

RESEARCH ARTICLE

Corporate social responsibility and circular economy integration framework within sustainable supply chain management: Building blocks for industry 5.0

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Abstract

The emergence of Industry 5.0 (I5.0) underscores the importance of integrating sustainability and human-centricity into organizations. This requires combining corporate social responsibility (CSR) and circular economy (CE) within sustainable supply chain management (SSCM). However, the interplay between CSR, CE, and SSCM remains underexplored, especially in the context of I5.0. Therefore, this article proposes a framework for integrating CSR and CE principles within SSCM, serving as a transition to I5.0. The framework is derived from a comprehensive scoping review and experts' input, with a backdrop of the business legitimacy theory. It comprises several key constructs, including the supply chain structure and promoters, organized around four pillars representing the components of CE and embracing the triple bottom line dimensions. With 12 guidelines, the framework stands as a practical tool for organizations aiming to seamlessly integrate CSR and CE within SSCM, facilitating the transition to I5.0 and promoting a sustainable, socially responsible ethos.

KEYWORDS

business legitimacy theory, circular flows, circular inputs, human-centricity, product and process design, triple bottom line

1 | INTRODUCTION

Society's escalating expectations for environmental and social responsibility from organizations and their supply chains are compelling a shift toward more sustainable operations (Caiado et al., 2023; Zeng et al., 2017). Amidst this, the imperative arises for organizations to

embrace a new paradigm—Industry 5.0 (I5.0), an extension of Industry 4.0 (I4.0) (e.g., Bueno et al., 2023; Ghobakhloo et al., 2023) with a focus on sustainability, human-centricity, and resilience (European Commission, 2022). Unlike the fourth industrial revolution, the I5.0 paradigm focuses on human needs and interests and adapts technology to support the workforce (Caiado et al., 2024; Waheed

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et al., 2022). It also aims to make the industry a force for sustainability, regeneration, and inclusion, requiring changes in policy and governance (Karmaker et al., 2023). The nexus between social sustainability, human-centricity, and corporate social responsibility (CSR) becomes crucial as organizations recognize the link between sustainable performance, CSR, and brand image improvement (Al-Minhas et al., 2020). The paradigm shift poised by the transition to I5.0, more than technological, is one of complete restructuring of organizations and production systems to keep productivity and at the same time pursue more sustainable and human-centric solutions to improve resilience. In this context, circular economy (CE) and CSR are important vectors to leverage resilience (Ghobakhloo et al., 2023; Turner et al., 2022).

CSR is a current initiative due to its role in ensuring economic, environmental and social values, and is considered an appropriate approach for the authenticity of socially responsible initiatives and practices by organizations (Tiep Le et al., 2021). Thus, CSR supports the implementation of corporate sustainability, a corporate governance model that considers organizations' short- and long-term economic, social and environmental performance (Blinova et al., 2022).

The CE is also a key element of I5.0, as it aligns with the UN goal of sustainable consumption and production. It involves reusing, repurposing, and recycling natural resources, reducing waste and impact (Fontoura et al., 2023; Ivanov, 2023). In this context, integrating the CE is imperative for long-term sustainability (Konietzko, 2021). CE offers a solution to corporate sustainability challenges by promoting the efficient use of limited natural resources (Blinova et al., 2022). It entails rethinking resource utilization within a regenerative system, diverging from linear economic models (de Jesus et al., 2021). The CE model encourages designing products, manufacturing processes, and supply chains to sustain continuous resource flow in a closed loop (Jawahir & Bradley, 2016).

To adopt sustainable supply chain management (SSCM), organizations must consider CE's key components, as these align with the triple bottom line (TBL) perspective, encompassing environmental, social, and economic dimensions (Narimissa et al., 2020; Welford & Starkey, 2001). Weetman's (2016) CE model, focusing on circular inputs, product design, process design, and circular flows, serves as the foundation for the circular supply chain (Batista et al., 2018; Prieto-Sandoval et al., 2018). This integration facilitates strategic management of material, information, and capital flows, aligning with the three dimensions of sustainable development.

The evolving landscape of CE, marked by the expansion of the traditional 4Rs (reduce, reuse, recycle, recover) into the 10Rs: reduce, reuse, recycle, recover, repair, re-furbish, remanufacture, refuse, re-think, and repurpose, necessitates a continuous exploration of circular business models and their integration with CSR (de Mattos Nascimento et al., 2024; Scarpellini, 2022). Sandin and Peters (2018) highlight the importance of the Rs for maintaining the Circular Supply Chain, which aims to achieve zero waste and includes the vision of a closed-loop supply chain (Zhang et al., 2021).

