

# A review of entrepreneurship and circular economy research: State of the art and future directions

Nathalia Suchek<sup>1</sup>  | João J. Ferreira<sup>1</sup>  | Paula O. Fernandes<sup>2</sup> 

<sup>1</sup>Department of Management and Economics & NECE Research Unit in Business Sciences, University of Beira Interior, Covilhã, Portugal

<sup>2</sup>UNIAG & Polytechnic Institute of Bragança, Bragança, Portugal

## Correspondence

João J. Ferreira, Universidade da Beira Interior & NECE - Research Unit in Business Science, Estrada do Sineiro, 6200-209 Covilhã, Portugal.

Email: [jjmf@ubi.pt](mailto:jjmf@ubi.pt)

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## Abstract

The circular economy (CE) emerged as an alternative model to the linear system to foster sustainable development. Entrepreneurship represents a key factor in capturing new circular business opportunities. Research on circular entrepreneurship remains at an early phase and is correspondingly somewhat dispersed. Thus, the research objective here is to bring entrepreneurship into the focus of discussions on CE through a systematic literature review. In the absence of any systematic review on this theme, this work aims to map the relevant research and identify the themes discussed in the literature straddling entrepreneurship and the CE currently dispersed across the existing literature. Based on a sample of 102 articles collected from the Scopus and Web of Science databases, this approach identified four thematic groups: growing circular SMEs, born circular firms and start-ups, social entrepreneurship in CE, and support ecosystem for circular entrepreneurship. A greater emphasis on the study of growing circular SMEs to the detriment of other groups is observed. Also, research in the field is mainly focused on European countries. We then propose a future research agenda and a conceptual model for the entrepreneurial process in CE as a point of departure for further developing and deepening the literature on circular entrepreneurship.

## KEY WORDS

circular economy, entrepreneurship, sustainability, systematic review

## 1 | INTRODUCTION

The concept of sustainable development arose from the discussions following the publication of the Brundtland report in 1987. This defined the concept as development that considers the present without compromising the capacity of future generations to meet their own needs (Brundtland, 1987). Henceforth, a series of sustainable

development based initiatives have taken place. The most recent involved the definition of the 17 Sustainable Development Goals (SDGs) for Agenda 2030, based on balancing the three dimensions to sustainable development: economic, social, and environmental (United Nations, 2015).

Within the sustainability paradigm, the circular economy (CE) holds an important and relevant role (Geissdoerfer et al., 2017) and represents an alternative to the linear economic system based on "take-make-dispose" characterised by the primacy attributed to economic objectives with only very low relevance awarded to ecological and social concerns (Sauvé et al., 2016). The CE holds the objective of maintaining products, components, and materials at the highest level of utility and value over time through slowing, closing, and narrowing production cycles (Bocken et al., 2016). The CE enables the

**Abbreviations:** CBM, circular business model; CE, circular economy; CSR, corporate social responsibility; EMM, environmental management maturity; MCDM, multicriterion decision-making; PEERD, public environmental and energy research and development; RCC, resources, competences and capabilities; SCRM, supply chain relationship management; SDG, sustainable development goals; SME, small and medium sized enterprises; SSCD, sustainable supply chain design; TPB, theory of planned behaviour; WEEE, waste from electrical and electronic equipment; WEFW, water, energy, food and waste; WMC, wood-frame multistorey construction; WoS, web of science.

establishment of a basis for conciliating the problem of enhancing productivity while considering the externalities to production processes, the consumption of products and the impacts of the end of their useful lifespan. Therefore, the CE becomes a means by which companies may operationally implement sustainable development (Geissdoerfer et al., 2017; Sauvé et al., 2016).

The transition to a CE means a systemic change that aims to reduce the impacts of the linear economy and construct long-term resilience and establish economic and business opportunities in addition to returning environmental and social benefits (Ellen MacArthur Foundation, 2015). In CE, one of the main goals is to transform waste into a resource. In this sense, waste management emerges as a relevant CE subsector (Merli et al., 2018). New smart technologies are required to promote efficient waste management as a basis for CE (Dantas et al., 2021).

Hence, the CE represents an economic system that encapsulates a change in paradigm in the ways that human society interrelates with nature within the scope of preventing the depletion of resources, closing energy and material cycles, and facilitating sustainable development through implementation across the micro (companies and consumers), meso (economic actors acting through symbiotic integration) and macro (cities, regions, governments) levels (Prieto-Sandoval, Jaca, & Ormazabal, 2018). From a micro perspective, companies are crucial to any transition to a CE in keeping with how they hold the responsibility and implement innovative strategies to plan for waste, reutilising materials and products, and influencing consumer awareness and demand for green products (Veleva & Bodkin, 2018).

Research within CE scope has received increasing attention from scholars, as evidenced by reviews addressing different perspectives in recent years. These reviews comprise studies analysing CE and issues as CE concept (Homrich et al., 2018; Kirchherr et al., 2017; Prieto-Sandoval, Jaca, & Ormazabal, 2018), business models (Centobelli et al., 2021; Hina et al., 2021; Pieroni et al., 2019a), innovation (de Jesus et al., 2019; de Jesus & Mendonça, 2018; Suchek et al., 2021), industry 4.0 (Agrawal et al., 2021; Awan et al., 2021; Dantas et al., 2021; Rosa et al., 2020), supply chains (MahmoumGonbadi et al., 2021; Masi et al., 2017), and others. However, Hofstetter et al. (2021) noted that CE research is still fragmented, and a particular challenge in researching CE from a business or economic perspective is that circular economies are largely nonexistent, although there are examples of regional industrial symbiosis or internal company configurations. Thus, issues such as the complex articulation of global value chains, the dominant linear logic that continues to display institutional capture, and the inclusion of the Global South in North-dominated circular economies are issues that require scholars' attention to achieve an accurate circular economic model (Hofstetter et al., 2021).

In the literature, the studies on circular business models (CBM) primarily focus on established companies and large corporations due to their high profile and influence over their respective markets (Henry et al., 2020). Despite this, the business models of incumbents and start-ups are different; while the former can influence the

ecosystem in which they are embedded towards CE, can also be less flexible than start-ups in capturing opportunities and developing radical innovations (Suchek et al., 2021).

Entrepreneurs represent individuals with the function of identifying and leveraging new opportunities through staging new combinations, resulting in new products, methods of production, sources of raw materials and markets, as well as new forms of organisations (Schumpeter, 1934). Considering how entrepreneurship derives from the willingness to assume risks when faced with uncertainty, the entrepreneur is the individual that accepts challenges with confidence in their own judgements over committing financial resources that they may end up losing (Knight, 1921). As uncertainties surround environmental questions, they pose major opportunities for entrepreneurial activities. Entrepreneurial actions may offset environmental market failures by discovering, evaluating and exploiting the opportunities encapsulated by these failures to drive the more efficient utilisation of environmental and natural resources and bring about the development of an ecologically sustainable economy (Dean & McMullen, 2007). Furthermore, sustainable entrepreneurs are also capable of advocating changes in the institutional structures that thereby enable the exploitation of sustainable opportunities, improving the competitiveness of sustainable behaviours and paving the way for new entrepreneurial attitudes (Pacheco et al., 2010).

Furthermore, entrepreneurs are also able to foster transformations in the social dimension. Social entrepreneurs target opportunities within the scope of boosting social wealth through establishing new ventures or innovatively managing existing organisations (Zahra et al., 2009). They thus represent a means of overcoming market-based mechanisms for profit-making organisations and promoting the reinvestment of their positive results in the respective communities, groups, and stakeholders (Phillips et al., 2015).

Sustainable entrepreneurship, therefore, interconnects with business, creative processes and wellbeing across the social, economic, and environmental dimensions (Crecente, Sarabia, & Del Val, 2021). However, sustainable entrepreneurs encounter difficulties in bringing about changes in the market on their own account and, to this end, require the support of government and other stakeholders to bring about better mediation, more ambitious political policies, infrastructures and new social norms for nurturing more sustainable lives (Veleva, 2021).

Circular entrepreneurship, in turn, is defined as the process of exploration and exploitation opportunities in the CE domain (Zucchella & Urban, 2019). In this sense, as CE is considered a strategy to achieve sustainability outcomes (Geissdoerfer et al., 2020), circular entrepreneurship is a form of sustainable entrepreneurship. Crecente, Sarabia, and Del Val (2021) argue that circular entrepreneurship is one of the emerging forms of sustainable entrepreneurship that aims to care for and protect people and their environments. According to the authors, entrepreneurship interrelates with other forms of entrepreneurship, especially organic entrepreneurship (focusing on health and well-being), green entrepreneurship (focusing on climate and ecosystems), and blue entrepreneurship (focusing on clean water and marine life).



Circular entrepreneurship can be represented by born-circular companies, consisting of young ventures created to deliver circular value propositions and explore CE opportunities (Zucchella & Urban, 2019). New circular businesses contribute to solutions to environmental problems by creating new environmentally sustainable products, services, and institutions through actions that pose higher risks to incumbents (York & Venkataraman, 2010). Given their newcomer status, such ventures are more credible when they claim to be part of the solution rather than the problems caused by incumbent firms (Hockerts & Wüstenhagen, 2010).

At the same time, circular entrepreneurship can be represented by growing circular enterprises, namely, established companies that are transitioning to less impactful activities and adopting circularity principles (Zucchella & Urban, 2019). In this sense, SMEs can observe business opportunities in CE, such as niche opportunities with customers predisposed to sustainable consumption (Linder & Williander, 2017; Šebestová & Sroka, 2020), increased prestige, reduced costs and financial profitability, restoration of the local environment or the sustainability of the company (Ormazabal et al., 2018; Rizos et al., 2016) and contribute to the transition to CE by opting for CE principles. Importantly, opportunities are observed for entrepreneurial companies with innovative business models to fill the gap and provide critical linkages for corporations in reverse supply chains while creating new business opportunities with social benefits (Veleva & Bodkin, 2018).

While sustainable development focused entrepreneurship has received considerable discussion over the last decade, the literature still requires further development (Filser et al., 2019). The case of CE entrepreneurship is no different, and the study of the role of entrepreneurship in the transition process towards establishing a CE is recent and remains at an early phase (Heshmati, 2017).

Most of the published studies seem to focus on implementing CE by SMEs (Demirel & Danisman, 2019; Linder & Williander, 2017; Rizos et al., 2016; Sawe et al., 2021; Zamfir et al., 2017). For example, Prieto-Sandoval, Ormazabal, et al. (2018) identified the key elements in assessing CE implementation in SMEs, namely, CE fields of action (take, make, distribute, use, and recover), industrial symbiosis and environmental certifications. Some authors have explored the implementation of CE in SMEs in different contexts, such as in Spain (Ormazabal et al., 2016, 2018; Prieto-Sandoval et al., 2019), the United Kingdom (Dey et al., 2020), Italy (Mura et al., 2020), Germany (Schmidt et al., 2021), Austria (Holzer et al., 2021), and India (Sharma et al., 2021). On the other hand, there is a lack of studies about born-circular firms (Cullen & De Angelis, 2021; Henry et al., 2020; Hull et al., 2021; Millette et al., 2020; Rok & Kulik, 2021) and very little is known about designing and implementing CBM from scratch. This may indicate a focus on incremental innovations rather than more radical innovations.

