting meta-analyses dealing with CSF for CBMI. Within all studies, the CSF for CBMI have been identified through (systematic) literature reviews. Afterward, the factors have been categorized within different dimensions. Table 3 provides an overview of the dimensions, as well as the factors identified in the studies. Due to their relevance for further investigation in this study, the overview is limited to the research of Aloini et al. [33] and Khan et al. [43].

Table 3. Overview of dimensions and critical success factors for CBMI.

Authors	Dimensions	Critical Success Factors
Aloini et al. [33]	Technological	Information systems/information and communication technology; Rs technology *
	Economic and financial	Financial support; financial and economic sustainability
	Institutional	Legal and regulatory environmental framework; public awareness; support
	Strategic	CE-oriented business model; company culture; CE-oriented knowledge and information management; CE-oriented environmental strategy
	External	Coordination and collaboration; consumer awareness
Khan et al. [43]	Organizational	Management commitment and support; vision with regard to the CE; policies for CE practices; business models
	Economical	Financial sustainability; capital investments; reuse of resources; remanufacturing/reuse cost
	Technological	Methods, indicators, and monitoring; integration of CE with digital technologies; the expertise of key people in their respective fields; technical know-how and skill development; ability to innovate; technological resources for CE implementation; quality preservation of reused materials
	Environmental	Eco-innovation; eco-design; cleaner production; legal and regulatory environment
	Social	Public awareness of CE; employment generation; consumer perception toward the product

* Rs technology: Technology positively contributing to CE principles, among others, reduction, repairing, remanufacturing, and recycling [69–71].

From this research, the following dimensions for CSF can be derived:

1. Technological: Enabling technologies for CE (to achieve the Rs, and for measurement/monitoring), accompanied by know-how and available resources;
2. Economic and financial: Financial and economic sustainability and support/investments, followed by the reuse of resources and remanufacturing/reuse costs;
3. Environmental: Capabilities of eco-innovation, eco-design, and cleaner production;
4. Organizational/strategic: CE-oriented business model, enabled by vision, company culture, and knowledge management towards CE, and management commitment;
5. External/social: Coordination and collaboration, supported by customer/public awareness and product perception;
6. Institutional: Legal/regulatory environmental framework and governmental support.

3. Methodology

The questions raised in this study do concern a widely explored subject in the field of the CE; however, based on the interviews with five experts conducted in advance of the study, some specific areas with regard to CSF have not yet been addressed in the scientific literature. Therefore, an exploratory methodological procedure is applied [72]. Semi-structured interviews were carried out, as these are an effective method for the collection of empirical data [73], with experts in the field of CBMI. Semi-structured interviews are a method for the collection of data in a structured way, but provide a degree of openness to new and unpredictable facts [74]. As many experts as possible were interviewed until no significant increase in knowledge could be observed [75]. This methodological procedure is a widely used technique in sustainability and CBMI, and has been applied in numerous studies [76–79]. For the research approach, validity and reliability have been ensured by a

variety of measures, among others, those inspired by Gibbert et al. [80]. An overview of the measures is given in Table 4.

Table 4. Applied validity and reliability measures.

Validity/Reliability	Measures
Construct validity	Interview question development, based on a comprehensive literature review Conducting interviews with key stakeholders
Internal validity	Research for potential factors that could lead to different interpretations Triangulation of interview participants, based on the triple helix model of innovation
External validity	Composition of the expert panels, based on predefined criteria Generalization of results, based on data patterns
Reliability	Elaboration of a semi-structured interview guideline Transcription of the expert interviews Structured coding process

3.1. Data Sampling and Collection

As CE is a multidisciplinary area, various stakeholders need to be involved in research on CBMI [81,82]. Therefore, experts with a business background, as well as scientists and representatives from the group of politics/non-governmental organizations (NGOs), have been selected as a result of stakeholder analysis. Having a good or very good knowledge of the field of CBMI (3.7/5 on average, according to the assessment of the respective experts; using a Likert 5 scale, 1 = very low, 5 = very high) as well as several years of experience (approx. 5 years of experience on average in the panel) were set as selection criteria.

A total of 30 semi-structured interviews have been conducted. Compared to previous studies in the field of business model innovation, which apply expert interviews as a methodological approach, the size of the expert panel provides a comparably good basis for the generalizability of the results [76,78,83,84]. This is also supported by the consideration of the triple helix model. Three of the experts belong to the field of politics/NGOs; five interviews were conducted with scientists, and 22 interviewees were selected from the group of practitioners, whereby different industries have been taken into account, e.g., the chemical industry, textile industry, healthcare technology industry, as well as consulting. Regarding the educational level, the experts' qualifications are distributed as follows: three experts hold a Ph.D., 23 experts have a master's degree, three experts have a bachelor's degree, and one expert has an associate's degree. Furthermore, most of the experts have special qualifications, including, for example, having a very good knowledge of circular packaging or CE-focused investments, being an expert in European Union politics on sustainability and circularity, or being a co-creator of a CE platform. Through this heterogeneous sample, generalizing the results, as well as preventing sample bias effects, is achieved [75]. An overview of the interviewees is offered in Table 5; however, their names and the employers of the experts have been anonymized.

The interviews were conducted in November and December 2021. As only one author conducted the interviews, a bias that could be triggered because of having several interviewers has been avoided. Five of the interviews were carried out in advance, on the one hand, to ensure that new knowledge is expected in addition to that gained through previous research, and, on the other hand, to test the interview guidelines and questions as proposed by Sayrs [85]. The interview guideline consisted of two parts; in the first part, questions directly related to the expert (e.g., work experience, knowledge of the field of CBMI, academic background) were addressed; the second part consisted of questions that focus on identifying drivers and CSF for CBMI. An overview of the interview guideline is presented in Appendix A, Table A1.

Table 5. Interview partners.

#	Category	Area/Industry	Educational Background	Special Qualification
1	Business	Consulting	Master's degree	Co-founder of consultancy focusing on circular business models and product development
2	Business	Consulting	Master's degree	
3	Business	Oil industry	Master's degree	Expert in topics at the interface of the CE and social impacts and human rights
4	Business	Chemical	Ph.D.	Expert in transformation processes
5	Politics/NGO		Master's degree	Very good knowledge of CE metrics
6	Business	FMCG	Bachelor's degree	
7	Business	Consulting	Master's degree	Founder of a green economy search engine, among others focusing on the CE
8	Science	CE research	Master's degree	Co-creator of a CE platform
9	Business	Consulting	Master's degree	Very good knowledge of partnership building and circular procurement
10	Politics/NGO		Master's degree	
11	Business	Healthcare technology	Master's degree	Expert in translating consumer knowledge into products and services
12	Business	Textile	Master's degree	European Union police expert on circularity
13	Business	Consulting	Master's degree	Expert in enabling circularity through digital transformation
14	Politics/NGO		Bachelor's degree	
15	Business	Consulting	Master's degree	Very good knowledge of circular transformation processes
16	Business	Utility	Master's degree	Expert in user journeys and the improvement of user experience and conversion rates
17	Business	Chemical	Ph.D.	Very good knowledge of circular packaging
18	Business	Textile	Master's degree	
19	Business	Utility	Master's degree	
20	Science	CE research	Master's degree	
21	Science	CE research	Master's degree	Organizer of events dealing with the CE to create innovative circular initiatives
22	Business	Consulting	Master's degree	
23	Science	CE research	Master's degree	
24	Business	Healthcare technology	Master's degree	Expert in embedding CE principles into business strategy and action
25	Business	Consulting	Master's degree	
26	Business	Consulting	Bachelor's degree	Very good knowledge of designing circular strategies and responsible businesses
27	Business	Technical equipment	Ph.D.	
28	Business	Technical equipment	Master's degree	
29	Business	Venture capital	Associate's degree	Very good knowledge of CE-focused investments
30	Business	Consulting	Master's degree	Coach and trainer for business model innovation