1.1 | Research gaps

In a context where the CE model is taking root, embracing a holistic perspective with its components, TBL dimensions and the different Rs, applying the CSR approach is relevant and beneficial for organizations (Stoyanova, 2019). However, the relationship between CSR and CE has yet to be further explored, which largely depends on an organization's institutional environment and CE policies (Blinova et al., 2022). Indeed, implementing CSR in organizations has been challenging due to the complexity surrounding the topic. This is supported by the literature insofar as more and more organizations develop and implement a myriad of CSR programs and policies to generate contributions to society and the natural environment (Cezarino et al., 2022). CSR involves initiatives and practices that address the concerns and interests of organizations' various stakeholders to balance the needs of sustainability and enterprise (Tiep Le et al., 2021). Stakeholders are individuals or groups of people who affect or may be affected by the actions, objectives and policies of an organization, for example, shareholders, creditors, directors, employees, government, suppliers, customers, trade unions and the community from which the business draws its resources (Shi & Veenstra, 2021). It is important to consider stakeholders' opinions toward an effective CSR (Blinova et al., 2022). Organizations' commitment to CSR initiatives is demonstrated by their commitment to building relationships with their stakeholders (Patuelli et al., 2022). In this context, the presentation of the elements that make up CSR is relevant, as the CSR theme is included in the structure of organizations (Welzel et al., 2015).

To establish the connection between CSR and CE, it is necessary to consider new business models presented as vehicle instruments for the transition to CE. The framework of business legitimacy could help address the gap, combining the approach from institutional theory with the normative approach from business ethics and political CSR (Rendtorff, 2020a). Babiak and Trendafilova (2011) delve into the motives behind the adoption of environmental management practices within businesses. Their study reveals that strategic motives and the pursuit of legitimacy are key drivers for businesses to focus on environmental CSR. Liu et al. (2021) underscores the significant role of business legitimacy in enhancing access to capital and reducing financing constraints. Their findings suggest that firms with better Corporate Environmental Performance enjoy increased government support and market legitimacy. These studies demonstrate how legitimacy can influence a firm's strategic decisions, particularly in relation to environmental management and CSR. In this way, new business models connect supply and demand innovations while at the same time driving other forms of innovation linked to design, product manufacturing, logistics and reverse logistics, as well as product end-of-life management and recovery (de Jesus et al., 2021). Moreover, how CSR and CE are related is still little explored in the literature (Del Baldo & D'Anghela, 2020). Circular business models are also little studied, so evidence of changes in circular business models should be analyzed to build a new framework of the influences that drive the integration of CE with CSR (Scarpellini, 2022). Analysis of the literature indicates that for the CE model, organizations would have to

adopt frameworks for decision-making, considering the potential impacts of TBL (Scarpellini, 2022). Thus, the literature also shows a lack of research on CE to understand whether this model is becoming part of an organization's strategies and to investigate the role of promoters in influencing the implementation of CE practices in an organization's sustainability agenda (Del Baldo & D'Anghela, 2020). The relationship between CSR and CE concepts and TBL and SSCM, which direct organizations toward an environmental and socially oriented approach, deserves more academic attention (Del Baldo & D'Anghela, 2020; Santiago et al., 2023). Business legitimacy with a normative approach from business ethics (Rendtorff, 2020a) is essential as a backdrop to integrate CSR, CE and SSCM.

The integration of CE and CSR has gained traction, but the perspectives of consumers are still not fully understood. Kolling et al. (2023) highlight the need to investigate consumer knowledge and perception of CSR and CE, as well as their willingness to pay for products from companies adopting these concepts. This perspective emphasizes the importance of increasing consumer awareness about socio-environmental concepts to enhance their willingness to pay for sustainable products. Additionally, Mazzucchelli et al. (2022) underscore that CE and CSR are converging concepts, with CE putting CSR into practice, helping firms address resource scarcity and environmental challenges. Walker et al. (2023) further demonstrate how CE practices, such as the Circular Transition Indicators, can provide systematic insights into the lifecycle of materials and products, aiding companies in developing environmentally impactful value propositions. However, there remains a significant gap in understanding the dynamic capabilities required to implement CE practices effectively.

1.2 | Business legitimacy theoretical lens

According to Suchman (1995), legitimacy is the generalized perception that the actions of an entity are desirable, proper, or appropriate within a socially constructed system of norms, values, beliefs, and definitions. This legitimacy affects how people act toward organizations and how they understand them. It improves a company's ability to compete for resources, garner stakeholder approval, and build goodwill during crises (Deephouse & Suchman, 2008). The quest for business legitimacy is a critical motivator for organizations to engage in CSR (Gjesdal, 2024; Suchman, 1995) also expands on legitimacy by defining it as a generalized perception that an entity's actions are desirable and appropriate within a socially constructed system of norms, values, and beliefs. This perspective influences how organizations are understood and perceived, with legitimate organizations viewed as more meaningful, predictable, and trustworthy. The CSR-business connection implies that achieving legitimacy can enhance a company's competitive ability, stakeholder approval, and resilience during crises (Godfrey & Hatch, 2007). Legitimacy is a multilevel construct involving cognitive, moral, and pragmatic dimensions, which collectively influence stakeholders' perceptions and expectations (Suchman, 1995).

Business legitimacy can be categorized into three models (Rendtorff, 2020b). The economically and legally responsible corporation (type I) focuses on market success and legal compliance, emphasizing rational strategic planning and economic criteria. The ethically and socially responsible corporation (type II) also aims for economic success but considers ethical norms and social customs, seeking legitimacy beyond mere market criteria. This model avoids actions that contradict social norms and strives for ethical conduct. The proactive corporation (type III) searching for corporate citizenship goes further, incorporating values-driven management, CSR, business ethics, and sustainability, aiming to be respected as a good citizen in society.