Studies on this issue confirm that entrepreneurs can introduce business models, innovative products and services, explore the opportunities deriving from the CE and resolve issues around the social and environmental spheres (Veleva & Bodkin, 2018). In this perspective, there remains much to be done in entrepreneurship research ranging

from design to scalability. Therefore, this research aims to deploy entrepreneurship at the centre of the CE related discussion through a systematic literature review (SLR). In the absence of any earlier SLR on this theme, this study seeks to map the relevant research on the study of entrepreneurship within a CE framework, currently dispersed across the literature, aiming to answer the following research question: What is the state of the art of entrepreneurship in the CE scope, and what are the future research directions?

Thus, this literature review focused is on mapping the scientific production around entrepreneurship and CE, acting as a starting point to consolidate and develop the research field and guide future research directions.

The results reflect a strand of research that still requires a great deal of development. Analysis of the articles selected enables the identification of four thematic groups: growing circular SMEs, born circular firms and start-ups, social entrepreneurship in CE, and support ecosystem for circular entrepreneurship. The study reveals a greater focus on the study of SMEs to the detriment of the study of companies already born in a CBM, of social entrepreneurs acting in a manner aligned with the CE principles and of the entrepreneurial ecosystem that provides the conditions for the development of the entrepreneurial activity. Suggestions for future studies and a conceptual model for entrepreneurial activity emerge and provide a point of departure for broadening and deepening the literature on CE entrepreneurship. In this sense, our study adds to the field by providing a theoretical background around entrepreneurship in CE. Furthermore, our study presents itself as a reference point for entrepreneurs aiming to implement CBMs and policy-makers who aim to develop the conditions for entrepreneurship in CE.

Below, in Section 2, there is a detailed description of the methodology followed, in Section 3, by a presentation of the results of the SLR, specifically the descriptive profiles of the article sample and the main groups identified in the currently existing literature. Finally, Section 4 sets out the key conclusions and suggestions for future research.

## 2 | METHODS

Intending to systematise the literature, identify research paths and present the emerging aspects interrelating entrepreneurship and the CE, the articles incorporated into this SLR derive from the Scopus and Web of Science (WoS) databases. We used two databases to cover most articles. We have chosen to use WoS and Scopus since they are well-established bibliographic databases (Paul & Criado, 2020). The research in these databases was made in September 2021 using the following: "circular econom\*\*" OR "circularit\*\*" OR "closed-loop\*\*" AND "entrepreneur\*\*" OR "start-up\*\*" OR "startup\*\*" OR "start up\*\*" OR "new venture\*\*" OR "new enterprise\*\*" OR "new business\*\*" OR "new compan\*\*" OR "small enterprise\*\*" OR "small business\*\*" OR "small venture\*\*" OR "small compan\*\*" OR "SME\*\*" within the topics in the case of the WoS and in the titles, abstracts and keywords in the case of Scopus. We followed the recommendation of Kraus et al. (2020) for

entrepreneurship literature reviews, and we have conducted the search via online databases and for journal articles only. In this sense, we aimed to ensure the highest standards of transparency. The filter applied to article selection stipulated only English language articles with no further filter on the research field to identify publications and capture all of the articles of relevance to the research. However, this decision may have held consequences for the number of articles subsequently excluded from the final set of publications following the screening and eligibility phases.

The process of inclusion and exclusion took place according to the Prisma Protocol (Moher et al., 2009). Figure 1 presents the research protocol, which resulted in 102 articles published from 2016 to 2021 in the SLR sample.

We present the descriptive analysis and the main thematic groups identified along with their respective key contributions.

## 3 | RESULTS

### 3.1 | Descriptive data

The articles included within this SLR underwent publication between 2016 and 2021. The trend in their publication features in Figure 2

additionally reflects the rising and recent interest in this theme. The first four articles came out in 2016, and an increase in interest in the topic was noted in 2018. The number of articles published in 2021 is more than double the number of publications two years earlier, in 2019. The evolution of citations per year relates to the WoS database, given that ninety-nine articles of the one hundred and two under study are available in this database. As well as the number of publications per year, the number of citations per year highlights the high interest in the research topic, also reflecting an evolution in the field.

### 3.2 | Thematic groups and key contributions

Qualitative analysis of the articles enabled their classification into four core thematic areas (groups) according to their main objectives: (1) Growing circular SMEs, composed by studies about CE principles adoption by SMEs; (2) born circular firms, composed by studies about firms that were created based in a CBM; (3) social business in the CE, composed by studies regarding the role and characteristics of social entrepreneurs, due their special attention to social outcomes, implementing CE; and (4) Support ecosystem for CE, including interactions with other stakeholders, regional governance and determinants, and technological trends. Besides that, subgroups are identified. The

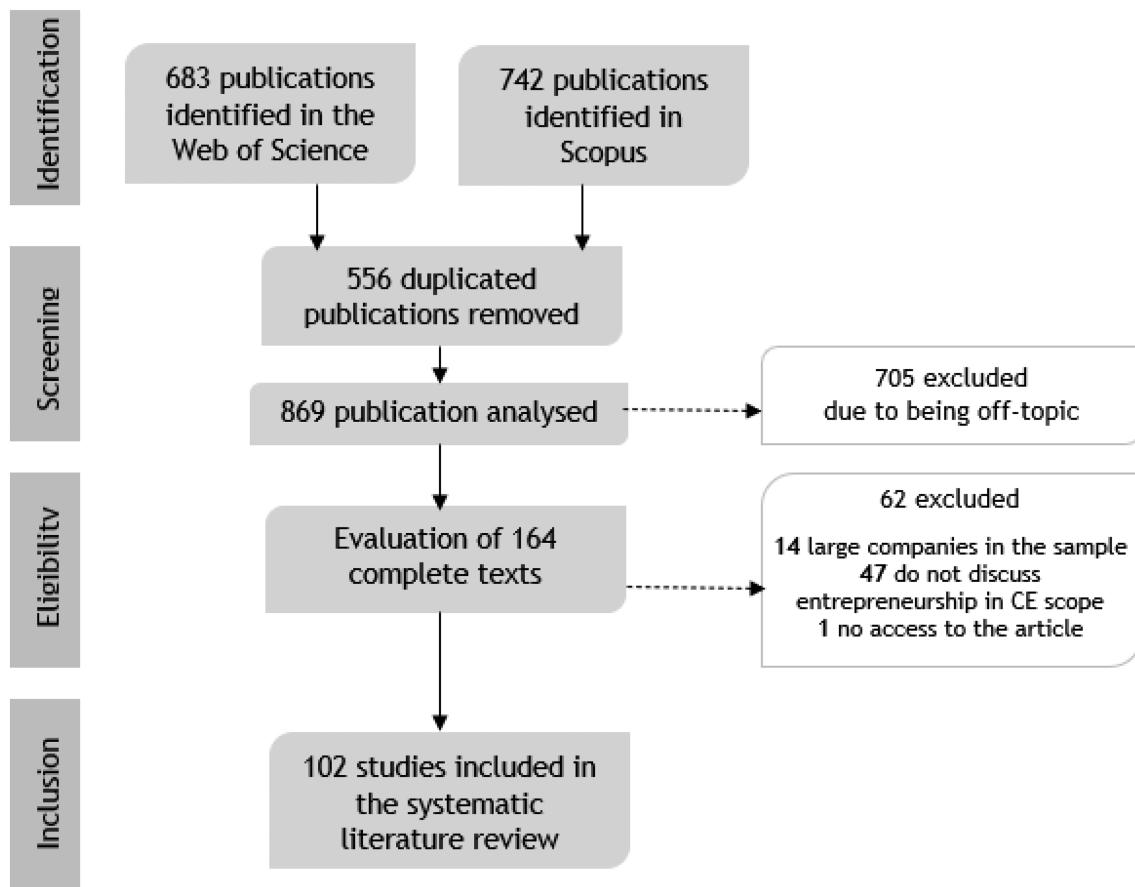


FIGURE 1 Research protocol

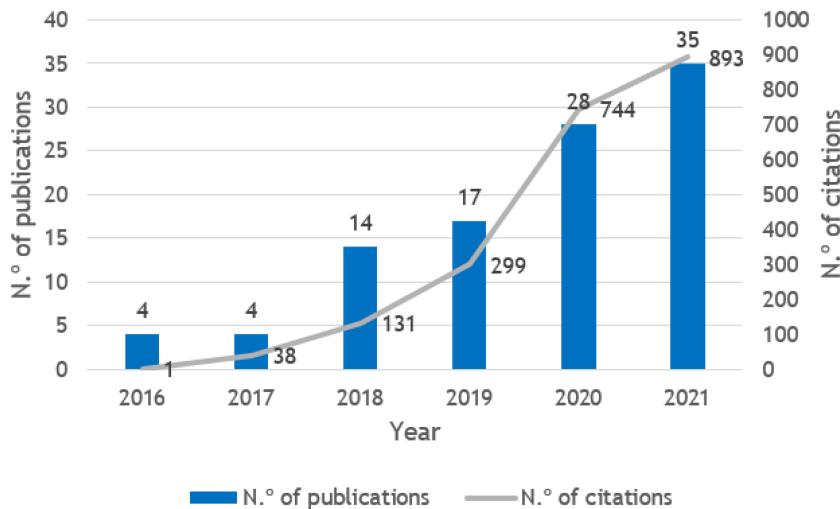


FIGURE 2 Publications and citations trends

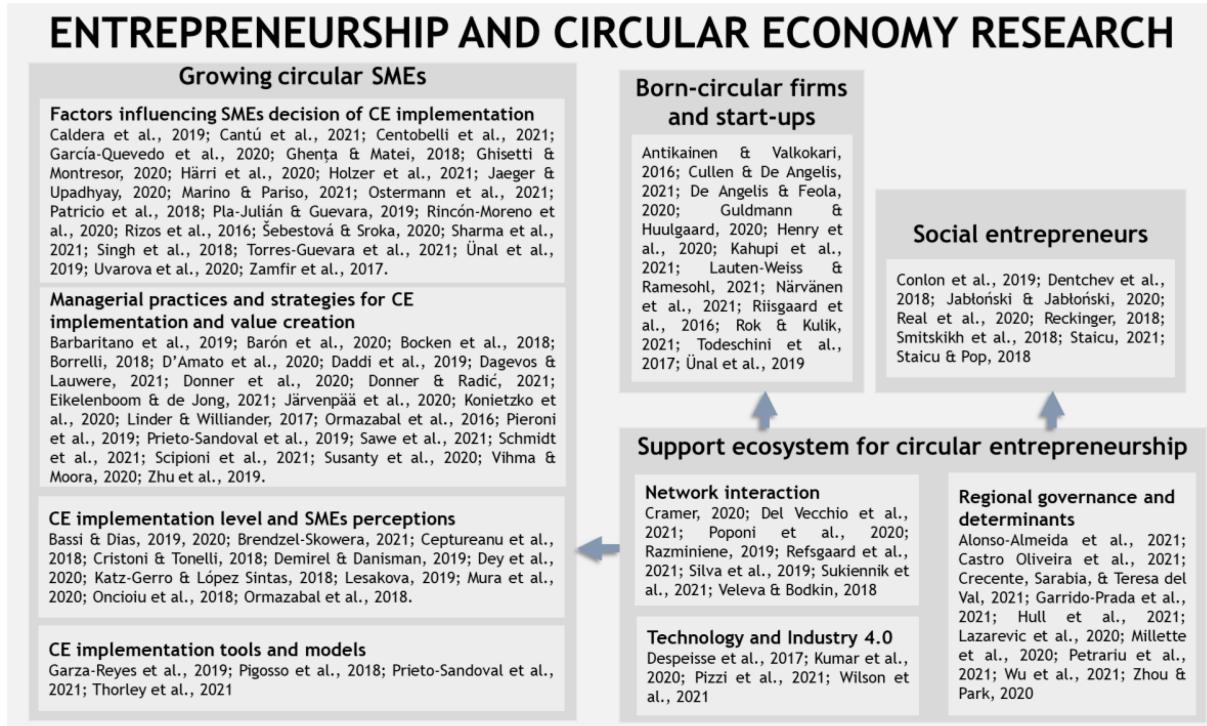


FIGURE 3 Studies included in thematic groups and subgroups

studies' objectives, geographic area and sectors, and methodological approach for each article are presented in Appendix A. Figure 3 shows the articles included in each group and subgroup. We would highlight that many articles contribute to more than one group and exceed the identified groups' scope.