3.2. Coding and Data Analysis

Interview times ranged from 17 to 55 min and the interviews were conducted in English and German. Due to geographic circumstances, as well as constraints caused by the COVID-19 pandemic, the interviews were carried out virtually or by telephone. The interviews were tape-recorded, for which permission was requested at the beginning of the interviews, and were transcribed afterward [86]. The transcripts of the 30 interviews were analyzed inductively using qualitative content analysis. The goal of this analysis is to identify common words and phrases [87,88]. After the coding has been completed, to answer the second research question, the CSF have been assigned to the SDGs by an independent group of researchers within a virtual workshop. A workshop-based approach, being an approved method in the field of business model innovation [89,90], was chosen to systematically identify the connection between the CSF and the SDGs. Workshops are used, in particular, for the development of models and frameworks, and are, therefore,

a suitable approach for this research [91]. Within the workshops, firstly, the SDGs were presented, while also outlining previous research linking the SDGs to CE to get a common understanding. Afterward, the CSF results from this study were discussed individually, until a consistent picture of CSF's influence on the SDGs was established.

4. Results

The transition of companies from a linear to a circular business model entails several CSFs. Tables 6 and 7 illustrate the findings of the expert interviews, dividing the factors from an internal, as well as an external perspective, after which some of the experts subdivided them. Each identified CSF is underpinned by an exemplary statement.

Table 6. Internal critical success factors for circular business model innovation.

Dimension	Top Code	Subcode	Exemplary Expert Statement
Internal success factors (4)	Product design	Circular product design (3)	"I think the success will be coming from the designers that really want to incorporate circularity." (E29)
		Design thinking approach (2)	"So, it's almost like a design thinking approach rather than a traditional project management." (E12)
		Product lifecycle consideration (2)	"[. . .] looking at the entire lifecycle, from material sourcing to a potential take back." (E13)
	Product-service systems	Service creation (10)	"[. . .] rethink the way we are doing business selling product-service bundles instead of selling products." (E23)
		Reverse flow management (7)	"They need capabilities, for the business to have these reverse logistics processes in places." (E24)
		Financing and budget (8)	"[. . .] if you have a subscription or leasing model, you should also be able to finance it." (E10)
	People & culture	Knowledge and skills (10)	"Do they have the necessary skill set, the necessary capabilities and knowledge within the organizations to even adopt this new business model?" (E21)
		Long-term vision (6)	"You have to take smaller margins in the short term because we think it will be for the long-term success of our company." (E6)
		Internal communication (5)	"You are doing something very innovative, it's kind of have you also thought about how are you going to communicate people around any process?" (E14)
		Mindset change (10)	"[. . .] is to create a simple, circular-driven corporate mindset throughout the company." (E7)
		Agility (2)	"Well, being like a lean company with a nimble structure, that can definitely help." (E30)
	Implementation process	Core business inclusion (1)	"However, it was really hard to scale because it wasn't a central part of the business." (E19)
		Top management commitment (5)	"It is not a surprise, but top management was highly important to most projects." (E19)
		Business plan and profitability (9)	"The most obvious success factor is the fact that you're going to make money out of it, so it should be profitable." (E10)
		Pilot projects (1)	"[. . .] you have to practice this cycle in the value chain." (E4)
		Cross-functional involvement (2)	"It really touches upon every aspect and every team and every division in a company." (E2)
	Transparency	Data management (4)	"That is really clear. Primary and secondary data. You have to take a moment to understand what you are going through." (E16)
		Market intelligence (9)	"[. . .] is to really know your market, and the different behaviors of your stakeholders." (E16)
		Supply chain transparency (1)	"One is ensuring that you have a 360-degree perspective on your supply chain, go through and evaluate all the elements." (E13)
		Success measurement (8)	"It allows us to actually measure circularity [. . .], so that this will help to take steps forward." (E2)
	Technology		"Technology has been critical and an enabler for successful transformation." (E8)

Table 7. External critical success factors for circular business model innovation.

Dimension	Top Code	Subcode	Exemplary Expert Statement
External success factors (4)	Ecosystem (4)	Collaboration and partnerships (19)	"We need to have cooperative and collaborative efforts between several stakeholders, between the public, private and academic sector." (E30)
		Best-practice sharing (2)	"From my perspective, we kind of need more best practices to understand a little bit more concretely how the circular economy works. (E1)
		Stakeholder coordination (2)	"But circular business models need a different approach, you need to balance out all the different interests of the different stakeholders." (E15)
		Coordination technology (1)	"In my opinion, digital tools [. . .] to coordinate all the different stakeholders efficiently." (E15)
		New markets (3)	"[. . .] not only to scan my industry but somehow everything that is around me, it may be that someone can support me." (E1)
		Supplier involvement (3)	"Somebody who is trying to implement a business model and the upstream supply chain is not ready for it to implement [. . .]" (E15)
		Common goals and values (4)	"Without aligning the different purposes and objectives of all of the stakeholders, it would be very hard to achieve circularity." (E30)
		Open innovation and knowledge sharing (7)	"Innovation in your own company? Yes. But I think the circular economy is also breaking this down a bit, and acceptance is already very high." (E25)
		Shared infrastructure (1)	"Shared infrastructure is also important, especially in recycling. I think it's quite hard for individual companies to build that up on their own." (E25)
	Customers (19)	Customer feedback (3)	"I think customer feedback by having these channels from your customer. It's one of the key things: transactional to relational." (E6)
		Customer awareness (5)	"[. . .] you have to explain to the customer how circularity works." (E9)
		Customer value (11)	"If the circularity and the sustainable use of the product is the only value proposition, you'll fail." (E17)
	Government (2)	Regulations (3)	"We need like regulations to support a circular economy transformation." (E19)
		Law harmonization (1)	"So, we have to make sure that there is a consistent regulation, for example, how we can recycle, where we can recycle, across different countries." (E13)
		Subsidies (1)	"So, I think financial incentives like that could also really help." (E13)
		Legislation (2)	"It's also important that national legislation is that we're trying to get businesses can succeed over time." (E3)
		Circular strategy (2)	"And I think then it's also totally critical that we have a really holistic strategy in Germany that also shows companies directions." (E1)

From the interviews, nine top-codes have been identified, namely, *product design*, *product-service systems*, *people and culture*, *implementation process*, *transparency*, and *technology* within the dimension of internal CSFs, along with *ecosystem*, *customers*, and *government* within the external dimension.

As the first success factor, the *product design* process must be radically rethought. Circularity should be embedded in the design process, using a customer-centric design-thinking approach for product development. In this process, the whole lifecycle of the product should be considered. The creation of *product-service systems*, characterized by the establishment or expansion of those services accompanying the product, is another critical success factor mentioned by the expert panel. This also supports the creation of reverse flow capabilities, as well as the topic of financing and budget for setting up a new business model that eventually has new capabilities. Another factor is *people and culture*. Experts mentioned the importance of knowledge and skills about the CE in general, and CBMI, in particular. In this regard, an agile way of working, a change in mindset toward circularity, as well as having a long-term vision as a company have been named. This also includes internal communication. To support the *implementation process* toward a circular business model, a clear, profitable business plan must be developed as a basis. In this regard, top management commitment, as well as cross-functional involvement, is key to success, according to the experts. The new business models should, therefore, be included in the core business, starting with small pilot cases. Having a certain level of *transparency* has been identified as another CSF. This includes data management, along with a success measurement based on it. Furthermore, having market intelligence within the company, as well as an elevated level of transparency in the supply chain, have been identified by

the experts. As the last internal success factors, *technologies* have been identified, either in terms of information and communication or for production and recycling.