Digital technologies also play a pivotal role in fostering human-centricity and sustainability by integrating CSR and CE principles. From the I5.0 paradigm, for example, connectivity technologies such as the internet, which encompass the network, Web, and cloud computing, facilitate transparency, accountability, and stakeholder engagement, thereby enhancing business legitimacy (Gonzalez, 2020). As businesses navigate the complexities of the digital economy, the integration of scientific, technological, and social dimensions becomes imperative (Gonzalez, 2020). This approach not only addresses the economic and legal responsibilities of corporations but also emphasizes ethical and social considerations, moving toward a model of ethically and socially responsible corporations (Rendtorff, 2020b).

Modern organizations, unlike classical closed systems, are seen as open systems that interact closely with their external environments (Suchman, 1995). The interdisciplinary approach to business legitimacy research focuses on responsibility, ethics, and societal impact, aiming to elucidate the dynamic relationship between companies and their environments. This perspective underscores the importance of historical context, competitive innovation, and technological advancements in shaping and sustaining business legitimacy (Gonzalez, 2020).

In the context of I5.0, which emphasizes human-centricity and sustainability, business legitimacy becomes even more crucial. The integration of advanced digital technologies within this paradigm requires organizations to demonstrate their commitment to ethical values and social norms. This legitimacy ensures that firms can secure the necessary resources and maintain a license to operate within society (Rendtorff, 2020b). The evolution from environmental management to environmental strategy, as noted by (Sarkar, 2008), aligns with the need for firms to adapt to normative pressures and enhance their business legitimacy through sustainable practices (Flammer, 2013). The need for legitimacy in adopting CE and CSR practices is underscored by the complex, dynamic nature of modern business environments. As firms navigate technological innovations and societal expectations, maintaining legitimacy through ethical and sustainable practices becomes a cornerstone for long-term success (Gonzalez, 2020). Ultimately, it also remains to be investigated how the Rs of CE are implemented and the duty of government institutions and other promoters in cross-sector collaboration for the implementation of CSR (Ho et al., 2022). This is in line with the need for an SSCM framework for sustainable supply chains to increase sustainability in supply chains and further advance corporate sustainable development (Kusi-Sarpong et al., 2019).



Moreover, a CSR framework is lacking to clarify the relationships between drivers, corporate characteristics, corporate sustainability practices and corporate performance for implementing circular supply chain management (Bai et al., 2015). More research is still needed to achieve more inclusive social supply chains in relation to social concerns in supply chains and to systematize these findings into a framework for integrating social, environmental and economic dimensions in supply chains (Bubicz et al., 2019). A first effort in this direction is seen in Santiago et al. (2023), which offers a preliminary Circular and SSCM framework from the perspective of TBL. However, additional efforts still need to be conducted to fill the literature's gap on the topic, especially regarding the implementation in practice. In addition to this, urgently, the transition to the I5.0 paradigm has become imperative. However, the academic literature lacks comprehensive research on transformative frameworks seamlessly integrating CSR and the CE within the broader context of SSCM with a backdrop of legitimacy theory.

1.3 | Research question, goal and contributions

Within the overarching framework of addressing the pressing need for sustainable development and aligning with the transition to I5.0, this study endeavors to answer a pivotal research question: "How can organizations implement CSR by incorporating the concepts of CE and SSCM?" To delve deeper into the intricate relationship between CSR, CE, and SSCM and to address the identified literature gaps, the primary objective of this research is to propose a comprehensive framework for integrating CSR and CE principles within SSCM, serving as a transition to I5.0. To achieve this objective, a meticulous two-method approach is adopted. The initial phase involves a thorough scoping review of existing literature to construct a preliminary version of the framework. Subsequently, a panel of experts contributes to its refinement, followed by an empirical validation round to ensure its applicability and effectiveness.

This research's theoretical contributions are manifold. Firstly, from the lens of business legitimacy theory, it provides a normative framework combining institutional theory with business ethics to address the legitimacy of integrating CSR with CE (Kolling et al., 2023). This integration underscores the human-centricity and sustainability aspects of the I5.0 paradigm, illustrating how businesses can balance ethical responsibilities and societal expectations in their supply chain practices (Todaro & Torelli, 2024). This paradigm shift emphasizes human needs and interests, adapting technology to support the workforce while promoting sustainability and social responsibility.

In terms of practical contributions, this research introduces a novel framework offering guidelines for CSR targeting CE from an SSCM perspective (Mazzucchelli et al., 2022). The framework, derived from a comprehensive scoping review and refined by the perspective of experts, is a practical tool comprising several key constructs, including supply chain structure and promoters, organized around four pillars representing CE components and embracing TBL dimensions

(Opferkuch et al., 2023). The guidelines aim to provide tangible implications for organizations aiming to seamlessly integrate CSR with a focus on CE within the SSCM perspective, enhancing their sustainability and operational efficiency (Walker et al., 2023).

Methodologically, this study bridges the gap between theoretical and empirical perspectives through a mixed-method approach (Gajanayake et al., 2024). By combining a structured literature review and a panel of experts to build and refine a new artifact, the research ensures a robust and comprehensive framework. This approach not only validates the theoretical constructs but also aligns them with practical, real-world applications, ensuring the framework's relevance and effectiveness in diverse organizational contexts. This methodological rigor contributes to the development of a transformative framework that integrates CSR, CE, and SSCM, thereby supporting the transition to the I5.0 paradigm and advancing the field of sustainable business practices.