### 3.2.1 | Growing circular SMEs

Most of the articles included in the sample are dedicated to studying the implementation of CE practices in SMEs for a transition towards

more CBMs, in this work referred to as growing circular SMEs. These studies focus on factors influencing CE implementation decisions in SMEs, managerial practices and strategies for CE implementation and value creation, level of CE implementation and SMEs perceptions, and CE implementation tools and models for SMEs.

#### Factors influencing the decision for CE implementation in SMEs

This group is composed of studies that explore the factors influencing SMEs decision to CE implementation, including motivations, obstacles and enablers for these firms. The principal factors can be highlighted from the studies.

In the first place, different motivations are observed for implementing CE. Financial attractiveness and external recognition are benefits targeted by SMEs (Rizos et al., 2016). In the beer and mushroom sectors, the motivations for industrial symbiosis highlight the focus on economic and environmental gains and observed market opportunities (Patrício et al., 2018). Czech entrepreneurs are motivated to implement sustainable solutions mainly when they are involved in export activities or when they are at the beginning of their activities because this is what their customers desire (Šebestová & Sroka, 2020). In the case of a Brazilian born-sustainable in the fashion sector, the search for innovative sustainable practices was noted as the main driver of CE implementation (Ostermann et al., 2021). Holzer et al. (2021) found that the key factors for Austrian SMEs are sustainability, resource efficiency, and differentiation. A gap is noticed between perceived importance and performance when acquiring more efficient resources and processes becomes an opportunity.

Singh et al. (2018) added the environmental commitment and green economic incentives to the Theory of Planned Behaviour (TPB) model to study the CE readiness of Indian SMEs. The results confirm the influence of both the environmental commitment and green economic incentives. Also, attitude is a dominant component influencing the readiness to CE. Social pressure also influences CE readiness, while perceived behaviour control, which represents technological, financial, infrastructure and human barriers, has a negative impact on environmental commitment. Both environmental commitment and green economic incentives influence supply chain relationship management (SCRM) and sustainable supply chain design (SSCD), which in turn are key factors to improving SMEs' CE capabilities (Centobelli et al., 2021).

Both internal and external factors can influence SMEs when implementing CE practices. From an intern perspective, the lack of capital for investments in CE is a barrier observed (Caldera et al., 2019; Rizos et al., 2016). In some cases, it is highlighted the high start-up costs (Jaeger & Upadhyay, 2020) and high costs to implement remanufacturing (Pla-Julián & Guevara, 2019; Sharma et al., 2021). Ghisetti and Montresor (2020) observed that financial-as-usual fundraising patterns enable the implementation of CE practices. Self-finance is the most important source, followed by public financing and debt financing. It also highlights the role of support from policymakers to enable CE implementation.

Administrative burdens are also a challenge observed by SMEs (Rizos et al., 2016). Implementing CE requires time and knowledge, and the studies report the lack of these two factors as barriers observed by SMEs (Caldera et al., 2019; Patrício et al., 2018). The lack of technical skills and information on product design and production are also reported (Jaeger & Upadhyay, 2020).

In this sense, an environmental culture and leadership commitment to implementing CE become fundamental to address these challenges (Rizos et al., 2016; Torres-Guevara et al., 2021). Sharma et al. (2021) noted that strong "management will" is one of the major prerequisites to CE implementation in Indian SMEs. Other prerequisites referred to employee training, motivation, and appropriate guidelines (Sharma et al., 2021).

Ünal, Urbinati, Chiaroni, and Manzini (2019) argue that the contextual factors, both internal (strategic orientation, industrial capabilities, learning and training mechanisms, company size and age) and external (local and cultural settings, regulatory framework, level of market competition) determine the nature of value creation in CBMs by characterising the bundles of managerial practices to be implemented.

In relation to the company's external context, issues related to the supply chain, market, and governmental support are highlighted. Depending on the position in the supply chain, CE opportunities were more or less evident, and the need to think about the relationship with stakeholders had different dimensions (Pla-Julián & Guevara, 2019). CE practices in the design, manufacturing and distribution stages are mainly observed in companies at the beginning of the value chain. Because they depend on their customers' needs, companies that lack design power do not have as many opportunities and can try to generate value from waste instead of paying for disposal, changing energy sources and looking for positive ways to impact the environment (Pla-Julián & Guevara, 2019). Different barriers are also seen for different CE practices, while companies that undertake disruptive innovation, redesigning products and services to minimise the use of materials, are more likely to perceive more barriers than companies that implement activities such as waste minimisation, replanning energy use, and using renewable energy, which only perceives barriers related to administrative and regulatory procedures (García-Quevedo et al., 2020).

In terms of supply, obstacles are observed regarding inputs required for the CBM (Marino & Pariso, 2021; Ostermann et al., 2021; Rizos et al., 2016). In terms of demand, specifically convincing consumers of the potentials of CE and that recycled products have no inferior quality (Rizos et al., 2016) and selling circular products in the fashion sector, due to the fast fashion trend, are challenges (Ostermann et al., 2021).

Governmental support, in turn, is pointed out in most of the studies. Challenges include lack of legislation and support from local authorities, difficulty getting clearance for new raw material production, and quality certification, among others (Marino & Pariso, 2021; Rizos et al., 2016). From the study of European SMEs, it was found that the main decision factor in practising CE is the country in which they are located, highlighting the importance of factors such as economic development, national programmes, financing mechanisms, the institutional framework, and incentives (Zamfir et al., 2017). Regulatory barriers, namely, the cost of complying with regulations and the existence of complex administrative and legal procedures, are the main obstacle for European SMEs (García-Quevedo et al., 2020; Ghență & Matei, 2018).

In this sense, interaction with other ecosystem actors is fundamental to CE implementation in SMEs. While the lack of supporting reference points and challenging B2B cooperation (Jaeger & Upadhyay, 2020; Rizos et al., 2016) may be barriers, networks are considered a valuable information source (Ostermann et al., 2021), and the existence of a fertile ecosystem, CE intermediaries for the implementation process, and stakeholder engagement may act as

drivers for CE implementation in SMEs (Caldera et al., 2019; Torres-Guevara et al., 2021). In the case of potentials for industrial symbiosis in SMEs, three groups of problems were identified; namely, organisational management, related to low IT assistance and lack of data reliability; waste management, related to the weak CE waste policy and poor waste-to-resource strategies; and resource management, related to low coordination and high centralisation of resources (Rincón-Moreno et al., 2020).

In rural SMEs, both in the manufacturing and agriculture sectors, Uvarova et al. (2020) observed challenges in the environment for innovation, innovation policies and support measures, lack of workforce and low competitiveness in the industry within rural SMEs. These SMEs have rarely heard about the CE and even less about CBMs. Even those more familiar with green initiatives are reluctant towards introducing new business models or business model innovations. Especially in agriculture, Härrí et al. (2020) argue that institutional factors such as cultivation practices, labour market, credit schemes, IT systems, among others, may hinder small-scale farmers from supplying biomass to produce textile fibres and contribute to a circular system.

In this group, studies focus especially on motivations, barriers and enablers to implement CE in SMEs. More than half of the articles are exploratory, based on qualitative methodologies, and therefore their results may not be generalisable. Nevertheless, in this group, we highlight and organise the main factors discussed in the studies and present them in relation to SMEs' internal and external perspectives.

#### *Managerial practices and strategies for CE implementation and value creation*

This group is composed of articles that explore managerial practices and strategies for CE implementation and value creation.

Studies indicate the importance of environmental management in facilitating the CE implementation process. In Spain, Ormazabal et al. (2016) have found indications of a positive relationship between SMEs' environmental management maturity (EMM) level and willingness to implement CE. This is because companies at higher maturity levels have already realised that environmental improvements can influence their prestige and result in cost savings. These companies also present more flexible business models (i.e., maintenance services, renting instead of selling). In sequence, Prieto-Sandoval et al. (2019) mapped CE strategies for SMEs by CE fields of action (take, make, distribute, use, recovery, industrial symbiosis) and EMM level. The authors also identified the main stakeholders and the resources, competencies, and capabilities (RCC) per field of action and dynamic capabilities to capture CE opportunities. Barón et al. (2020) researched EMAS-registered SMEs, noting that most companies focus on reducing emissions, optimising the materials cycle and improving internal production processes. Eco-design stands out as the main driver among circular transformation practices.

According to Daddi et al. (2019), actions primarily aimed at promoting environmental engagement in EC, such as environmental certifications, are considered proactive strategies to deal with paradoxical tensions faced by SMEs, that is, use of recycled inputs and the

consequent potential loss of competitiveness by using recycled materials in specific products, which consumers may perceive as of inferior quality. On the other hand, actions aimed at reducing the "negative" sign of the economic pillar of corporate sustainability, that is, increasing the firm's competitiveness, are considered defensive strategies.

Studies also indicate the CBM experimentation as a fundamental capability for sustainable transformations in business (Bocken et al., 2018; Konietzko et al., 2020), also highlighting that collaboration with external partners can ease this process. Konietzko et al. (2020) report how participants hold a major influence over the experimentation regarding what they attribute importance to, their level of knowledge and who they know. In addition, participants concerned about circularity know about this and correspondingly tend to have a network of interested parties in supporting circularity within the scope of perspective on the ecosystem fundamental to the process of experimentation with CBMs.

According to Vihma and Moora (2020), to perform successfully circular design capacity and capability, critical dimensions for Romanian SMEs are relevant strategy and planning, network integration, learning process, and owners and managers' leadership. Regarding CBM-related organisational learning, Scipioni et al. (2021) identified the elements of the contextual factor that influence this process and evaluated the most frequent processes in Italian SMEs in the construction sector. Contextual factors, specifically cultural, regulatory, structural, and process factors, can be considered both drivers and barriers and are presented in three dimensions—external environment, supply chain, and SME.

To drive the implementation of CE, Sawe et al. (2021) argue that entrepreneurs should focus on people-driven factors considered as causes, namely factors such as management and leadership, organisational culture and strategic alignment. Performance appraisal, intention and motivation towards green initiatives, green project management, customer relationship management, welcoming green initiatives, and strategic partnerships and relationships, in turn, are considered effects.

In this sense, the relationship between the manager's interpretation of circularity as an opportunity, the manager's holistic thinking, circular network interactions and the integration of circularity in a company's strategy was analysed by Eikelenboom and de Jong (2021). The results point to the essential role for managers encouraging the development of circular network interactions, while the manager's level of holistic thinking may be a supporting factor in this process. It is also noted that collaboration with customers improves the impact of the internal environmental management and eco-design on economic and environmental performances. In contrast, collaboration with the supplier through green purchasing can only improve the effect of eco-design on environmental performance (Susanty et al., 2020).