Regarding the external CSF, interacting within an *ecosystem* has been named by a large number of the interviewed experts. This includes collaboration and partnerships with different stakeholders, as well as coordination between them. In this context, coordination technologies have been highlighted as important. Within these ecosystems, the sharing of knowledge, open innovation, best-practice sharing, common goals and values, as well as using shared infrastructures, have been identified as critical for success. Therefore, for a company, the development of new markets and the involvement of suppliers in the transformation have also been addressed. Another CSF is the interaction with the *customer* side. Here, the collection of customer feedback is stated as being critical, as well as fostering the customer's awareness of circularity. Furthermore, the experts mentioned customer value besides circularity and sustainability as being an essential factor for circular transformation. Otherwise, only a limited target group of consumers would be eligible for the product. Finally, the *government*, with various fields of action, has been identified as critical. This includes the setting up of regulations, as well as legislation supporting the transition, in addition to the harmonization of laws across borders. An overall circular strategy—on a country level, as well as a subordinate level—in connection with subsidies has also been identified as a critical success factor.

The results show a total of nine main codes, classified into the two dimensions "*internal CSFs*" and "*external success factors*", which have also been derived from the expert's statements. Below these, in turn, except in the group coded as *technology*, 37 sub-codes are allocated.

5. Discussion

Research on CSF for CBMI has only been conducted to a limited extent in recent years. With regard to meta-analyses, Aloini et al. [33] and Khan et al. [43] proposed the first studies to comprehensively collect and categorize the factors in 2020. Considering this research gap, the aim of this paper was to extend the literature on CSFs for CBMI, as well as on the connection between CE practices and the SDGs. Therefore, expert interviews with 30 participants have been carried out for factor identification, as well as a workshop, conducted to show the connection between the identified factors and their contribution to the SDGs. In this section, a discussion is held regarding CSFs for CBMI, followed by identifying the connection between the factors and the SDGs. Finally, the theoretical contributions and practical implications are described, and the limitations and directions for further research are highlighted.

5.1. Critical Success Factors for CBMI

Product design, as the first dimension of CSFs, has also been identified by previous studies [43,92], and is confirmed by the experts consulted in this research. Furthermore, the consideration of the total product lifecycle is mentioned as being critical for success, as already stated by Hapuwatte and Jawahir [93] and Sauerwein et al. [94].

The creation of *product-service systems* is, for the first time, identified as a CSF in this study. This finding supports the interconnection between service/digitalization and the CE, which has been illuminated by numerous studies [95–99], also in the context of business model innovation [25]. Among others, Yang et al. [100] revealed a positive effect of product-service systems on circular supply chain operations. Thereby, the reverse flow management as a CSF within product-service systems business models has also been included in previous research [101,102].

The importance of *people and company culture* for the successful transition from a linear to a circular business model has been identified as critical by various studies, among others, by Aloini et al. [33], Khan et al. [43] and Sehnem et al. [42], and underpinned by further contributions [31,103,104]. Specifically, among other things, long-term vision is also identified as a CSF [43]. In this study, knowledge and skills, in particular, as well

as a mindset change, have been identified as vital several times, among other topics also covered by Rossi et al. [105].

As another top-level code, the *implementation process* within the CBMI process has been recognized in this study. The sub-codes, especially top-management commitment, business plan, and profitability, have already been identified in previous studies but were assigned to other dimensions [33,43]. Conducting pilot projects, supplemented by an early inclusion of the transformation within the core business, with cross-functional involvement, has so far not been included in CBMI research.

Furthermore, this study confirms the importance of *technologies* as a critical success factor, which has already been investigated in depth in numerous studies [33,43,45].

As the last internal success factor, *transparency* has been identified by the expert panel. This is in line with previously published research, especially with regard to drivers and barriers [106]. The sub-code success measurement has so far only been included by Khan et al. [43], but with a focus on the underlying technology for the performance measurement of a company or product.

Government (top-code) has also been discussed by some studies dealing with CSFs for CBMI [33,43], and has been confirmed in this research. This is also reflected in numerous studies investigating the role of governments in the development of the CE [107–110].

The *customer* side, identified as being critical in this study, has also been part of the research conducted by Khan et al. [43], Goyal et al. [45], and Aloini et al. [33]. The awareness of the customer's role, as well as an additional value for the customer, are covered in previous studies, whereas this study extends the dimension in terms of the importance of customer feedback. The importance of customers to CBMI is also highlighted by numerous studies emphasizing, among others, their role and value creation [77,111–113]. Mostaghel and Chirumalla [114], in particular, identify the customer as a crucial enabler of CBMI.

As a completely new critical success factor for CBMI, *ecosystem* has emerged from these results. Therefore, the study of Aloini et al. [33] is expanded, in which only coordination and collaboration are identified within the external dimension. This finding is consistent with numerous studies regarding the interface between ecosystems, the CE, and business model innovation. At its core, the interaction of companies with an ecosystem is crucial, shifting from a company-centric to a network-centric logic to move towards a circular business model [14]. This ecosystem perspective is, among others, analyzed by Chirumalla et al. [115], Gamidullaeva et al. [116], and Kanda et al. [117] across various industries, also with a focus on CBMI [62].

The framework, including the CSF for CBMI identified in this study, is presented in Figure 1. It consists of nine top-codes, which have been discussed in this section. The codes belong to the internal and external dimensions and have been assigned a total of 37 CSF.