The article is organized into five main sections, the first of which is this introduction. Section 2 describes the research methodology adopted. Section 3 presents the results, embracing the framework's constructs. Section 4 offers the discussions leading to the proposed framework with its implementation guidelines. Finally, section 5 presents the research conclusions and suggestions for future investigations.

2 | METHOD

The research was conducted into two methodological stages. The first stage consists of a process of synthesizing the literature based on existing evidence through a scoping review of the literature (Arksey & O'Malley, 2005), identifying the constructs for the framework and laying the foundations for a preliminary version. The prior knowledge obtained from the literature in this first stage is complemented and refined in the second stage with the panel of experts, thus perfecting the framework following empirical validation and generating novel knowledge. Figure 1 summarizes the two-stage research approach inspired by Wieland and Wallenburg (2012), which is described in the next two subsections.

2.1 | Scoping review

The scoping review sought to synthesize the existing literature on the specific subject of this research, comparing results obtained from different studies to present state of the art and highlight possibilities for further studies, as recommended by (Fink, 2019) and in the case of this article made tangible by the framework proposal. This scoping review sought to identify the types of evidence available associated with the relationship between CSR and CE and the constructs that govern this relationship, considering the SSCM perspective. This review sought to clarify the main concepts/definitions in the literature, examining how scientific studies have been conducted and identifying the main characteristics related to the theme of this research,

FIGURE 1 Stages of the methodological approach inspired by Wieland and Wallenburg (2012).

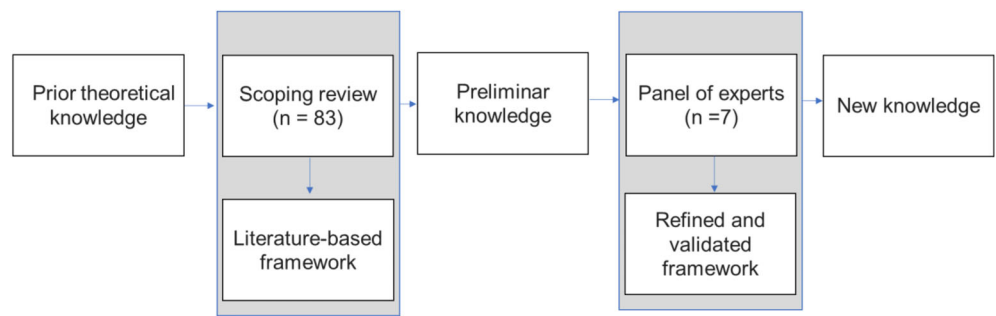


TABLE 1 The keywords with search strings for the scoping review.

Scope	Search strings
Circular economy	ALL (circular AND economy) AND
Corporate social responsibility	ALL (corporate AND social AND responsibility) AND
Sustainable supply chain management	TITLE-ABS-KEY (sustainable AND supply, chain, AND management))

in line with what is recommended by (Munn et al., 2018). This systemic and structured approach, consistent with Tranfield et al. (2003) and Thomé et al. (2016), provided guidelines for the first methodological step of the research, from planning to reporting the findings. Thus, this stage of the research followed the five steps proposed by Arksey and O'Malley (2005): (1) Definition of the research question/problem; (2) Identification of relevant studies; (3) Selection of studies; (4) Data mapping and analysis of results; and (5) Grouping, summarizing and presenting the results.

The result of the first step is presented in the introduction to this article, covering the research's problem, question and goal, highlighting the need for a CSR framework aimed at CE from an SSCM perspective. The second step consisted of identifying relevant studies in the literature. The researchers chose the Scopus database for this purpose, as it is considered the major curated abstract and citation database of the scientific literature (Schotten et al., 2017), being one of the most reliable publications' database (Trifan et al., 2019) and with high relevance to operations management and sustainability (Magon et al., 2018). Citation database such as Scopus ensure a broader diversification of studies, as it indexes several Journals and vendors database in a single location (Thomé et al., 2016). Initially, a search was carried out for articles addressing the main themes of this study. The keywords used were based on those adopted in Santiago et al. (2023), namely "CE," "CSR," and "SSCM." Thus, the exact search engine used was specified by the expression (ALL (circular AND economy) AND ALL (corporate AND social AND responsibility) AND TITLE-ABS-KEY (sustainable AND supply, chain, AND management)). Table 1 shows the Keywords with search strings for Scoping Review. The search did not restrict publication years. The first search was carried out in June 2022, then updated in January 2023 to include articles published up to December 31, 2022, and again updated in October 2023, embracing more recent articles to update the sample.