According to Donner et al. (2020), agro-waste CBMs rely on partnerships and each other. Among the six CBMs identified is upcycling entrepreneurship, which focuses especially on the valorisation of by-products. This CBM presents two main challenges: the scalability process (pilot) and the seasonality of inputs, which requires

partnerships with other organisations. Donner and Radić (2021) also observed a strong focus on partnerships and cooperation for inputs, knowledge exchange, and distribution channels for the olive sector.

Special attention is required in environmental policies and consumer preferences, as highlighted by Järvenpää et al. (2020) regarding foresight activities and future expectations in SMEs. In the case of CE practices, market orientation and closed-loop orientation are related (Schmidt et al., 2021). Market orientation can fuel the emergence of closed-loop orientation, positively influencing internal environmental management and eco-design.

Other authors also analysed the alignment of CE principles in agriculture. In the Tuscany Region, the compatibilities between wine-production entrepreneurial strategies and the principles of CE were studied (Borrelli, 2018). Entrepreneurs try to create synergies with the landscape, are concerned with heredity and biodiversity, and get closer to organic production. They are also concerned with energy efficiency and installing PV and wind farms. Zhu et al. (2019) also show that environmental, economic and social objectives can be achieved by implementing circular agriculture. The study analysed a pig breeding farm case that has searched for alternatives for by-products. Although the project started as a government initiative through financial incentives, it requires the ability of the entrepreneur to provide economic viability. A production pattern is also required for the economic viability of the project. Some farmers opt for an adaptative approach, relying first and foremost on technological solutions to address circular challenges. Other farmers adopt an alternative approach, stating that making a profit, whatever the costs, and growing production, whatever the inputs required, is no longer indisputable (Dagevos & Lauwere, 2021).

Studies also investigate the implementation of CBM based in a product-service system (i.e., it involves the producer retaining ownership of the product after-sale and during use) in SMEs. Linder and Williander (2017) observed that several hitherto described challenges of CBM can at least sometimes be overcome in practice (including channel resilience, ensuring return flow and likely fashion vulnerability and operational risk), but validating a CBM also takes longer than the corresponding linear business model. Pieroni et al. (2019b) similarly found that the new capabilities required by these solutions would be realistic to achieve, despite already challenging for their context. The implementation of this type of CBM can also influence internal (e.g., sponsors and board members) or external actors (e.g., new investors, suppliers, new partners in the value chain, customers) that CE-oriented business models can generate business results or additional value, and are worth expanding into more sophisticated solutions. In forest-based industry, D'Amato et al. (2020) identified six CBM archetypes: material and energy efficiency, waste recovery, use of renewable materials, environmental and social management, sufficiency and frugality, and scaling up sustainable solutions. Authors highlighted that CBMs appeared to be dominated by traditional practices, while more radical solutions are missing, such as promoting frugality, reducing materiality, securing livelihoods, and supporting natural systems.

As in the previous group, most studies consist of qualitative analyses. It also includes action-research, design-science research, and

Multi-Criterion Decision-Making (MCDM) methods. In this sense, we present the main management practices and strategies for CE implementation and value creation outlined in the studies, including environmental management, CBM experimentation, organisational learning, the analysis of CBMs implemented by SMEs in different sectors, and others.

#### *Level of CE implementation and SMEs perceptions*

Studies in this group analyse CE implementation in SMEs and their perceptions. Ormazabal et al. (2018) found three factors associated with CE perception by SMEs: material provision, resources reutilisation, and financial advantages. Regarding the SMEs perceptions about CE implementation, Cristoni and Tonelli (2018) analysed the relevance and maturity of CE practices in Italy. The authors found that sourcing, end-use and design are the most relevant practices along the value chain, while their maturity is more consistent in distribution and production. In the same context, Mura et al. (2020) analysed twenty different CE practices related to waste management, packaging, supply chain and product/process design. Waste management was widely applied, while a small part of the sample implemented resource-saving practices.

According to Oncioiu et al. (2018), the main CE practices implemented in Romanian SMEs are the consolidation of guarantees for customers buying online, the use of renewable energy, smart and eco-design and energy labelling, and advanced manufacturing facilities for cleaner production. The authors also highlight that the CE activities are mainly financed with SMEs' own capital. In Poland, Brendzel-Skowera (2021) observed that most CE practices implemented consist of using circular raw materials, recovery of raw materials, modification and repair.

In the United Kingdom, Dey et al. (2020) analysed CE fields (take, make, distribute, use, and recover) and firms' sustainability performance, finding that all CE fields are related to economic performance, but only the make and use fields are linked to environmental and social performance. Ceptureanu et al. (2018) analysed the correlation of the dimensions of the ReSOLVE model (Regenerate, Share, Optimize, Loop, Virtualize) with value creation in terms of competitive advantage, additional revenues, constant long-term revenues, improved resource management, and beneficial partnerships, finding mixed results. At the same time, Demirel and Danisman (2019) found that eco-design generates the highest returns on investment for SMEs. The other types of CE practices, such as replanning water and energy use, using renewable energy and minimising waste, have significant impacts on firm growth. These authors also presented evidence on how SMEs are not economically justified to integrate CE due to the high levels of investment required.

To explain internal differences in countries at the firm level, factors such as size, total turnover, percentage of turnover dedicated to R&D and type of activity are observed (Bassi & Dias, 2019). Micro-firms are the least involved in CE practices. Particular involvement with waste minimisation and resource use optimisation is related to small firms, and medium-sized firms reflect ongoing CE activities or full involvement (Katz-Gerro & López Sintas, 2019). According to

Bassi and Dias (2020), four classes of SMEs are observed: companies with no interest in CE; companies in the process of introducing CE, which is the smallest group; firms interested in specific CE practices only (e.g., minimising waste and redesigning products to use recycled materials), which is the largest group; and firms with a very positive attitude towards the green economy that already implement the CE practices analysed. Waste minimisation is the most likely practice to be adopted, followed, in descending order, by energy use replanning, product and service eco-design, and finally renewable energy use and water use replanning (Katz-Gerro & López Sintas, 2019).

When addressing the level of implementation of CE in SMEs, naturally, these studies are based on quantitative methodological approaches. Dey et al. (2020) and Mura et al. (2020) further employ mixed approaches, incorporating components of qualitative analysis. These studies are focused only on the European context and analyse the level of implementation of CE in SMEs based on different dimensions (e.g., take, make, distribute, use, and recover; Dey et al., 2020; Ormazabal et al., 2018), and replanning of water, replanning energy use, renewable energy use, minimising waste and redesigning products and services (Bassi & Dias, 2019, 2020; Demirel & Danisman, 2019; Katz-Gerro & López Sintas, 2019).

#### *CE implementation tools and models for SMEs*

The last subgroup studying growing circular SMEs includes four studies focused on tools and methodologies to help SMEs transition to CE. Pigozzo et al. (2018) proposed a screening tool to identify and evaluate SMEs' potential for eco-innovation, focusing on industrial symbiosis and green business models aspects. Garza-Reyes et al. (2019) propose a Circularity Measurement Toolkit that enables assessing the degree of circularity in manufacturing SMEs. Prieto-Sandoval et al. (2021) proposed a methodology that guides step-by-step any industrial SMEs in the transition from the linear to a circular model, and Thorley et al. (2021) developed a conceptual model to measure CE readiness in SMEs.

### 3.2.2 | Born-circular firms and start-ups

Some studies have dedicated themselves to analysing born-circular firms through case studies (Cullen & De Angelis, 2021; De Angelis & Feola, 2020; Rok & Kulik, 2021; Todeschini et al., 2017; Ünal, Urbinati, & Chiaroni, 2019). Two studies have developed frameworks for CBMs and used start-ups as pilot cases (Antikainen & Valkokari, 2016; Lauten-Weiss & Ramesohl, 2021).

Todeschini et al. (2017) maintain that fashion start-ups normally begin on a sustainable basis, given that the commitment towards fostering social and environmental sustainability tend to rank among the core values and motivations of founders and partners. As a result, these entrepreneurs plan start-ups with innovative business models that furthermore pose serious risks to incumbent companies. Furthermore, they identify the entrepreneurial challenges and opportunities to sustainable business models in the fashion industry. The challenges incorporate the design strategies, consumer education and

expectations, and values alignment down through the supply chain. The opportunities include the focus on corporate social responsibility (CSR), service-based business models and the monetisation of voluntary simplicity.

Cullen and De Angelis (2021) observed that the CBM of a born-circular start-up is characterised by the entrepreneurial proposition, creation and delivery, and value capture. The entrepreneur's initial motivation was to prevent the waste of a natural resource and evolved into a conscious effort to create value for the local community with the end product and throughout the entire business process while addressing ecological and social dimensions. Similarly, Rok and Kulik (2021) indicate how the development of start-ups started from the recognition of an environmental problem that potential entrepreneurs encountered or experienced in private or professional life or some other recurring problem. At the same time, circular innovations in business models often address existing market limitations, regulatory structure or environmental awareness.

The challenges encountered in CBMs of start-ups may include factors such as the unprepared market for a particularly sustainable product or service, problems with escalation activities and the potential source of mission deviation in the process of business expansion, raw material variability and product volatility given informal contracts and ad-hoc arrangements with suppliers (Cullen & De Angelis, 2021; Rok & Kulik, 2021). Kahupi et al. (2021) report how investors are more doubtful about sustainability-based innovations due to their costs, the returns and risks associated with investments, which ends up hindering the financing of new sustainable businesses. Furthermore, consumers emerge as increasingly receptive to this type of innovation. Therefore, sustainable entrepreneurs should certify their business plans can produce the products and services able to attract investors and, to this end, may also count on support from incubators. Furthermore, Guldmann and Huulgaard (2020) suggest that the divergences found within circular start-ups for CBM innovation go beyond size, industry and segment, and may be related to factors such as the level of ambition for the business model innovation process, the internal configurations of the company, the level of management attention, the available resources, which internal and external stakeholders were involved in the process, and their attitudes towards the CBM. From the study of a born-circular, Ünal, Urbinati, and Chiaroni (2019) highlight the importance of managerial commitment as a key moderating factor between the value network and the customer value proposition and interface dimensions. These dimensions should interact, through managerial commitment, to allow the transfer of value from producer to customer. De Angelis and Feola (2020) presented the case of an academic spin-off, which is based on a CBM that capture value from the combination of reduced expenditure, use of secondary raw materials, recovered resources and low transportation costs, and the existence of a premium price and potential additional revenues arising from a new product line.

Henry et al. (2020) developed a more comprehensive study and analysed 128 circular start-ups. The authors mapped the types of innovation and strategies and defined five types of business models: design-based, waste-based, platform-based, service-based, and

nature-based, according to the types of innovation in the CBM. From the study, the authors found that the dominant strategy is reduction, focusing on increasing the efficiency of product design or manufacturing.

More recently, the institutional work by circular start-ups to prevent and reduce food waste was analysed by Närvenänen et al. (2021), highlighting the value of start-ups alongside established actors in addressing the problem, not only through innovative technological innovations and awareness-raising but also by redefining actors' roles and responsibilities and encouraging them to reduce food waste as part of their business or personal goals.

To conclude, few studies address companies already born based on a CBM. These are all based on qualitative methods and are focused on different sectors in European context (except for Todeschini et al., 2017, who analyse cases in Brazil and Italy). It is observed that they were developed in an isolated way, indicating that there is still much to be developed in terms of the study of born-circular firms.