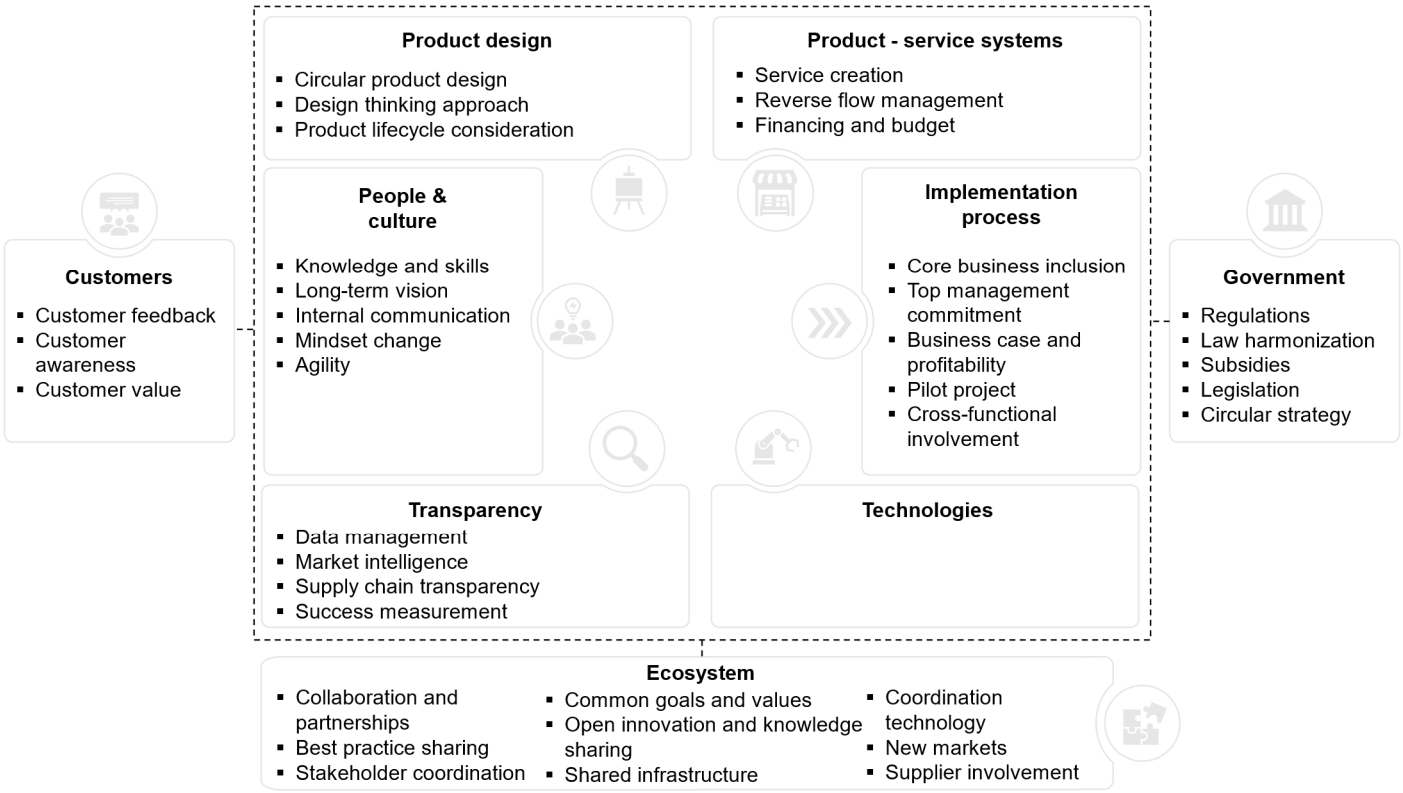

Figure 1. Framework of the critical success factors for circular business model innovation [118].

5.2. Connecting Critical Success Factors for CBMI and the SDGs

In the second step of this research, a connection between the previously identified CSFs, as well as the SDGs, which have been briefly introduced in Section 2.1, has been made. Therefore, the positive effects of the CSFs on the different SDGs have been discussed and then mapped afterward. The results are shown in Figure 2. As can be seen, all internal success factors contribute to the pursuit of SDG 12, regarding sustainable consumption and production. Furthermore, a positive connection between *product design* and *technology* with SDG 9, as well as *people and culture* and SDG 13, is demonstrated. The external factors show a positive impact on the achievement of SDGs 8 and 13 (via the factor of *government*), SDGs 9 and 17 (via the factor of the building of *ecosystems*), as well as on SDG 12 via the factor of the *customer*. The results of the analysis are presented in Figure 2.

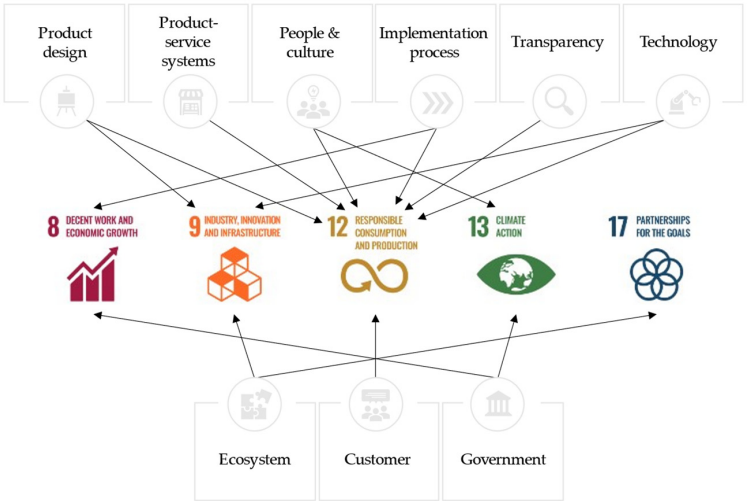

Figure 2. Influence of the critical success factors of CBMI on the SDGs.

These results are in line with previous studies. The positive effect on SDG 8 of the CE is, among other things, highlighted by Schroeder et al. [9]. Therefore, progress toward the goal is in supporting the CE regarding development-oriented policies, which is confirmed by the results of this study.

SDG 9 is, among others, positively influenced by technology as a critical success factor for CBMI. This phenomenon has been widely discussed by Dantas et al. [50] and Panchal et al. [55], as well as being mentioned by Mina et al. [54], and its importance is confirmed in this study. The positive influence of product design has so far only been mentioned in passing [119]. Furthermore, the contribution of ecosystems in connection with the CE to SDG 9 has also not been directly verified. The effect might mainly be due to the positive influence of the circular ecosystem on innovation, as discussed by numerous authors [27,120,121].

SDG 12 is positively affected by a variety of CSF. This is, among other things, due to the aim of sustainable consumption and production by the CE [122]. The relationship has already been identified by Schroeder et al. [9], Morales et al. [52], and Rodríguez-Antón et al. [123] in general across various industries [55], as well as by Dantas et al. [50], Fatimah et al. [53] and Patyal et al. [56] regarding technology. This connection is confirmed by the results of this research. The relationship between the other CSF and the SDGs has not been covered in previous studies, but is due to the connection between CE and sustainable production and consumption, as mentioned above [122].

The connection between CE and SDG 13 has been investigated in previous studies and was also verified in this study. The relationship between the factor of *government* and the SDG, in particular, is in line with the findings of Del Pérez-Peña et al. [51], stating that climate action policies should be considered, as well as with Rodríguez-Antón et al. [123].

The results of this study show that SDG 17 (partnership for achieving the goals) is positively affected [50,52] concretely by the building of *ecosystems*, which might be due to the fundamental idea of collaboration.

Overall, it should be noted that there is a significant relationship between the critical success factors for CBMI and the SDGs, further reinforcing the need for companies to transform their business models toward a more circular way of operation.

6. Conclusions

In this section, the theoretical, as well as the practical, contributions of this research study are summarized, including its limitations and directions for further research.

6.1. Theoretical and Practical Contributions

As already mentioned in the Introduction, the transformation of companies toward a circular business model poses numerous challenges. The CSF of this journey have, so far, not been investigated in depth. By doing so, we both contribute theoretically and also derive practical implications.

6.1.1. Theoretical Contributions

By shedding light on the topic of CSF for CBMI, this research contributes to the research stream by:

- Expanding the mostly theoretically driven knowledge base, based on empirical insights regarding CSF for CBMI (e.g., Aloini et al. [33] and Khan et al. [43]), as well as the connection between CSF for CBMI and the SDGs;
- Systematic clustering by building a framework for CSF for CBMI, extending the factors identified in previous studies, and discussing the references to the previously published literature;
- Establishing a classification for the critical success factors for circular business model innovation, both on a dimension (internal and external), as well as on a top-code level.

6.1.2. Practical Contributions

Besides the theoretical contributions, the research supports companies during business model transformation by:

- Driving the awareness of CSF, accompanied by argument and support for (change) managers by linking the success factors for CBMI and the SDGs;
- Offering a multi-stakeholder view, to enable practitioners to take different perspectives into account;
- Providing managers with a framework to proactively prepare for the transformation project, both in terms of the possibility to assess current capabilities, and as a starting point to derive measures addressing the internal and external success factors.

6.2. Limitations and Further Research

The results of this research offer a starting point for further studies but have some limitations to be considered.

Firstly, although the connections between the CSFs for CBMI and the SDGs identified in the workshop offer a solid, comprehensible overview, the consideration is nevertheless qualitative in nature. Further research could deepen the analysis, taking quantitative research methods into account. To advance a better understanding, future research could not only be based on the SDGs but also on the underlying targets.

The second limitation comprises the time horizon of CBMI. As there is no specific focus on the different process steps and the company's maturity levels, future studies could specifically address these additional dimensions.

Thirdly, the object of consideration is limited to CSF. As there is an interconnection between barriers, drivers, and CSF, influencing the success of the transformation toward a circular business model, further research should consider these areas within an interlocked context.