The scoping review's third step was the selection of relevant studies. A step-by-step approach was adopted, involving multiple reviewers to meet Denyer and Tranfield's (2009) quality criteria of transparency, inclusiveness, and explanatory power. The protocol answered the RQs and defined the scope in terms of focus, goal, perspective, coverage, organization, and audience (Cooper, 1988). The inclusion criteria for selecting studies were (i) articles written in English, (ii) articles published in peer-reviewed Journals, as they serve as a gauge of research quality (Thomé et al., 2016) and (iii) articles that were related to the integration of CSR and CE from the SSCM perspective, echoing (Santiago et al., 2023). The peer-review process has norms that are standardized by all peer-reviewed journals and in the publication process, peer-reviewed journals seem to be the best platform for sharing research results (Ezeala et al., 2013; Jain et al., 2022). Articles dealing with this theme peripherally or associated with side findings were excluded from the sample. The PRISMA model (preferred reporting items for systematic reviews and meta-analyses) – (Page et al., 2021) was adopted, as displayed in Figure 2. The first screen of the literature lead to 621 articles. This number was reduced to 370 articles after excluding the ones not written in English (4) that were not published in peer-reviewed journals (115) and that did not offer an integration of CSR and CE from the SSCM perspective (132) based on the analysis of their abstracts. In cases where there were doubts, the article was left for the full text read round. After applying the inclusion criteria in the full text, a further 295 articles were excluded from the sample, as they did not deal directly with integration of CSR and CE from the SSCM perspective, leaving 75 articles for a scoping re-view sample for an in deep analysis. Aiming to go beyond the search based on the selected keywords for a boarder inclusiveness, a snowball search was conducted at the end (Greenhalgh & Peacock, 2005). Therefore, eight additional articles were included through backward search (Thomé et al., 2016) resulting in a total of 83 studies retrieved for the research.

In the fourth step, these remaining articles were analyzed according to their results through content analysis, a well-established procedure for processing textual data, helping to develop a deeper understanding of a specific phenomenon by providing structure in a large amount of textual data through a systematic process of interpretation (Kleinheksel et al., 2020; Krippendorff, 2004), with a backdrop of the legitimacy theory (Rendtorff, 2020b; Suchman, 1995) to support the analysis of results. Data gathering used a concept matrix (vom Brocke et al., 2015) organizing articles by dimensions. Content

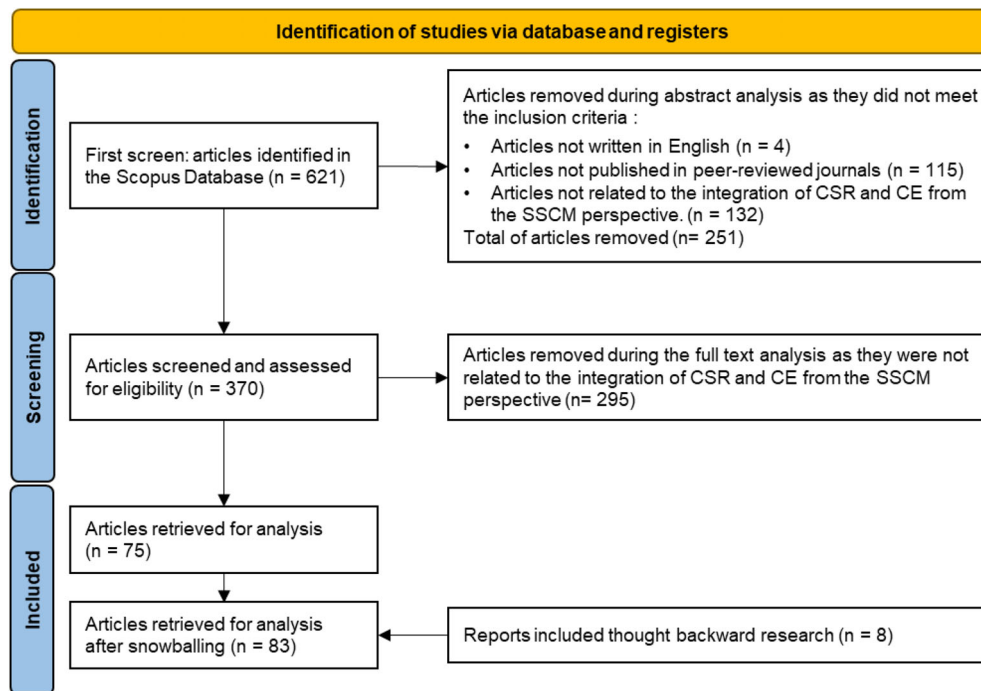


FIGURE 2 The preferred reporting items for systematic reviews and meta-analyses (PRISMA) model for the scoping review.

analysis identified emerging dimensions and elements related to the research topics (Seuring & Gold, 2012), following Mayring's (2008) process. First, the materials were gathered, and the unit of analysis was established. The second step involved a descriptive analysis, during which the material was assessed to support the initial classification of documents within each dimension. In the third step, these dimensions were refined through an interactive process that compared the content of the selected articles with the dimensions identified in the previous step. In the final step, the material was synthesized according to these analytical dimensions to contribute to both theory and practice. An inductive inference approach, as described by Ketokivi and Mantere (2010), was employed, wherein the dimensions were developed from the examined material using an iterative process of constructing, testing, and revising the dimensions through constant comparison with the literature. This phase was carried out to interrelate the framework's constructs and to develop guidelines organized into each dimension of TBL, encompassing findings for implementing CSR with a view to CE. The results of this analysis contribute to both theory and practice, synthesizing material according to analytic dimensions through an iterative process. It also provides a comprehensive overview of the literature on CSR and CE from the SSCM perspective, identifying gaps and opportunities for future research. Finally, in the last phase of the scoping review, the articles in the sample were grouped together, and their results were summarized and presented in the following sections of this article.