### 3.2.3 | Social entrepreneurs in CE

In this group, studies are dedicated to understanding the role and characteristics of social entrepreneurs working in the CE. Even while poorly explored in the literature, social entrepreneurship represents a potential influence over introducing sustainable and innovative business models (Dentchev et al., 2018). Social entrepreneurs maintain their place in the chain of value to support movements within the direction of a CE even if, in the meanwhile, there is a lack of visibility among these entrepreneurs as regards other stakeholders in the ecosystem (Staicu & Pop, 2018). These social entrepreneurs attain greater renown for their products, based upon validation by consumers, and for their social causes.

By optimising the ecological and social well-being dimensions, ethical entrepreneurship incorporates CE practices. From the social perspective, especially in agriculture, demarginalisation and motivation are crucial, rendering the ecological production of vegetable produce viable, while in ecological terms, the focus is on the gradual regeneration of the soil while maximising production (Reckinger, 2018).

Social entrepreneurship can foster positive social impacts through raising income and working opportunities for marginalised groups, with training and the development of skills in local communities coupled with the potential empowerment of women and improvements in terms of gender equality. Environmental benefits may arise from transforming materials, which would otherwise have been disposed of in a landfill, dumped on wasteland or burned, into products with aggregate value as observed in social companies with recycling-based activities in Sri Lanka (Conlon et al., 2019). From the economic point of view, the incentive for the development of local businesses, the reduction of costs to the community, the increase in purchasing power and the creation of innovative chains of value all help drive greater economic activities at the local level (Conlon et al., 2019).

Smitskikh et al. (2020) set out a model for social entrepreneurship in the CE, taking into account the interested parties and their environmental, social and economic impacts, and defend how the determining factor in the development of CE is the long term effects of social entrepreneurship. Jabłoński and Jabłoński (2020) analyse the role of trust in the social business models in the Polish water sector, verifying how social capital registers fairly low levels in Poland and trust-based risk holds a strong influence over the establishing of trust-based social business models.

Staicu (2021) explored the circular social entrepreneurship in the textile sector in Romania in terms of legal forms, longevity on the market, human resources, legal and fiscal framework, costumers, products and communication, and raw materials and technology. Real et al. (2020) highlight how social entrepreneurs in the textile sector need to pay attention when choosing convivial technologies, focusing on more user-friendly technologies to ensure the appropriate scale of productions while simultaneously nurturing accessibility and adaptability. Other challenges also arise from this social dimension, including the management of fair practices for staff members, facilitating transparent governance processes and empowering co-producers, users and consumers in sustainable behaviours. As regards the interaction with the regional metabolism, its business models remain capped by the existing local political structures and with these initiatives involving, in addition to their own "project perimeters," through different regional groups, networks of interested parties and intermediaries specialising in textiles.

This group highlights that social entrepreneurs are able to embrace CE principles, especially collaborating for positive social outcomes. Again, qualitative methods predominate among the studies, which investigate the textile, agriculture and water supply sectors, except two conceptual studies (Dentchev et al., 2018; Smitskikh et al., 2020).

### 3.2.4 | Support ecosystem for circular entrepreneurship

This group inserted articles that explore the support ecosystem for circular entrepreneurship. This includes interactions and collaboration with other actors in the ecosystem, regional governance and determinants, and technological resources.

#### *Collaboration with other ecosystem actors*

Studies in this group analyse the interaction between firms and other ecosystem actors as a fundamental path to fostering CE. Regarding collaboration between firms, Veleva and Bodkin (2018) explore the collaborations between entrepreneurs and corporations to advance with the CE, finding that corporations hold the motivation to collaborate with entrepreneurs over their sustainability commitments, where state or European Union mandated opportunities to cut costs and gain reputation and other benefits. Corporations and other large organisations become the suppliers for entrepreneurs to the extent that the latter handle significant quantities of expired stock, packaging and



waste. Entrepreneurs may take advantage of technology and strategic partnerships with large corporations to create value for their partners and communities, reducing risks and costs and improving the reputation of the company and its social impacts. The geographic proximity of the actors facilitates the establishment of mutual circularity among participants, as observed in a network of Brazilian businesses made up of small companies, individual entrepreneurs and farmers forming a cooperative regime (Silva et al., 2019).

The digital platforms, in turn, as observed by Del Vecchio et al. (2021) in an Italian case study, enable the highlighting of opportunities and inter-sectorial challenges through means of providing a meeting point where interested parties may share their solutions and work in conjunction in specific challenges, interconnecting existing initiatives and supporting the CE at the national, regional and local levels. Hence, such platforms hold an influence on establishing CE focused ecosystems of innovation.

From another perspective, Cramer (2020) addressed the role of transition brokers as intermediaries in the regional governance in implementing CE. In that case, the intermediary becomes the person or organisation that develops proper interfaces between the triple-helix actors (business, research, and government). They facilitate both the transition process (learning, communication) and content (feeding new information and seeking ambitious solutions). Regarding the universities' role, Poponi et al. (2020) explore the potential of academic spin-offs as drivers for the CE and find that these may be an alternative tool for fostering the transfer of technology and/or knowledge to the commercial and productive sector and nurturing the circular process. Sukiennik et al. (2021) presented the results of the Limbra Project, focused on strengthening entrepreneurship in Poland, Slovakia, Hungary and the Czech Republic, in line with the recommendations of the "Green action plan for SMEs" in a way to meet the requirements of the CE. Findings highlight the role of universities in raising awareness of the participants and leading to building a permanent pro-environmental attitude and to supporting the raw material market in Poland.

The importance of clusters is also studied (Razminiene, 2019; Refsgaard et al., 2021). Examples of high levels of cooperation between diverse actors arise in Nordic countries. Countries such as Iceland, Denmark, and Sweden convey the importance of regional and local levels in establishing new institutional structures for cooperation between companies and public authorities capable of paving the way to synergistic clusters that foster the founding of new companies, and new jobs while also nurturing sustainable development. One such cluster in Denmark displays how its success is related to the human factor, a history of trust and entrepreneurial trial and error (Refsgaard et al., 2021).

This group includes studies related to network interaction with other actors in the ecosystem, including the study of interaction with other companies, clusters, CE intermediaries, digital platforms, and universities.

#### Regional governance and determinants

This group is composed of studies that analyse the effects of regional governance and determinants in CE establishment, focusing especially

on the importance of governmental support. Some authors study the emergence of CE related sectors. Lazarevic et al. (2020) argue that the wood-frame multistorey construction (WMC) in Finland, as an alternative for the established construction sector, has been driven by governmental programmes that have set targets and guided the direction of search. The study highlights the importance of creative destruction as a motor for innovation in science and technology and the role of government in stimulating this process. On the other hand, it is observed that entrepreneurs of the Water, Energy, Food and Waste (WEFW) sector in Romania cannot fully capture market opportunities due to the lack of a coherent legislative framework (Petrariu et al., 2021). The lack of efficient policies is that decision-makers do not completely understand the interconnectedness and transdisciplinary factors in WEFW sectors. In the case of Taiwan's recycling sector, Wu et al. (2021) argue that institutional governance, in the form of efforts of various levels of government to initiate and organise events and networking activities and to facilitate dialogue among stakeholders, was an essential factor for the successful establishment of an industrial-level CE. Under this framework, entrepreneurs have identified, selected, and acquired usable materials and connected and recombined them into fit resources through collective bricolage. The institutional governance approach has led to the emergence of a lively ecosystem of institutional entrepreneurship in Taiwan.

Zhou and Park (2020) explored the regional determinants of new venture creation in the car-sharing sector in China. Positive influences of urbanisation economic effects, human capital effects and venture capital effects were observed. In contrast, population density, regional economic effects, innovation ability of knowledge spillover, and the competitive car-sharing market do not play an obvious role in establishing new car-sharing ventures.

At the European level, Garrido-Prada et al. (2021) confirm the hypothesis that public environmental and energy R&D (PEERD) impact SMEs' implementation of CE activities by enabling these firms to access key scientific knowledge and by creating an appropriate knowledge and institutional environment for CE. According to the results, as PEERD stocks increase, the likelihood of SMEs implementing CE activities also increase. The study also finds a negative relationship between the stock of PEERD and SME investment intensity in CE activities, suggesting that this is the result of positive knowledge and technology spillovers from public R&D to SMEs, which lowers firms' private investment needs. Strategies such as mobilising resources, collaborations among actors and, especially, in support for knowledge-building are all core facilitators for European countries to act as institutional entrepreneurs and advance with the CE agenda (del Mar Alonso-Almeida et al., 2021).

The studies point out that entrepreneurial opportunity arises from the policies implemented. There is a clear relationship between the contributions of European countries to climate change and improvements to the proportion of eco-innovation in countries. Therefore, the European Union should establish more fiscal incentive mechanisms for European countries making contributions towards the sustainable economy (Crecente, Sarabia, & Teresa del Val, 2021). Oliveira et al. (2021) also observed that firms that complied with the WEEE

directive (Commission Decision 2004/249/EC) are more innovative, presenting a significant and positive change in the number of patents and the value of intangibles after companies comply with the waste management regulation.

Finally, CE incubators are also studied in the scope of CE. The objective of developing an incubator for CBMs underpins the study by Millette et al. (2020), focusing on the motivations and drivers of the stakeholders in participating in this incubator model. The authors also explore the different perspectives of the stakeholders in the CE incubator within the context of Trinidad and Tobago. The results highlight a major need for education regarding circularity to enable entrepreneurs to understand the scope of CE-based opportunities. This furthermore questions government participation in CE incubators in this particular context, probably due to the lack of trust in the government, a frequent factor faced by developing countries (Hull et al., 2021).

Unlike the previous groups, this group, despite containing few studies, is mostly based on quantitative studies, confirming the influence of government interventions on entrepreneurship in specific sectors related to CE. The studies also investigated issues such as institutional governance, collective bricolage, and CE incubators based on qualitative methods.

#### *Technology and industry 4.0*

In this group, the studies investigate issues associated with technology and industry 4.0 for entrepreneurship in CE. Specifically, the

authors explored the adoption of 3D printing (Despeisse et al., 2017), I4.0 technologies (Kumar et al., 2020), fintech (Pizzi et al., 2021), and artificial intelligence (Wilson et al., 2022). A series of obstacles are faced by entrepreneurs seeking to explore the potential for 3D printing in the CE (Despeisse et al., 2017). Among these challenges, there is the lack of knowledge among potential clients about the technology and its applications, the limitations to increasing scale, the dual challenge of marketing and communicating the advantages of utilisation, and the importance of applying recycled materials in addition to the investment barriers due to the technological and market uncertainties. Kumar et al. (2020) identified the challenges for applying industry 4.0 in SMEs for ethical and sustainable production, dividing them into causes and effects. The most critical challenge in the cause category is the lack of motivations of customers/OEM on adoption I4.0 technologies, followed by lack of long term planning on the adoption of I4.0 technologies, lack of awareness about I4.0 benefits, lack of management support for I4.0 technologies and the high initial cost of I4.0 technologies. On the other side, the effect category includes fear of failure of I4.0 technologies, fear of demand uncertainty due to market disruptions, fear of unemployment/reduction in workforce, lack of trained workforce on sustainable operations and I4.0 technologies and lack of alternative solutions to the technological breakdown. Pizzi et al. (2021) discuss how fintechs, an example of sectors developed under the influence of industry 4.0, could help SMEs towards CE implementation in terms of value proposition, value creation, and value delivery. And,

## ENTREPRENEURSHIP AND CIRCULAR ECONOMY RESEARCH

### Growing circular SMEs

- Factors influencing SMEs decision of CE implementation**
- Motivations: market demand, regulation, economic benefits (e.g. resource efficiency) sustainable awareness and commitment, external recognition, differentiation.
  - Internal factors: leadership, environmental culture, knowledge and technical skills, human resources, time financial resources, technology, strategic alignment.
  - External factors: regulations and government support, suppliers, customers, network relationships.