Fourthly, despite the fact that the research sample size allows valuable insights into CSF for CBMI, further research should be made to confirm and ensure the representativeness of the results, for example, by an extension of the panel size.

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Appendix A

Table A1. Interview guideline.

Interview Part	Description/Exemplary Questions
Introduction part—Research project introduction	Introduction of research background, objective and methodological approach, as well as of interview participants.
Introduction part—Presentation of the most important definitions	Defining the most important terms (circular business model innovation, critical success factors) to ensure a common understanding.
Main part—Generation of critical success factors	Identification of critical success factors for circular business model innovation, among others, is based on the following questions: What critical success factors exist for circular business model innovation? Could you please go into a little more detail? Could you please give an example? Why do you think that this is a critical success factor for circular business model innovation? What important factors did you become aware of during your last project? What success factors could possibly be derived from barriers that exist in your experience? Did we miss anything important that you would like to add?
Closing part	Explanation of the further course of study.

References

1. Geissdoerfer, M.; Savaget, P.; Bocken, N.M.; Hultink, E.J. The Circular Economy—A new sustainability paradigm? *J. Clean. Prod.* **2017**, *143*, 757–768. [CrossRef]
2. Korhonen, J.; Nuur, C.; Feldmann, A.; Birkie, S.E. Circular economy as an essentially contested concept. *J. Clean. Prod.* **2018**, *175*, 544–552. [CrossRef]
3. Kirchherr, J.; Reike, D.; Hekkert, M. Conceptualizing the circular economy: An analysis of 114 definitions. *Res. Conserv. Rec.* **2017**, *127*, 221–232. [CrossRef]
4. Ellen McArthur Foundation. *Towards the Circular Economy: Economic and Business Rationale for an Accelerated Transition*; Ellen McArthur Foundation: Cowes, UK, 2013.
5. Roos, G. Business Model Innovation to Create and Capture Resource Value in Future Circular Material Chains. *Resources* **2014**, *3*, 248–274. [CrossRef]
6. Geissdoerfer, M.; Vladimirova, D.; Evans, S. Sustainable business model innovation: A review. *J. Clean. Prod.* **2018**, *198*, 401–416. [CrossRef]
7. Nosratabadi, S.; Mosavi, A.; Shamshirband, S.; Kazimieras Zavadskas, E.; Rakotonirainy, A.; Chau, K.W. Sustainable Business Models: A Review. *Sustainability* **2019**, *11*, 1663. [CrossRef]
8. Geissdoerfer, M.; Morioka, S.N.; De Carvalho, M.M.; Evans, S. Business models and supply chains for the circular economy. *J. Clean. Prod.* **2018**, *190*, 712–721. [CrossRef]
9. Schroeder, P.; Anggraeni, K.; Weber, U. The Relevance of Circular Economy Practices to the Sustainable Development Goals. *J. Ind. Ecol.* **2019**, *23*, 77–95. [CrossRef]
10. Nußholz, J. Circular Business Models: Defining a Concept and Framing an Emerging Research Field. *Sustainability* **2017**, *9*, 1810. [CrossRef]
11. Hopkinson, P.; De Angelis, R.; Zils, M. Systemic building blocks for creating and capturing value from circular economy. *Res. Conserv. Rec.* **2020**, *155*, 104672. [CrossRef]
12. Bocken, N.M.; Harsch, A.; Weissbrod, I. Circular business models for the fastmoving consumer goods industry: Desirability, feasibility, and viability. *Sustain. Prod. Consum.* **2022**, *30*, 799–814. [CrossRef]
13. Cantú, A.; Aguiñaga, E.; Scheel, C. Learning from Failure and Success: The Challenges for Circular Economy Implementation in SMEs in an Emerging Economy. *Sustainability* **2021**, *13*, 1529. [CrossRef]
14. Pieroni, M.P.; McAloone, T.C.; Pigosso, D.C. Business model innovation for circular economy and sustainability: A review of approaches. *J. Clean. Prod.* **2019**, *215*, 198–216. [CrossRef]
15. Bocken, N.; Strupeit, L.; Whalen, K.; Nußholz, J. A Review and Evaluation of Circular Business Model Innovation Tools. *Sustainability* **2019**, *11*, 2210. [CrossRef]
16. Geissdoerfer, M.; Pieroni, M.P.; Pigosso, D.C.; Soufani, K. Circular business models: A review. *J. Clean. Prod.* **2020**, *277*, 123741. [CrossRef]
17. Suchek, N.; Fernandes, C.I.; Kraus, S.; Filser, M.; Sjögrén, H. Innovation and the circular economy: A systematic literature review. *Bus. Strat. Environ.* **2021**, *30*, 3686–3702. [CrossRef]
18. Loon, P.; van Wassenhove, L.N.; Mihelic, A. Designing a circular business strategy: 7 years of evolution at a large washing machine manufacturer. *Bus. Strat. Environ.* **2022**, *31*, 1030–1041. [CrossRef]
19. Huynh, P.H. Enabling circular business models in the fashion industry: The role of digital innovation. *Int. J. Product. Perform. Manag.* **2022**, *71*, 870–895. [CrossRef]
20. Sehnem, S.; Queiroz, A.A.F.S.L.; Pereira, S.C.F.; Santos Correia, G.; Kuzma, E. Circular economy and innovation: A look from the perspective of organizational capabilities. *Bus. Strat. Environ.* **2022**, *31*, 236–250. [CrossRef]
21. Scheel, C.; Bello, B. Transforming Linear Production Chains into Circular Value Extended Systems. *Sustainability* **2022**, *14*, 3726. [CrossRef]
22. Awan, U.; Sroufe, R. Sustainability in the Circular Economy: Insights and Dynamics of Designing Circular Business Models. *Appl. Sci.* **2022**, *12*, 1521. [CrossRef]
23. Bocken, N.; Ritala, P. Six ways to build circular business models. *J. Bus. Strateg.* **2022**, *43*, 184–192. [CrossRef]
24. Antikainen, M.; Valkokari, K. A Framework for Sustainable Circular Business Model Innovation. *Technol. Innov. Manag. Rev.* **2016**, *6*, 5–12. [CrossRef]
25. Da Fernandes, S.C.; Pigosso, D.C.; McAloone, T.C.; Rozenfeld, H. Towards product-service system oriented to circular economy: A systematic review of value proposition design approaches. *J. Clean. Prod.* **2020**, *257*, 120507. [CrossRef]
26. Schulte, U.G. New business models for a radical change in resource efficiency. *Environ. Innov. Soc. Trans.* **2013**, *9*, 43–47. [CrossRef]
27. Konietzko, J.; Bocken, N.; Hultink, E.J. Circular ecosystem innovation: An initial set of principles. *J. Clean. Prod.* **2020**, *253*, 119942. [CrossRef]
28. Bianchini, A.; Rossi, J.; Pellegrini, M. Overcoming the Main Barriers of Circular Economy Implementation through a New Visualization Tool for Circular Business Models. *Sustainability* **2019**, *11*, 6614. [CrossRef]
29. Hofmann, F. Circular business models: Business approach as driver or obstructer of sustainability transitions? *J. Clean. Prod.* **2019**, *224*, 361–374. [CrossRef]
30. Tura, N.; Hanski, J.; Ahola, T.; Ståhle, M.; Piiparinen, S.; Valkokari, P. Unlocking circular business: A framework of barriers and drivers. *J. Clean. Prod.* **2019**, *212*, 90–98. [CrossRef]