2.2 | Panel of experts

The second stage of the research consisted of interviews with experts through a panel, as Peters et al. (2015) suggested, which is

sometimes considered a sixth step of the scoping review. The panel of experts made it possible to delve deeper industry insights into the research topic, contributing to greater reflection on the findings carried out in the pre-liminary stage of the research, embracing both theory and practice, as recommended by Dresch et al. (2015). The purpose of the panel was to present information on concepts and findings, with the aim of absorbing words and understanding models of judgment and criticism on the targeted subject (Plummer, 2017). In this research, the expert panel was used as a technique to refine and validate the preliminary framework generated from the scoping review, along the lines of Tremblay et al. (2010).

The number of panelists and the knowledge they possess were the criteria used to choose these interviewees (Hopkins, 2007). The definition of the size of the panel considered the panelists' area of expertise and a research script for the panel. It included seven panelists with both academic and industry experience in SSCM, sustainability, CE and CSR. A heterogeneous group in terms of experience was sought, with young experts having at least 3 years of experience in the industry, and others more experienced, with at least 20 years of experience. All the interviewees had an academic background in areas related to the research, with three of them holding a PhD degree with articles published in first tier journals. The panel had an intermediary, who was one of the authors of this article, which is relevant to its success (Plummer, 2017).

The panel was conducted online via Google Meet and recorded with the experts' prior authorisation (Prieto-Sandoval et al., 2019). The panel was piloted with three experts, and the other four experts were included. The interviews were conducted separately and lasted between 1 and 2 hours (each). The online survey followed a formal procedure with several steps. Firstly, a form was sent to invite the panelists to participate in the survey, presenting the research goals

and providing information on protecting their data, based on (Khan et al., 2020; Machado et al., 2021). Next, the selected panelists received the material for a pre-analysis containing a contextualization of the research and the constructs of the framework to prepare for the stage of conducting a synchronous online interview with the intermediary. The synchronous online step included a brief introduction to the panelists of the topics of the CE, SSCM, and CSR to align the concepts between the interviewee and the interlocutor so as to ensure fluidity throughout the process and avoid misunderstandings. This stage also included a questionnaire focused on each construct of the preliminary version of the framework. All the results collected were then analyzed and discussed by the group of researchers associated with this research and an improved version of the framework was established. This version was then presented to the experts for a final round of validation where a consensus on the final version was reached.

3 | RESULTS

This section presents the research findings related to the constructs that support the development of the framework. The TBL approach analysis considers the economic, social, and environmental dimensions of sustainability, encompassing production and consumption in industrial systems and supply chain activities (Kusi-Sarpong et al., 2016). The environmental and social dimensions are the pillars of the sustainable supply chain and the economic dimension is built on these two pillars (Liu et al., 2017).

Regarding the environmental dimension, the notion of a circular supply chain deserves attention due to the issues of enormous waste generation, deterioration of environmental conditions and increased consumption of natural resources. Thus, the adoption of CE in the supply chain becomes critical due to the difficulties of barriers related to the implementation of CSR which correspond to the lack of support from top management and commitment to adhere to circular practices for the adoption of re-manufactured, recycled, and reconditioned products (Lahane & Kant, 2021). In SSCM, the relationship between environmental performance and business performance affects the implementation of its practices, specifically sustainable production and sustainable sourcing, as organizations determine their efforts toward SSCM practices according to environmental performance feedback (Kaiser et al., 2022; Shou et al., 2020). Companies will become more proactive toward environmental strategy when they perceive greater stakeholder pressure (Garcés-Ayerbe et al., 2012). CE can be a key element for companies to gain a competitive advantage by providing green product value to customers (Prieto-Sandoval et al., 2018).

Concerning the economic dimension, CE practices do not always lead to a direct improvement in the organization's performance, as the effects of implementing CE practices on financial performance must consider the mediating effect exerted by SSCM to make its operations more efficient and demonstrate the effects of sustainability on the organization's financial performance (Rodríguez-González

et al., 2022). Moreover, CE improves the business models of individual firm, supply chain and society in a systemic way, reducing price volatility of resources and enhancing supply chain relationships and employment opportunities (Mokhtar et al., 2019). SSCM also deserves special attention in light of dynamic market developments, globalization, dependencies on foreign markets and imports, outsourcing, risks of SC disruption, or economic recessions (Lee et al., 2010).

In the social dimension, sustainability concerns have been increasingly addressed over the years, but more research is still needed to achieve more inclusive supply chains and to identify the main research gaps and trends regarding supply chain concerns to integrate social aspects (Bubicz et al., 2019). The social dimension is much less explored in the literature. This is due, for instance, to the difficulty of measuring social indicators and organizations' lack of interest and incentive to achieve significant gains in this area (Das & Shaw, 2017). In fact, most research focuses on the economic and environmental dimensions while neglecting the social dimension (Shoukoohyar & Seddigh, 2020).

The relationship of the four components of CE (circular inputs, product design, process design, circular flows) with TBL is necessary for a better supply chain management (Birasnav et al., 2022). The CE and circular business models generate value along the supply chain through the Rs with sustainable management and contextual considerations of circular business models (Ferasso et al., 2020). The result of this relationship is the intersection of each CE component with the TBL dimensions, connected by the Rs, as highlighted next.