### Managerial practices and strategies for CE implementation and value creation

- Environmental management, CBM experimentation, organizational learning, are important for CE implementation.
- CBMs requires partnerships and network interaction (to share e.g., inputs, knowledge, distribution channels) for value creation.
- Market orientation and closed-loop orientation are related.
- It is possible to align agriculture to CE principles.
- CBMs based in by-products valorisation, product-service systems, and forest-based industry are identified.

### CE implementation level and SMEs perceptions

- Analysis of the CE practices implemented in Spain, Italy, Romania, Poland, United Kingdom.
- Analysis of implementation of CE practices in European SMEs (eco-design, water replan, energy use replan, renewable energy use, waste minimisation).

### CE implementation tools and models

- Screening tool for eco-innovation potential in SMEs
- Circularity Measurement Toolkit
- Methodology to guide industrial SMEs to circular business models
- Conceptual model to measure CE readiness in SMEs

### Born-circular firms and start-ups

- Entrepreneurial process evolved from an environmental opportunity identified in daily life.
- Commitment with environmental and social outcomes.
- Challenges in terms of investors and scalability.
- Start-ups CBMs based in design, waste, platform, service, and nature.
- May realise institutional work to foster CE.

### Social entrepreneurs

- Lack of visibility in ecosystem.
- Renown for their products, based upon validation by consumers, and for their social causes.
- Social benefits in terms of raising income and working opportunities for marginalised groups, development of skills in local communities, and gender equality.
- Attention in convivial technologies, social dimensions and business metabolism integration.
- Conceptual model for social entrepreneurship in CE.

### Support ecosystem for circular entrepreneurship

- #### Network interaction
- Other companies
  - Clusters
  - CE intermediaries
  - Digital platforms
  - Universities

- #### Technology and Industry 4.0
- 3D printing
  - Artificial intelligence
  - Fintechs

#### Regional governance and determinants

- Government pushing innovation in technology and science.
- Positive influence of public environment and energy R&D investments
- Institutional governance and collective bricolage
- Strategies as mobilising resources, collaborations among actors and support for knowledge building are facilitators
- CE incubators

FIGURE 4 Framework of Entrepreneurship and CE Research

**TABLE 1** Suggestion for future research

Group	Subgroup	Research agenda	Research questions
(1) Growing circular SMEs	Factors influencing SMEs decision of CE implementation	Identify the individual characteristics of business owners/entrepreneurs and their respective motivations for adopting CE practices in their companies.	What is the personal profile of entrepreneurs who are committed to moving their businesses towards circular business models? What is the relationship between the profile of the entrepreneur and the motivations that led them to change their business model?
	Managerial practices and strategies for CE implementation and value creation	Identify how business owners/entrepreneurs face the barriers encountered in the transition process to CE.	How do entrepreneurs acquire the CE knowledge needed for the new CBM? How do entrepreneurs finance the implementation of CE activities?
		Investigate CBMs in new contexts and sectors.	What is the level of implementation of CE in SMEs in other contexts (e.g., developing countries and Global South countries)? What are the differences in the implementation of CE between different sectors of activities and positions in the supply chain?
	CE implementation level and SMEs perceptions	Investigate more radical CBMs (e.g., product-service systems) implementation in SMEs.	How SMEs can implement more radical CBMs in place of isolated practices aligned to the EC
		Investigate the level of implementation of CE in other contexts and sectors.	What are the differences in the implementation of CE across countries and sectors? What are the economic, environmental and social outcomes resulting from the implementation of CE by SMEs?
	CE implementation tools and models for SMEs	To test the tools and models developed for implementing CE in SMEs and to identify the main difficulties faced by entrepreneurs.	How do entrepreneurs use the tools and models developed? What are the main difficulties encountered in the process? What are the most effective tools for SMEs?
(2) Born-circular firms and start-ups		Apply the circular start-up typology to other geographic areas and analyse their respective performance levels.	What CBMs have start-ups introduced in other contexts? Are there differences between regional contexts?
		Map the barriers and specific opportunities for circular start-ups as well as the factors of success.	How did born-circular entrepreneurs identify the opportunity? What were the challenges encountered in developing CBM from scratch? How were the challenges overcome?
		Carry out case studies of academic spin-offs that support the CE and explore their role.	What are the conditions for the development of academic spin-offs?
(3) Social entrepreneurs in CE		Analyse the institutional work developed by circular start-ups.	How can born-circular firm entrepreneurs act as institutional entrepreneurs?
		Research the value creation process, whether in economic,	How do social entrepreneurs achieve economic,

**TABLE 1** (Continued)

Group	Subgroup	Research agenda	Research questions
(4) Support ecosystem for circular entrepreneurship	Network interactions	<p>environmental or social terms, in the CBMs.</p> <p>Analyse how circular social companies adapt within ecosystems.</p> <p>Analyse the specific obstacles to social businesses engaging in the CE.</p>	<p>environmental, and social outcomes simultaneously?</p> <p>How do social entrepreneurs integrate their CBMs to the circular ecosystem?</p> <p>What are the challenges encountered by social entrepreneurs in implementing CBMs?</p>
	Regional governance and determinants	<p>Introduce the n-helix models for exploring the motivations and roles of interested parties in collaborating with entrepreneurs as well as the interrelated obstacles.</p> <p>Analyse the role of CE intermediaries.</p> <p>Analyse the role of universities.</p>	<p>How does the process of collaboration between entrepreneurs and stakeholders take place? What are the motivations of stakeholders to collaborate with entrepreneurs? What are the obstacles observed? What kind of resources are exchanged?</p> <p>Who are the CE intermediaries? What is the meeting point between CE intermediaries and entrepreneurs? What is the work developed by CE intermediaries?</p> <p>How can universities help in the development of entrepreneurship in CE? How can they influence entrepreneurship education and train entrepreneurs in CE?</p>
	Technology and Industry 4.0	<p>Measure the entrepreneurial results deriving from the different CE policies implemented.</p> <p>Analyse the influence of institutional framework in entrepreneurship in CE</p> <p>Analyse the CE incubators</p> <p>Develop indicators to evaluate CE across the micro, meso and macro levels.</p>	<p>What are the results of entrepreneurship, in different sectors and countries, as a result of implementing policies to support CE?</p> <p>What is the influence of the institutional framework conditions in entrepreneurial activity regarding CE?</p> <p>How can CE incubators accelerate the process of creating CBMs, and what are the challenges observed?</p> <p>What indicators can be used at micro, meso, and macro levels to assess entrepreneurial activity and its economic, social and environmental outcomes?</p>
		To investigate the influence of new technologies on the development of CBMs, both in growing circular SMEs and in born-circular firms	How are new technologies incorporated into CBMs in SMEs and start-ups? How can they influence the creation and growth of CBMs?

finally, Wilson et al. (2022) highlighted the important role of technology in the entrepreneurial ecosystem, particularly artificial intelligence, as a key factor in the digital entrepreneurial ecosystem, in which reverse logistics occurs and continues to be improved by entrepreneurs.

These studies highlight the importance of technology when undertaking CE. Clearly, the study of the technological dimension is limited and requires further development to understand the potential benefits as well as barriers to its use in the implementation of CBMs in SMEs or start-ups.

## 4 | A FRAMEWORK OF ENTREPRENEURSHIP AND CE RESEARCH AND FUTURE DIRECTIONS OF RESEARCH

This paper identifies the relevant literature on entrepreneurship within CE and organises the studies according to their main research themes and objectives. Figure 4 presents the framework for current entrepreneurship and CE research, based on 102 articles from WoS and Scopus.

It is possible to observe in the framework the four main thematic groups identified: (1) growing circular SMEs, composed by studies about CE principles adoption by SMEs; (2) born circular firms and start-ups, composed by studies about firms that were created based on a CBM; (3) social entrepreneurs in CE, composed by studies regarding the role and characteristics of social entrepreneurs due their special attention to social outcomes, implementing CE; and (4) support ecosystem for CE, including interactions with other stakeholders, regional governance and determinants, and technological trends. The framework provides an overview of what, until now, was researched about entrepreneurship in CE.

Clearly, the more developed group is dedicated to studying SMEs growing circular. This group counts with more than half of the studies in the sample, investigating in depth the motivations and factors (internal and external) that influence decisions to implement CE, the management practices and strategies to implement CE, the level of CE implementation and perceptions of SMEs, and CE implementation tools and models for SMEs.

The other groups identified, born circular firms and start-ups, social entrepreneurs in CE, and support ecosystem for circular entrepreneurship, are more restricted in terms of the number of articles that form them, consisting of a research gap. These groups contain

papers developed in isolation and require further research to deepen the theoretical background on born-circular firms and start-ups, social entrepreneurs and circular ecosystems. Therefore, to continue the development of the literature on entrepreneurship in the CE, the groups identified in our study are the main departure point for proposing future research directions (Table 1).

Furthermore, the analysis of sample studies highlights methodology and geographical contexts issues. Regarding methodology, there is a large presence of qualitative studies to the detriment of quantitative studies. Naturally, given the nascent nature of the topic, qualitative studies are necessary to understand the entrepreneurial process fully. However, quantitative studies with representative samples are necessary to make the results generalisable, making it possible to evaluate the most or less effective alternatives as well as the critical success factors.

Considering the geographical contexts of the studies, most studies focus on the European context, reflecting the European Union's advanced role in fostering the CE. However, other geographic regions require exploring to understand better how entrepreneurship might foster the CE in countries worldwide displaying very different characteristics. The CE requires the integration of different actors and obtaining robust, sustainable objectives in the future require other countries to be fully prepared. The research of these ecosystems needs the development of contexts that nurture entrepreneurship in the CE and understands the other variables that contribute to this process—especially considering the integration of countries from the Global South into the CE promoted by countries from the Global North.