31. Guldmann, E.; Huulgaard, R.D. Barriers to circular business model innovation: A multiple-case study. *J. Clean. Prod.* **2020**, *243*, 118160. [CrossRef]
32. Hina, M.; Chauhan, C.; Kaur, P.; Kraus, S.; Dhir, A. Drivers and barriers of circular economy business models: Where we are now, and where we are heading. *J. Clean. Prod.* **2022**, *333*, 130049. [CrossRef]
33. Aloini, D.; Dulmin, R.; Mininno, V.; Stefanini, A.; Zerbino, P. Driving the Transition to a Circular Economic Model: A Systematic Review on Drivers and Critical Success Factors in Circular Economy. *Sustainability* **2020**, *12*, 10672. [CrossRef]
34. Julianelli, V.; Caiado, R.G.G.; Scavarda, L.F.; Cruz, S.P.d.M.F. Interplay between reverse logistics and circular economy: Critical success factors-based taxonomy and framework. *Res. Conserv. Rec.* **2020**, *158*, 104784. [CrossRef]
35. Salmenperä, H.; Pitkänen, K.; Kautto, P.; Saikku, L. Critical factors for enhancing the circular economy in waste management. *J. Clean. Prod.* **2021**, *280*, 124339. [CrossRef]
36. Moktadir, M.A.; Kumar, A.; Ali, S.M.; Paul, S.K.; Sultana, R.; Rezaei, J. Critical success factors for a circular economy: Implications for business strategy and the environment. *Bus. Strat. Environ.* **2020**, *29*, 3611–3635. [CrossRef]
37. Donner, M.; Verniquet, A.; Broeze, J.; Kayser, K.; De Vries, H. Critical success and risk factors for circular business models valorising agricultural waste and by-products. *Res. Conserv. Rec.* **2021**, *165*, 105236. [CrossRef]
38. Wuni, I.Y.; Shen, G.Q. Developing critical success factors for integrating circular economy into modular construction projects in Hong Kong. *Sustain. Prod. Consum.* **2022**, *29*, 574–587. [CrossRef]
39. Torres-Guevara, L.E.; Prieto-Sandoval, V.; Mejia-Villa, A. Success Drivers for Implementing Circular Economy: A Case Study from the Building Sector in Colombia. *Sustainability* **2021**, *13*, 1350. [CrossRef]
40. Sohal, A.; De Vass, T. Australian SME's experience in transitioning to circular economy. *J. Bus. Res.* **2022**, *142*, 594–604. [CrossRef]
41. Kumar, A.; Choudhary, S.; Garza-Reyes, J.A.; Kumar, V.; Rehman Khan, S.A.; Mishra, N. Analysis of critical success factors for implementing Industry 4.0 integrated circular supply chain—Moving towards sustainable operations. *Prod. Plan. Control* **2021**, 1–15. [CrossRef]
42. Sehnem, S.; Chiappetta Jabbour, C.J.; Farias Pereira, S.C.; De Sousa Jabbour, A.B.L. Improving sustainable supply chains performance through operational excellence: Circular economy approach. *Res. Conserv. Rec.* **2019**, *149*, 236–248. [CrossRef]
43. Khan, S.; Maqbool, A.; Haleem, A.; Khan, M.I. Analyzing critical success factors for a successful transition towards circular economy through DANP approach. *Manag. Environ. Qual.* **2020**, *31*, 505–529. [CrossRef]
44. Lahane, S.; Kant, R.; Shankar, R. Circular supply chain management: A state-of-art review and future opportunities. *J. Clean. Prod.* **2020**, *258*, 120859. [CrossRef]
45. Goyal, S.; Garg, D.; Luthra, S. Analyzing critical success factors to adopt sustainable consumption and production linked with circular economy. *Environ. Dev. Sustain.* **2021**, *24*, 5195–5224. [CrossRef]
46. UN General Assembly. *Transforming our World: The 2030 Agenda for Sustainable Development*; UN General Assembly: New York, NY, USA, 2015.
47. Kayikci, Y.; Kazancoglu, Y.; Lafci, C.; Gozacan-Chase, N.; Mangla, S.K. Smart circular supply chains to achieving SDGs for post-pandemic preparedness. *J. Enterp. Inf. Manag.* **2022**, *35*, 237–265. [CrossRef]
48. Pla-Julián, I.; Guevara, S. Is circular economy the key to transitioning towards sustainable development? Challenges from the perspective of care ethics. *Futures* **2019**, *105*, 67–77. [CrossRef]
49. Romero-Perdomo, F.; Carvajalino-Umaña, J.D.; Moreno-Gallego, J.L.; Ardila, N.; González-Curbelo, M.Á. Research Trends on Climate Change and Circular Economy from a Knowledge Mapping Perspective. *Sustainability* **2022**, *14*, 521. [CrossRef]
50. Dantas, T.; de-Souza, E.D.; Destro, I.R.; Hammes, G.; Rodriguez, C.; Soares, S.R. How the combination of Circular Economy and Industry 4.0 can contribute towards achieving the Sustainable Development Goals. *Sustain. Prod. Consum.* **2021**, *26*, 213–227. [CrossRef]
51. Del Pérez-Peña, M.C.; Jiménez-García, M.; Ruiz-Chico, J.; Peña-Sánchez, A.R. Analysis of Research on the SDGs: The Relationship between Climate Change, Poverty and Inequality. *Appl. Sci.* **2021**, *11*, 8947. [CrossRef]
52. Morales, M.E.; Batlles-delaFuente, A.; Cortés-García, F.J.; Belmonte-Ureña, L.J. Theoretical Research on Circular Economy and Sustainability Trade-Offs and Synergies. *Sustainability* **2021**, *13*, 11636. [CrossRef]
53. Fatimah, Y.A.; Govindan, K.; Murniningsih, R.; Setiawan, A. Industry 4.0 based sustainable circular economy approach for smart waste management system to achieve sustainable development goals: A case study of Indonesia. *J. Clean. Prod.* **2020**, *269*, 122263. [CrossRef]
54. Mina, H.; Kannan, D.; Gholami-Zanjani, S.M.; Biuki, M. Transition towards circular supplier selection in petrochemical industry: A hybrid approach to achieve sustainable development goals. *J. Clean. Prod.* **2021**, *286*, 125273. [CrossRef]
55. Panchal, R.; Singh, A.; Diwan, H. Does circular economy performance lead to sustainable development?—A systematic literature review. *J. Environ. Manag.* **2021**, *293*, 112811. [CrossRef] [PubMed]
56. Patyal, V.S.; Sarma, P.; Modgil, S.; Nag, T.; Dennehy, D. Mapping the links between Industry 4.0, circular economy and sustainability: A systematic literature review. *J. Enterp. Inf. Manag.* **2022**, *35*, 1–35. [CrossRef]
57. Rodriguez-Anton, J.M.; Rubio-Andrada, L.; Celemín-Pedroche, M.S.; Alonso-Almeida, M.D.M. Analysis of the relations between circular economy and sustainable development goals. *Int. J. Sustain. Dev. World Ecol.* **2019**, *26*, 708–720. [CrossRef]
58. Morales, M.E.; Belmonte-Urena, L.J. Theoretical research on circular economy and sustainability trade-offs and synergies: A bibliometric analysis. In Proceedings of the 2021 IEEE International Conference on Technology and Entrepreneurship (ICTE), Kaunas, Lithuania, 24–27 August 2021; pp. 1–6, ISBN 978-1-6654-3895-7.