Economic dimension considering the intersection with Circular Inputs: Legislation that obliges organizations to bear the cost of emissions of polluting substances, such as carbon dioxide, resulting from their economic activities is an effective approach to reducing emissions (Tseng & Hung, 2014). Reducing waste or raw materials throughout the production process, but especially from the beginning of the circular supply chain is also an effective approach and contributes positively to the economic dimension of TBL (Esfahbodi et al., 2016). Recycling is essential from the very beginning of circular supply chain management (Zhang et al., 2021). It is important to take recycling and remanufacturing into account even in the circular inputs component to better plan the economic dimension of TBL (Mastrocinque et al., 2022). Remanufacturing is necessary to achieve better management of the economic dimension of TBL in its alloy with circular inputs to determine which raw materials will be replaced in later components of the production process and in the circular supply chain as a whole (Kusi-Sarpong et al., 2016). Taking repair into account from the start of this process is also important so that throughout the circular chain, even from the component of circular inputs, there is an awareness of the need to repair minor damage to certain inputs (Kusi-Sarpong et al., 2019).

Economic dimension considering the intersection with product design: recycling has practical implications on two levels: the level of the individual actor and the level of the supply chain, since consumers' intentions to recycle products, supported by environmental responsibility, directly affect the economic performance of circular supply chains (Kumar, 2019). Considering the product design component,



worrying about recycling at this stage of the chain leads to cost savings and optimizes the organization's finances (Mastrocinque et al., 2022). This occurs at the intersection of the economic dimension of TBL and product design because it is necessary to save consumer goods and take advantage of this to carry out possible selective collection planning from the second component of circular supply chain management, with the aim of obtaining a leaner product design with a greater possibility of being made with recyclable materials, which leads to cost savings for organizations throughout this stage in the production process (Zhang et al., 2021). Remanufacturing must be considered in product design to understand this intersection with the economic dimension of TBL to determine possible replacements for product components and how much it will cost the organization to plan its production (Zhang et al., 2021). In this scenario, it is important to take remanufacturing into account to measure the costs of repairing damaged product components and optimize product design so that these costs are lower for the organization and its supply chain (Mastrocinque et al., 2022). Repairs also deserve to be highlighted when it comes to product design and the economic dimension of TBL, as it is necessary to be alert to minor damage to products and their design, since these repairs are also cost sources for the organization (Nazam et al., 2022).

Economic dimension considering the intersection with process design: recycling requires operational planning related to separate collection, which is important when discussing the economic dimension of TBL to optimize the process in the circular supply chain (Zhang et al., 2021). In addition, more efficient planning in the recycling process can lead to better solutions to the operational challenge related to the separate collection process (Mastrocinque et al., 2022). The economic dimension significantly affects sustainable management practices, which impacts supply and reuse in the supply chain process (Baig et al., 2020). An integrated resource efficiency index to evaluate economic efficiency contributes to the advancement and recovery of "green" SSCM (Koh et al., 2016). Taking remanufacturing into account at the intersection of process design and the economic dimension of the TBL is fundamental as it requires planning the process of replacing damaged components along the chain to establish the best possible design (Kazakova & Lee, 2022). This is relevant to solve operational challenges related to process design for replacing damaged components (Mastrocinque et al., 2022). Knowing how process design works to repair minor damage is shown to be a way of repairing the third component of circular supply chain management and contributes to solving any setbacks related to the costs of this process (Liu et al., 2017). Investigating the challenges and opportunities of how organizations can and will be able to restore economic growth and environmental management in the context of the CE paradigm is important for revenue generation (Park et al., 2010).

Economic dimension considering the intersection with circular flows: recycling appears as a part at the end of the process in circular flows, as it generates waste that needs to be used at the end of the production process through selective collection (Zhang et al., 2021). Recycling is shown as the movement of resources at the end of the production process in circular flows to save money through

selective collection, which contributes to better budget management for the corporation (Mastrocinque et al., 2022). SSCM helps to reduce the cost impacts caused by environmental degradation in relation to the economic sphere (Kausar et al., 2017). Remanufacturing is considered at the end of the production process and involves moving goods and resources that need replacing if they are damaged (Zhang et al., 2021). Remanufacturing generates savings because damaged components are replaced, which directly contributes to the organization's profits at the end of the production process (Mastrocinque et al., 2022). However, adopting SSCM practices does not necessarily lead to a repair in terms of economic cost performance (Esfahbodi et al., 2016).

Environmental dimension considering the intersection with circular inputs: recycling from the inputs brought in to be transformed into products is considered to determine which waste will be used in selective collection (Zhang et al., 2021). Recycling in this context involves taking care to continue the use of resources through selective collection, which contributes to environmental preservation (Mastrocinque et al., 2022). Organizations operating in emerging markets need to undertake sustainable management initiatives with a broader consideration of their results to reduce trade-offs in environmental performance (Esfahbodi et al., 2016). Remanufacturing to determine which damaged components should be replaced entails preserving the sustainable supply chain (Kusi-Sarpong et al., 2016). This replacement of damaged inputs from the beginning of the production process provided by remanufacturing serves to have a control of raw materials for preservation (Mastrocinque et al., 2022).