In addition, we propose a conceptual model of the entrepreneurial process in CE (Figure 5). According to our model, entrepreneurs recognise opportunities in terms of market limitation, regulatory structure, financial attractiveness, differentiation (company image), or

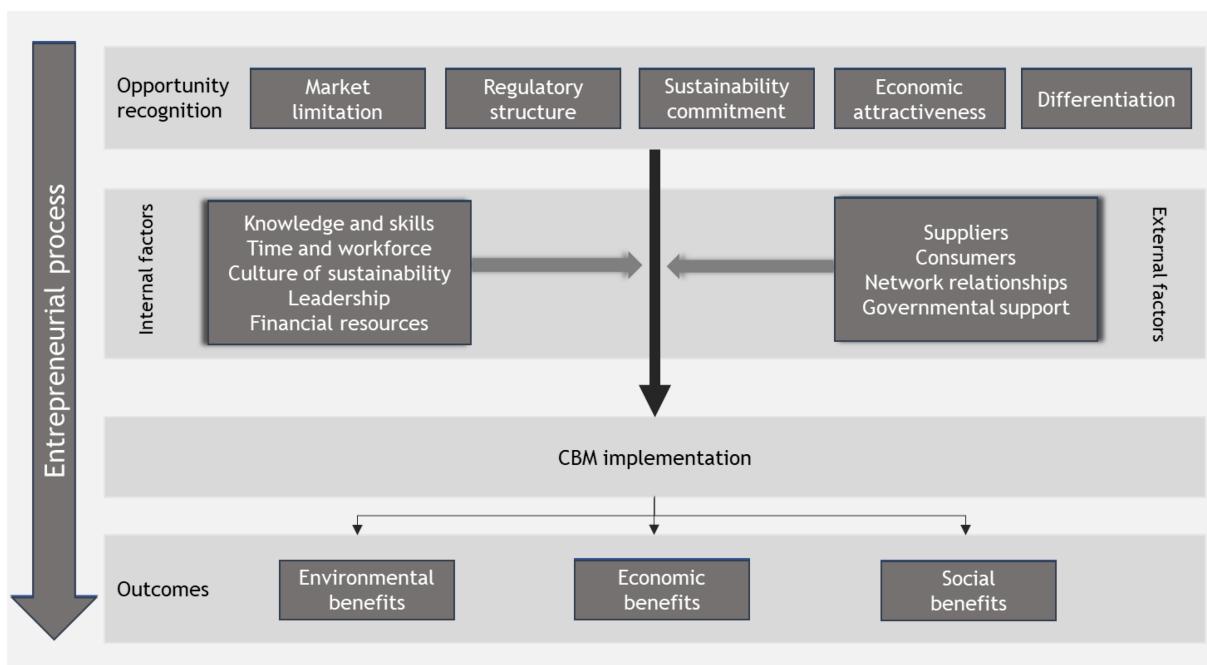


FIGURE 5 A conceptual model for entrepreneurial process in CE

simply because they are committed to the environment and social issues. As highlighted in this SLR, this process is influenced both by internal and external factors. To conclude, the entrepreneurial process is expected to generate economic, environmental, and social outcomes from implementing CBMs.

## 5 | CONCLUSIONS

Based on an SLR, in the previous sections, our paper answered the research question: What is the state of the art of entrepreneurship in the CE scope, and what are the future research directions? Our paper is the first SLR approaching the intersection of entrepreneurship and the CE themes, mapping the literature by identifying 102 relevant articles in WoS and Scopus and organising them in thematic groups. It contributes to the research field by providing a theoretical background of entrepreneurship and CE research that was dispersed until now. Furthermore, the thematic groups identified and the research agenda proposed to provide points of departure for developing the literature on this theme. Additionally, our paper presents a conceptual model of the entrepreneurial process in CE, also serving as a basis for the theoretical development of the topic.

It also can serve as a basis for new entrepreneurs and SME managers decision making. Understanding the opportunities generated by CE and the internal and external factors that can positively or negatively impact the implementation of more circular business models, the management practices and strategies that can facilitate the process, and the available tools are essential for entrepreneurs and managers to prepare for a transition to circularity.

Policy-makers can also use our results to understand the main obstacles and to foster CE through developing support measures for entrepreneurs setting up or moving their businesses to CBMs. Understanding the characteristics of SMEs, start-ups, and social entrepreneurs is crucial to formulating policies and enabling assistance to entrepreneurship within the framework of this new economic model.

This study, however, does contain certain limitations. Some of the articles reviewed do not focus on entrepreneurship among their core objectives. This fact reinforces the deep need for new studies deepening our understanding of entrepreneurship within the CE context. Furthermore, applying only two databases (Web of Science and Scopus) and excluding articles not written in English may have prevented identifying other relevant studies.

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## ORCID

Nathalia Suchek  <https://orcid.org/0000-0002-6663-9371>

João J. Ferreira  <https://orcid.org/0000-0002-5928-2474>

Paula O. Fernandes  <https://orcid.org/0000-0001-8714-4901>

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## APPENDIX A

**TABLE A1** Factors influencing SMEs decision of CE implementation

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Rizos et al. (2016)	UK, Netherlands, Estonia, Belgium, Germany and Greece	Multiple	Empirical (qualitative)	To explore the enablers and barriers faced by SMEs implementing CBMs.
Zamfir et al. (2017)	28 EU countries	Multiple	Empirical (quantitative)	Explore entrepreneurial decision models for adopting CE practices, aiming to understand the relation between characteristics of SMEs and their decisions related to CE.
Ghență and Matei (2018)	Romania	Multiple	Empirical (quantitative)	Analyse CE activities involvement of Romanian SMEs and barriers related.
Patrício et al. (2018)	Sweden (Västra Götaland)	Beer and mushroom production	Empirical (qualitative)	Analyse the implementation of industrial symbiosis, and identify barriers and motivations for partnerships.
Singh et al. (2018)	India	Manufacturing	Empirical (quantitative)	Explore CE readiness of Indian SMEs based in an extended model of Theory of Planned Behaviour (TPB).
Caldera et al. (2019)	Australia (Queensland)	Manufacturing	Empirical (qualitative)	To identify barriers, enablers and 'lean' tools helping in sustainable practices implementation.
Pla-Julian and Guevara (2019)	Spain (Navarra)	Multiple	Empirical (qualitative)	To explore the challenges for CE implementation in SMEs, and analyse them from a care ethics perspective.
Ünal, Urbinati, Chiaroni, and Manzini (2019)	United States	Building	Empirical (qualitative)	Analyse the connection of managerial practices and internal and external contextual factors for value creation in a CBM.
García-Quevedo et al. (2020)	28 EU countries	Multiple	Empirical (quantitative)	To identify the main barriers faced by SMEs to promote CE, focusing specially in lack of resources and capabilities, and regulatory framework.
Ghisetti and Montresor (2020)	28 EU countries	Multiple	Empirical (quantitative)	Investigates the extent to which the adoption of CE practices by SMEs correlates with their choices in financing.
Härrí et al. (2020)	India	Agriculture	Conceptual	To explore the role of farmers in the use of biomass to produce textile fibres, and respective impediments.
Jaeger and Upadhyay (2020)	Norway	Manufacturing	Empirical (qualitative)	To identify the dominant barriers for CE implementation in manufacturing SMEs.

TABLE A1 (Continued)

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Rincón-Moreno et al. (2020)	Spain (Basque Country)	Multiple	Empirical (qualitative)	Study the challenges that SMEs face in developing a CE system through industrial symbiosis.
Šebestová and Sroka (2020)	Czech Republic and Poland	SME sector	Empirical (mixed)	Compares the Czech and Polish SMEs approaches to the CE.
Uvarova et al. (2020)	Italy, Czech Republic, Latvia, Slovenia, Hungary and Bulgaria	Manufacturing and agriculture	Empirical (qualitative)	To explore the challenges, opportunities, and enablers for rural SME in regions of six EU countries.
Cantú et al. (2021)	Mexico	Manufacturing and services	Empirical (qualitative)	To identify the internal and external barriers faced by SME for CE implementation.
Centobelli et al. (2021)	Sweden, Germany, Netherlands, Finland, Austria, Belgium and Portugal	SMEs belonging to CE networks	Empirical (quantitative)	To explore relationships between social pressure, environmental commitment, green economic incentives, supply chain relationship management, sustainable supply chain design, and circular economy capability in SMEs.
Holzer et al. (2021)	Austria	Multiple	Empirical (quantitative)	Explore the gap between perceived importance and perceived performance in CE topical areas for SMEs.
Marino and Pariso (2021)	EU countries	Multiple	Empirical (qualitative)	Analyse trajectories of SMEs transition to CE and barriers in 13 sectors.
Ostermann et al. (2021)	Brazil	Fashion	Empirical (qualitative)	Analyse the drivers for EC in a born-sustainable fashion start-up.
Sharma et al. (2021)	India (Prayagraj - Naini Industrial Estate)	Textile, pharmaceutical, furniture, battery power, utensils and food	Empirical (qualitative)	To identify the prospects, impediments, and prerequisites for SMEs in transition from linear to CE.
Torres-Guevara et al. (2021)	Colombia	Building	Empirical (qualitative)	To explore the successful drivers for EC implementation and the opportunities and respective efforts and potential benefits by CE field of action.

**TABLE A2** Managerial practices and strategies for CE implementation and value creation

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Ormazabal et al. (2016)	Spain (Basque Country)	Industrial	Empirical (qualitative)	Analyse environmental management maturity (EMM) level and the degree of CE implementation in SMEs.
Linder & Williander (2017)	Sweden	Bike manufacturing	Empirical (qualitative)	Study inherent uncertainties observed in a product-service system CBM implementation.
Bocken et al. (2018)	Netherlands	Multiple	Action research	To explore business experimentation as an important capability for transition to sustainable business.
Borrelli (2018)	Italy (Tuscany)	Agriculture wine	Empirical (qualitative)	Analyse the alignment of strategies of winemaking firms with the principles of CE.
Barbaritano et al. (2019)	Italy	Luxury furniture sector	Empirical (qualitative)	Investigate how much firms know about CE practices, how they implement them and factors motivating and hindering their adoption..
Daddi et al. (2019)	Italy (Tuscany)	Paper production, textile/clothing, leather	Empirical (qualitative)	Investigate the acknowledgement of paradoxical tensions arising from CE implementation by SMEs and the strategies adopted to manage them.
Pieroni et al. (2019b)	Norway	Furniture	Action research	Analyse business model configuration for CE based in product-service system.
Prieto-Sandoval et al. (2019)	Spain	Industrial	Empirical (qualitative)	To identify key strategies by CE fields of action and EMM level, and the resources, competences and capabilities (RCC) for implementing CE in SMEs.
Zhu et al. (2019)	China (Jiangxi Province)	Agriculture pig breeding	Empirical (qualitative)	To explore the potential of circular agriculture in attain economic, ecological and social benefits simultaneously.
Barón et al. (2020)	Spain (Catalonia)	EMAS registered SMEs	Empirical (qualitative)	To identify and quantify CE practices implemented by EMAS registered SMEs.
D'Amato et al. (2020)	Finland	Forest-based bioeconomy textile, packaging, cosmetics, pharmaceutical	Empirical (qualitative)	To explore CBMs implemented by SMEs in circular bioeconomy and related challenges and opportunities.
Donner et al. (2020)	15 countries	Agriculture wine, cereal, manure	Empirical (qualitative)	To identify and characterise CBMs based in agricultural waste and by-products via cascading or closing loops.
Järvenpää et al. (2020)	Finland	CE-related sectors	Empirical (qualitative)	Study future foresight mechanisms and practices in SMEs operating in CE related industries.
Konietzko et al. (2020)	Netherlands and Switzerland	Not specified	Design-science	To explore the process of CBM experimentation and how the participants develop and test their assumptions to achieve circular outcomes.
Susanty et al. (2020)	Indonesia	Wooden furniture	Empirical (quantitative)	Investigate relationship between levels of environmental-oriented supply chain cooperation (ESCC) practices, CE implementation, and CE-target performances.

**TABLE A2** (Continued)

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Vihma & Moora (2020)	Estonia	Manufacturing	Empirical (mixed)	To explore circular design capacity and capability in product-oriented small manufacturing firms.
Dagevos and Lauwere (2021)	Netherlands	Agriculture	Empirical (qualitative)	Analyse farmers perception about the differences between circular business and normal business.
Donner and Radić (2021)	12 Mediterranean countries	Agriculture olive	Empirical (qualitative)	To explore business drivers and mechanisms of value creation in CBM based in olive waste.
Eikelenboom and de Jong (2021)	Netherlands	Multiple	Empirical (quantitative)	Analyse the role of organisational managers and network interactions for the integration of circularity in business strategy.
Sawe et al. (2021)	Developing countries	Industrial	MCDM (DEMATEL)	To identify key people driven factors towards enhancing CE practices in the SCs of SMEs and inter-relationships between them.
Schmidt et al. (2021)	Germany	Production	Empirical (quantitative)	Analyse how closed-loop orientation mediates the relationship between market orientation and the implementation of CE practices (internal environmental management, eco-design and corporate asset management and recovery).
Scipioni et al. (2021)	Italy	Construction	Empirical (mixed)	To explore CBM related organisational learning (OL) processes, identifying contextual elements of influence and most frequent OL processes.