59. Awan, U. Industrial Ecology in Support of Sustainable Development Goals. In *Responsible Consumption and Production*; Leal Filho, W., Azul, A.M., Brandli, L., Özuyar, P.G., Wall, T., Eds.; Springer International Publishing: Cham, Switzerland, 2019; pp. 1–12, ISBN 978-3-319-71062-4.
60. Boons, F.; Lüdeke-Freund, F. Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. *J. Clean. Prod.* **2013**, *45*, 9–19. [CrossRef]
61. Antikainen, M.; Aminoff, A.; Kettunen, O.; Sundqvist-Andberg, H.; Paloheimo, H. Circular Economy Business Model Innovation Process—Case Study. In *Sustainable Design and Manufacturing 2017*; Campana, G., Howlett, R.J., Setchi, R., Cimatti, B., Eds.; Springer International Publishing: Cham, Switzerland, 2017; pp. 546–555. ISBN 978-3-319-57077-8.
62. Sopelana, A.; Auriault, C.; Bansal, A.; Fifer, K.; Paiva, H.; Maurice, C.; Westin, G.; Rios, J.; Oleaga, A.; Cañas, A. Innovative Circular Economy Models for the European Pulp and Paper Industry: A Reference Framework for a Resource Recovery Scenario. *Sustainability* **2021**, *13*, 10285. [CrossRef]
63. Santa-Maria, T.; Vermeulen, W.J.; Baumgartner, R.J. Framing and assessing the emergent field of business model innovation for the circular economy: A combined literature review and multiple case study approach. *Sustain. Prod. Consum.* **2021**, *26*, 872–891. [CrossRef]
64. Bigliardi, B.; Filippelli, S. Investigating Circular Business Model Innovation through Keywords Analysis. *Sustainability* **2021**, *13*, 5036. [CrossRef]
65. Aldieri, L.; Brahmi, M.; Bruno, B.; Vinci, C.P. Circular Economy Business Models: The Complementarities with Sharing Economy and Eco-Innovations Investments. *Sustainability* **2021**, *13*, 12438. [CrossRef]
66. Sandberg, E.; Hultberg, E. Dynamic capabilities for the scaling of circular business model initiatives in the fashion industry. *J. Clean. Prod.* **2021**, *320*, 128831. [CrossRef]
67. Munaro, M.R.; Freitas, M.d.C.D.; Tavares, S.F.; Bragança, L. Circular Business Models: Current State and Framework to Achieve Sustainable Buildings. *J. Constr. Eng. Manag.* **2021**, *147*, 4021164. [CrossRef]
68. Linder, M.; Williander, M. Circular Business Model Innovation: Inherent Uncertainties. *Bus. Strat. Environ.* **2017**, *26*, 182–196. [CrossRef]
69. Barreiro-Gen, M.; Lozano, R. How circular is the circular economy? Analysing the implementation of circular economy in organisations. *Bus. Strat. Environ.* **2020**, *29*, 3484–3494. [CrossRef]
70. Garmulewicz, A.; Holweg, M.; Veldhuis, H.; Yang, A. Disruptive Technology as an Enabler of the Circular Economy: What Potential Does 3D Printing Hold? *Calif. Manag. Rev.* **2018**, *60*, 112–132. [CrossRef]
71. Tiwari, D.; Miscandlon, J.; Tiwari, A.; Jewell, G.W. A Review of Circular Economy Research for Electric Motors and the Role of Industry 4.0 Technologies. *Sustainability* **2021**, *13*, 9668. [CrossRef]
72. Miles, M.B.; Huberman, A.M.; Saldaña, J. *Qualitative Data Analysis: A Methods Sourcebook*; Sage: Los Angeles, CA, USA; London, UK; New Delhi, India; Singapore; Washington, DC, USA, 2014; ISBN 978-1452257877.
73. Eisenhardt, K.M.; Graebner, M.E. Theory Building from Cases: Opportunities and Challenges. *Acad. Manag. J.* **2007**, *50*, 25–32. [CrossRef]
74. Cannell, C.F.; Kahn, R.L. Interviewing. In *The Handbook of Social Psychology*; Addison Wesley: San Francisco, CA, USA, 1968; pp. 526–595.
75. Yin, R.K. *Case Study Research: Design and Methods*; Sage: Los Angeles, CA, USA; London, UK; New Delhi, India; Singapore; Washington, DC, USA, 2013; ISBN 978-1452242569.
76. Geissdoerfer, M.; Bocken, N.M.; Hultink, E.J. Design thinking to enhance the sustainable business modelling process—A workshop based on a value mapping process. *J. Clean. Prod.* **2016**, *135*, 1218–1232. [CrossRef]
77. Wastling, T.; Charnley, F.; Moreno, M. Design for Circular Behaviour: Considering Users in a Circular Economy. *Sustainability* **2018**, *10*, 1743. [CrossRef]
78. Hofmann, F.; Jaeger-Erben, M. Organizational transition management of circular business model innovations. *Bus. Strat Environ.* **2020**, *29*, 2770–2788. [CrossRef]
79. Lauten-Weiss, J.; Ramesohl, S. The Circular Business Framework for Building, Developing and Steering Businesses in the Circular Economy. *Sustainability* **2021**, *13*, 963. [CrossRef]
80. Gibbert, M.; Ruigrok, W.; Wicki, B. What passes as a rigorous case study? *Strat. Manag. J.* **2008**, *29*, 1465–1474. [CrossRef]
81. Korsunova, A.; Horn, S.; Vainio, A. Understanding circular economy in everyday life: Perceptions of young adults in the Finnish context. *Sustain. Prod. Consum.* **2021**, *26*, 759–769. [CrossRef]
82. Salvioni, D.M.; Almici, A. Transitioning Toward a Circular Economy: The Impact of Stakeholder Engagement on Sustainability Culture. *Sustainability* **2020**, *12*, 8641. [CrossRef]
83. Müller, J.M. Business model innovation in small- and medium-sized enterprises. *J. Manuf. Technol. Manag.* **2019**, *30*, 1127–1142. [CrossRef]
84. Ehrtmann, M.; Holstenkamp, L.; Becker, T. Regional Electricity Models for Community Energy in Germany: The Role of Governance Structures. *Sustainability* **2021**, *13*, 2241. [CrossRef]
85. Sayrs, L. InterViews: An Introduction to Qualitative Research Interviewing Steinar Kvale. Thousand Oaks, CA: Sage, 1996. 326 pp. *Am. J. Eval.* **1998**, *19*, 267–270. [CrossRef]
86. Riege, A.M. Validity and reliability tests in case study research: A literature review with "hands-on" applications for each research phase. *Qual. Mark. Res. Int. J.* **2003**, *6*, 75–86. [CrossRef]