**TABLE A3** CE implementation level and SMEs perceptions

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Ceptureanu et al. (2018)	Romania	PVC joinery	Empirical (quantitative)	Analyse the perception of Romanian SMEs using ReSOLVE framework and the relation between CE business actions and value creation.
Cristoni and Tonelli (2018)	Italy	Industrial manufacturing	Empirical (quantitative)	Investigate where, along the value chain, firms are more unaware of CE best practice and/or reluctant to invest.
Katz-Gerro and López Sintas (2019)	28 EU countries	Multiple	Empirical (quantitative)	Determine whether the patterns of CE activities adopted by SMEs are activity independent or activity dependent by company properties, type of industry, and country.
Oncioiu et al. (2018)	Romania	Multiple	Empirical (quantitative)	Investigate the involvement level of Romanian SMEs in CE related activities.
Ormazabal et al. (2018)	Spain	Multiple	Empirical (quantitative)	Analyse CE implementation degree by CE field of action, challenges and opportunities faced by SMEs.
Bassi and Dias (2019)	28 EU countries	Multiple	Empirical (quantitative)	Explore CE practices in SMEs controlling for within- and between-variability across EU countries.
Demirel and Danisman (2019)	28 EU countries	Multiple	Empirical (quantitative)	Analyse impact of CE practices and external funding available for CE activities on the growth of EU SMEs

(Continues)

**TABLE A3** (Continued)

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Lesakova (2019)	Slovakia	Multiple	Empirical (quantitative)	Compare involvement in CE activities of Slovak SMEs and EU (28 countries).
Bassi and Dias (2020)	28 EU countries	Multiple	Empirical (quantitative)	Explore how the homogeneous groups of SMEs are distributed across the groups of EU countries according to CE practices implemented and type of firms.
Dey et al. (2020)	United Kingdom	Manufacturing	Empirical (mixed)	Explore the relationship between CE fields of action and sustainability performance. To identify issues, challenges and opportunities for adopting CE and key strategies, resources and competences that facilitate the process.
Mura et al. (2020)	Italy	Multiple	Empirical (mixed)	Analyse actions implemented by SMEs aiming CE results, barriers, enablers and the relationship between CE, business strategy and performance.
Brendzel-Skowera (2021)	Poland	SME sector	Empirical (quantitative)	Analyse the organisational maturity of firms in terms of implementation of CE principles.

**TABLE A4** CE implementation tools and models

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Pigosso et al. (2018)	Denmark	Multiple	Action research	To propose a screening tool to SMEs' potential for eco-innovation, focusing on industrial symbiosis and green business models issues.
Garza-Reyes et al. (2019)	Mexico	Manufacturing plastics and metal	Empirical (qualitative)	Develop a Circularity Measurement Toolkit to assess the degree of circularity in manufacturing SMEs
Prieto-Sandoval et al. (2021)	Colombia	Industrial	Empirical (qualitative)	Propose the Ecopyme methodology, that guides step-by-step industrial SMEs in the transition from the linear to a circular model.
Thorley et al. (2021)	n/a	n/a	Conceptual	To propose a conceptual model to measure change readiness for CE adoption in SMEs.

**TABLE A5** Born-circular firms and start-ups

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Antikainen and Valkokari (2016)	Finland	Solutions for accelerating product reuse and recycling	Conceptual - Empirical (qualitative)	To develop a framework for sustainable CBM and present a pilot case with a born-circular enterprise.
Riisgaard et al. (2016)	Denmark	Smartphone repair	Empirical (qualitative)	To map the extend of the repair sector and drivers and barriers observed by SMEs for its emergence
Todeschini et al. (2017)	Brazil and Italy	Fashion	Empirical (qualitative)	To explore the trends and drivers of innovative sustainable business models and the opportunities and challenges in the fashion industry.
Ünal, Urbinati, and Chiaroni (2019)	Italy	Office supply	Empirical (qualitative)	To explore managerial practices to implement CBMs and how the firm create and capture value in this model.
De Angelis & Feola (2020)	Italy	Bio-based industry	Empirical (qualitative)	Understand how CE principles are translated into business models based in a circular start-up case.
Guldmann & Huulgaard (2020)	Denmark	Apparel, textile, machinery and mechatronics, furniture	Empirical (qualitative)	To explore the barriers hindering the adoption of CBMs across start-ups and incumbents and different sizes, industries and segments.
Henry et al. (2020)	Randstad (Netherlands), Berlin and London	Multiple	Empirical (qualitative)	To develop a typology of five circular business start-up models based on strategies and types of innovation in 128 CBM case studies.
Cullen and De Angelis (2021)	United Kingdom	Drinks and beverage	Empirical (qualitative)	To explore the entrepreneurial process and orientation from a business model perspective of a born-circular enterprise.
Kahupi et al. (2021)	Not specified	Multiple	Empirical (qualitative)	To study how sustainable innovators can build competitive advantage around sustainable products based in stakeholders' perspective.
Lauten-Weiss and Ramesohl (2021)	Germany	Urban gardening	Conceptual - Empirical (qualitative)	Development of a framework of circular businesses that provides a guide to structure the CBM and present a pilot case with a circular start-up.
Närvänen et al. (2021)	8 countries	Food	Empirical (qualitative)	To explore the forms of institutional work conducted by start-ups to prevent and reduce food waste.
Rok & Kulik (2021)	Poland	Multiple	Empirical (qualitative)	To study how circular start-ups design and implement innovation into their business models to increase their positive impact.

**TABLE A6** Social entrepreneurs in CE

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Dentchev et al. (2018)	n/a	n/a	Conceptual	To highlight how social entrepreneurship contribute for CE transition through CBM introduction.
Reckinger (2018)	Luxemburg	Agriculture	Empirical (qualitative)	To analyse four case studies of the circular and collaborative economy-type fruit and vegetable production as well as unpackaged and/or socially responsible food retail.
Smitskikh et al. (2020)	n/a	n/a	Conceptual	Development of a framework for CE social entrepreneurship and mapping the interactions between the interested parties and their respective negative or positive effects.
Staicu and Pop (2018)	Romania	Textile and apparel	Empirical (qualitative)	To study elements which hinder or facilitate the transition to the CE by identifying current and desired interactions among the ecosystem's stakeholders.
Conlon et al. (2019)	Sri Lanka	Upcycling	Empirical (qualitative)	To present lessons learned from the CE-based waste-to-wealth projects by the micro-social entrepreneurs in this field.
Jabłoński and Jabłoński (2020)	Poland	Water supply	Empirical (qualitative)	To explore the importance and the role of trust in social business models.
Real et al. (2020)	France	Textile and fashion	Empirical (qualitative)	To study the development of local business model niches within the scope of circular textiles and fashion in the case of social enterprises.
Staicu (2021)	Romania	Textile	Empirical (qualitative)	To explore the circular social entrepreneurship characteristics in terms of legal forms, longevity on the market, human resources, legal and fiscal framework, costumers, products and communication, and raw materials and technology.

**TABLE A7** Network interaction

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Veleva and Bodkin (2018)	United States	Multiple	Empirical (qualitative)	Development of a framework for analysing collaboration between entrepreneurs and corporations. Mapping the opportunities and the challenges involved.
Razminiene (2019)	n/a	n/a	Conceptual	To explore clusters and their role in the CE and suggest how SMEs could engage in a CE through clusters' performance development.
Silva et al. (2019)	Brazil	Multiple	Empirical (qualitative)	To explore CE practices in a network of Brazilian businesses composed of small companies, individual entrepreneurs and cooperative of farmers.
Cramer (2020)	Netherlands	n/a	Empirical (qualitative)	To explore the functions and benefits of transition brokers, as intermediaries, in regional governance for CE implementation.
Poponi et al. (2020)	Italy	n/a	Empirical (qualitative)	To understand how spin-off firms can be a driver for the development of CBMs and facilitate the transition to CE.
Del Vecchio et al. (2021)	Italy	n/a	Empirical (qualitative)	To analyse the case of a digital innovation ecosystem, the Italian Circular Economy Stakeholder Platform (ICESP).
Refsgaard et al. (2021)	Nordic countries	Bio-economy	Empirical (mixed)	To assess economic and social regional impacts of bioeconomy. Highlights the importance of the regional and local levels in creating the new institutional structures such as clusters.
Sukiennik et al. (2021)	Poland	Mining	Empirical (quantitative)	To explore the role of universities in supporting the transition to CE and sustainable development.

**TABLE A8** Regional governance and determinants

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Lazarevic et al. (2020)	Finland	Wood-frame multistorey construction (WMC)	Empirical (qualitative)	To analyse the emergence and evolution of the Finnish WMC from a technological innovation system perspective.
Millette et al. (2020)	n/a	n/a	Conceptual	To propose a framework for CE business incubators, identifying the contributions of the interested parties in each phase of the incubation process and the motivation to participate.
Zhou and Park (2020)	China	Car-sharing	Empirical (quantitative)	To explore the regional determinants of new firms creation in car-sharing industry.
del Mar Alonso-Almeida et al. (2021)	Europe	n/a	Empirical (quantitative)	To analyse relationships between institutional entrepreneurship enablers and impacts on CE strategies.
Crecente, Sarabia, and Teresa del Val (2021)	22 European countries	n/a	Empirical (quantitative)	To analyse the relationship between European entrepreneurship and climate change policy.
Garrido-Prada et al. (2021)	EU countries	Multiple	Empirical (quantitative)	To study the influence of public environmental and energy R&D (PEERD) on CE implementation and investment by SMEs.
Hull et al. (2021)	Trinidad and Tobago	n/a	Empirical (qualitative)	To study the development of CE incubators in Trinidad and Tobago and related challenges and opportunities.
Oliveira et al. (2021)	Portugal	Waste Electrical & Electronic Equipment (WEEE)	Empirical (quantitative)	To explore entrepreneurial ecosystems based in the analysis of the accomplishment of WEEE regulations and patents registered.
Petrariu et al. (2021)	Romania	Water, energy, food, and waste (WEFW)	Empirical (quantitative)	To study intersectoral synergies and trade-offs in the case of the WEFW nexus, judging from the perspectives of entrepreneurial activity and economic results.
Wu et al. (2021)	Taiwan	Plastic waste	Action research	To study the success case of transition to CE in plastic waste sector based in entrepreneurial bricolage and institutional governance.

**TABLE A9** Technology and Industry 4.0

Authors	Geographic area	Sectors	Methodological approach	Main goal of the article
Despeisse et al. (2017)	United Kingdom	3D printing	Conceptual - Empirical (qualitative)	Review of questions relating to 3D printing and sustainability and detailing research questions for exploring the usage potentials of 3D printing for creating value in the CE.
Kumar et al. (2020)	India	Manufacturing	MCDM (DEMATEL)	To identify the challenges faced by SMEs implementing Industry 4.0 technologies for ethical and sustainable business processes.
Pizzi et al. (2021)	Germany, United States, South Africa, India, Canada.	Multiple	Empirical (qualitative)	To explore cases of business models linking Fintech application and CE in diverse industries.
Wilson et al. (2022)	n/a	n/a	Conceptual	To understand the opportunities of artificial intelligence for reverse logistics.