87. Mayring, P.; Fenzl, T. Qualitative Inhaltsanalyse. In *Handbuch Methoden der Empirischen Sozialforschung*; Baur, N., Blasius, J., Eds.; Springer Fachmedien Wiesbaden: Wiesbaden, Germany, 2014; pp. 543–556. ISBN 978-3-531-17809-7.
88. Flick, U. *The SAGE Handbook of Qualitative Data Analysis*; Sage Publications Ltd.: London, UK, 2014; ISBN 9781446208984.
89. Bierwisch, A.; Huter, L.; Pattermann, J.; Som, O. Taking Eco-Innovation to the Road—A Design-Based Workshop Concept for the Development of Eco-Innovative Business Models. *Sustainability* **2021**, *13*, 8811. [CrossRef]
90. Pollard, J.; Osmani, M.; Cole, C.; Grubnic, S.; Colwill, J. A circular economy business model innovation process for the electrical and electronic equipment sector. *J. Clean. Prod.* **2021**, *305*, 127211. [CrossRef]
91. Blomsma, F.; Pieroni, M.; Kravchenko, M.; Pigosso, D.C.; Hildenbrand, J.; Kristinsdottir, A.R.; Kristoffersen, E.; Shahbazi, S.; Nielsen, K.D.; Jönbrink, A.-K.; et al. Developing a circular strategies framework for manufacturing companies to support circular economy-oriented innovation. *J. Clean. Prod.* **2019**, *241*, 118271. [CrossRef]
92. Moreno, M.; De Los Rios, C.; Rowe, Z.; Charnley, F. A Conceptual Framework for Circular Design. *Sustainability* **2016**, *8*, 937. [CrossRef]
93. Hapuwatte, B.M.; Jawahir, I.S. Closed-loop sustainable product design for circular economy. *J. Ind. Ecol.* **2021**, *25*, 1430–1446. [CrossRef]
94. Sauerwein, M.; Doubrovski, E.; Balkenende, R.; Bakker, C. Exploring the potential of additive manufacturing for product design in a circular economy. *J. Clean. Prod.* **2019**, *226*, 1138–1149. [CrossRef]
95. Agrawal, R.; Wankhede, V.A.; Kumar, A.; Luthra, S.; Huisingh, D. Progress and trends in integrating Industry 4.0 within Circular Economy: A comprehensive literature review and future research propositions. *Bus. Strat. Environ.* **2022**, *31*, 559–579. [CrossRef]
96. Chauhan, C.; Parida, V.; Dhir, A. Linking circular economy and digitalisation technologies: A systematic literature review of past achievements and future promises. *Technol. Forecast. Soc. Change* **2022**, *177*, 121508. [CrossRef]
97. Langley, D.J. Digital Product-Service Systems: The Role of Data in the Transition to Servitization Business Models. *Sustainability* **2022**, *14*, 1303. [CrossRef]
98. Pieroni, M.P.P.; McAloone, T.C.; Pigosso, D.C.A. Configuring New Business Models for Circular Economy through Product–Service Systems. *Sustainability* **2019**, *11*, 3727. [CrossRef]
99. Hernandez, R.J. Sustainable Product-Service Systems and Circular Economies. *Sustainability* **2019**, *11*, 5383. [CrossRef]
100. Yang, M.; Smart, P.; Kumar, M.; Jolly, M.; Evans, S. Product-service systems business models for circular supply chains. *Prod. Plan. Control* **2018**, *29*, 498–508. [CrossRef]
101. Kuo, T.C.; Ma, H.-Y.; Huang, S.H.; Hu, A.H.; Huang, C.S. Barrier analysis for product service system using interpretive structural model. *Int. J. Adv. Manuf. Technol.* **2010**, *49*, 407–417. [CrossRef]
102. Werning, J.P.; Spinler, S. Transition to circular economy on firm level: Barrier identification and prioritization along the value chain. *J. Clean. Prod.* **2020**, *245*, 118609. [CrossRef]
103. Sumter, D.; De Koning, J.; Bakker, C.; Balkenende, R. Key Competencies for Design in a Circular Economy: Exploring Gaps in Design Knowledge and Skills for a Circular Economy. *Sustainability* **2021**, *13*, 776. [CrossRef]
104. Zhang, B.; Comite, U.; Yucel, A.G.; Liu, X.; Khan, M.A.; Husain, S.; Sial, M.S.; Popp, J.; Oláh, J. Unleashing the Importance of TQM and Knowledge Management for Organizational Sustainability in the Age of Circular Economy. *Sustainability* **2021**, *13*, 11514. [CrossRef]
105. Rossi, E.; Bertassini, A.C.; Ferreira, C.d.S.; Neves do Amaral, W.A.; Ometto, A.R. Circular economy indicators for organizations considering sustainability and business models: Plastic, textile and electro-electronic cases. *J. Clean. Prod.* **2020**, *247*, 119137. [CrossRef]
106. Rizos, V.; Bryhn, J. Implementation of circular economy approaches in the electrical and electronic equipment (EEE) sector: Barriers, enablers and policy insights. *J. Clean. Prod.* **2022**, *338*, 130617. [CrossRef]
107. Dagilienė, L.; Varaniūtė, V.; Bruneckienė, J. Local governments' perspective on implementing the circular economy: A framework for future solutions. *J. Clean. Prod.* **2021**, *310*, 127340. [CrossRef]
108. Palm, J.; Bocken, N. Achieving the Circular Economy: Exploring the Role of Local Governments, Business and Citizens in an Urban Context. *Energies* **2021**, *14*, 875. [CrossRef]
109. van Buren, N.; Demmers, M.; van der Heijden, R.; Witlox, F. Towards a Circular Economy: The Role of Dutch Logistics Industries and Governments. *Sustainability* **2016**, *8*, 647. [CrossRef]
110. ten Wolde, A. Briefing: Governments as drivers for a circular economy. *Proc. Inst. Civil. Eng. Waste Res. Manag.* **2016**, *169*, 149–150. [CrossRef]
111. Salvador, R.; Barros, M.V.; Freire, F.; Halog, A.; Piekarski, C.M.; de Francisco, A.C. Circular economy strategies on business modelling: Identifying the greatest influences. *J. Clean. Prod.* **2021**, *299*, 126918. [CrossRef]
112. Van Boerdonk, P.; Krikke, H.R.; Lambrechts, W. New business models in circular economy: A multiple case study into touch points creating customer values in health care. *J. Clean. Prod.* **2021**, *282*, 125375. [CrossRef]
113. Boyer, R.H.W.; Hunka, A.D.; Whalen, K.A. Consumer Demand for Circular Products: Identifying Customer Segments in the Circular Economy. *Sustainability* **2021**, *13*, 12348. [CrossRef]
114. Mostaghel, R.; Chirumalla, K. Role of customers in circular business models. *J. Bus. Res.* **2021**, *127*, 35–44. [CrossRef]
115. Chirumalla, K.; Reyes, L.G.; Toorajipour, R. Mapping a circular business opportunity in electric vehicle battery value chain: A multi-stakeholder framework to create a win–win–win situation. *J. Bus. Res.* **2022**, *145*, 569–582. [CrossRef]

116. Gamidullaeva, L.; Shmeleva, N.; Tolstykh, T.; Shmatko, A. An Assessment Approach to Circular Business Models within an Industrial Ecosystem for Sustainable Territorial Development. *Sustainability* **2022**, *14*, 704. [CrossRef]
117. Kanda, W.; Geissdoerfer, M.; Hjelm, O. From circular business models to circular business ecosystems. *Bus. Strat. Environ.* **2021**, *30*, 2814–2829. [CrossRef]
118. Münch, C.; Marx, E.; Benz, L.; Hartmann, E.; Matzner, M. Capabilities of digital servitization: Evidence from the socio-technical systems theory. *Technol. Forecast. Soc. Change* **2022**, *176*, 121361. [CrossRef]
119. Sharma, H.B.; Vanapalli, K.R.; Samal, B.; Cheela, V.R.S.; Dubey, B.K.; Bhattacharya, J. Circular economy approach in solid waste management system to achieve UN-SDGs: Solutions for post-COVID recovery. *Sci. Total Environ.* **2021**, *800*, 149605. [CrossRef]
120. Tolstykh, T.; Shmeleva, N.; Gamidullaeva, L. Evaluation of Circular and Integration Potentials of Innovation Ecosystems for Industrial Sustainability. *Sustainability* **2020**, *12*, 4574. [CrossRef]
121. Bertassini, A.C.; Zanon, L.G.; Azarias, J.G.; Gerolamo, M.C.; Ometto, A.R. Circular Business Ecosystem Innovation: A guide for mapping stakeholders, capturing values, and finding new opportunities. *Sustain. Prod. Consum.* **2021**, *27*, 436–448. [CrossRef]
122. European Commission. Closing the Loop—An. EU Action Plan for Circular Economy. European Comission. 2015. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614 (accessed on 2 March 2022).
123. Rodríguez-Antón, J.M.; Rubio-Andrada, L.; Celemín-Pedroche, M.S.; Ruíz-Peñalver, S.M. From the circular economy to the sustainable development goals in the European Union: An empirical comparison. *Int. Environ. Agreem.* **2021**, *22*, 67–95. [CrossRef] [PubMed]