Environmental dimension considering the intersection with product design: recycling in product design is useful through the use of consumer goods in selective collection to continue and use the waste generated, which contributes to environmental preservation (Zhang et al., 2021). In addition, recycling helps to create new consumer goods and to control better the raw materials of these products and their preservation (Mastrocinque et al., 2022). Environmental factors in supply chain management have become a highly relevant topic for researchers and professionals in closed-loop supply chains, considering reverse logistics, reuse and product life cycle analysis (Brandenburg et al., 2014; Maldonado Paes et al., 2022). Remanufacturing is necessary for sustainable product management strategies with an emphasis on collecting discarded products at the end of their useful life (Hickle, 2017). Remanufacturing involves the replacement of damaged product components, and this, from an environmental point of view, works as a way of giving continuity and use to these products (Zhang et al., 2021). In Remanufacturing, this replacement of damaged components in products contributes to preserving consumer goods (Mastrocinque et al., 2022). Repair is necessary to repair minor damage to products, which in the environmental context of product design means greater control of raw materials to preserve these products and also to give them continued use (Mastrocinque et al., 2022). Environmental issues call sustainable production and consumption in closed-loop supply chains that increase competitiveness by recovering used products and reaching CSR (Koketsu et al., 2022).

Environmental dimension considering the intersection with process design: The Rs of CE including recycling are fundamental to the process of maintaining circular supply chain management (Lahane & Kant, 2021). Recycling and its planning for selective collection is a process design tool to overcome environmental preservation challenges (Zhang et al., 2021). Recycling contributes through selective collection to solving problems related to the preservation and continued use of resources throughout the chain (Mastrocinque et al., 2022). A SSCM framework is ideal for repairing the impacts of sustainable development on supply chain participants (Liu et al., 2017). CE and process changes in consumption patterns lead to the adoption of remanufacturing and more sustainable designs and operations (Kazakova & Lee, 2022). Remanufacturing involves replacing the components of damaged products, which contributes as a solution to environmental preservation and control of raw materials and resources (Mastrocinque et al., 2022). Recovery of “green” SSCM in process design works as a tool to solve operational challenges along this chain through an integrated and sustainable index (Koh et al., 2016). Restoration to return the product to its original state involves continuing the use of re-sources and serves to overcome operational challenges in the environmental area (Mastrocinque et al., 2022). Organizations implement different biodiversity management practices, which reduce the negative biodiversity outcomes or even contribute to the restoration of biodiversity in the environmental aspect throughout their process design (Salmi et al., 2023).

Environmental dimension considering the intersection with Circular Flows: The circular supply chain encompasses multiple dimensions, including closed-loop supply chains, remanufacturing, recycling, and industrial symbiosis (Zhang et al., 2021). Recycling involves controlling raw materials through selective collection and facilitates the movement of resources at the end of the production process for environmental preservation (Mastrocinque et al., 2022). Reduction to save the amount of waste and reduce consumption provides care to continue using resources (Esfahbodi et al., 2016). Reduction also makes moving resources and controlling raw materials easier for preservation at the end of the production process (Tiep Le et al., 2021). Remanufacturing by replacing damaged product components enables greater environmental preservation at the end of the process (Lahane & Kant, 2021). Remanufacturing with the replacement of components entails continuity in the use of resources and ease of moving them at the end of the production process (Mastrocinque et al., 2022). In recycling, reverse supply chain management through the collection and remanufacturing of used and end-of-life products plays an important role in improving environmental sustainability (Jia et al., 2023).

Social dimension considering the intersection with Circular Inputs: Recycling that generates waste to be used through selective collection facilitates the entry of inputs to be transformed into products (Zhang et al., 2021). Recycling through this use of waste contributes to meeting stakeholders' needs for a more sustainable supply chain (Mastrocinque et al., 2022). Reuse gives materials a new lease of life and reduces waste, transforming the input of materials into products leaner and more socially responsible (Sgarbossa & Russo, 2017). Reduction to save waste and reduce consumption involves inclusion,

diversity, and cooperation of stakeholders for greater preservation from the start of the production process (Tseng & Hung, 2014). Recovery aimed at utilizing resources that have been degraded becomes necessary for inputs to be transformed into product again and thus meet the needs of stakeholders with better planning from the beginning of the chain (Chou et al., 2022). Production and consumption in industrial systems and Remanufacturing activities in the supply chain are necessary to develop, evaluate and select essential green supply chain management practices as a goal for the successful implementation of SSCM (Kusi-Sarpong et al., 2016). Remanufacturing, which involves replacing the components of damaged products, requires the cooperation of stakeholders to ensure that this replacement takes place in the best possible way from input to product transformation (Mastrocinque et al., 2022).

Social dimension considering the intersection with Product Design: Recycling contributes to the creation of new consumer goods through selective collection, and this leads to meeting the needs of stakeholders concerning product design (Zhang et al., 2021). Recycling also contributes to stakeholder diversity and inclusion by creating jobs for those involved in the selective collection (Mastrocinque et al., 2022). Remanufacturing to replace damaged product components contributes to meeting stakeholder needs in relation to the consumer good created (Ball et al., 2022). The circular supply chain encompasses re-manufacturing and contributes to the inclusion and diversity of stakeholders involved in creating consumer goods and replacing damaged items to obtain the best product design for both consumers and the organization (Zhang et al., 2021). Remanufacturing with the replacement of components also contributes to meeting the needs of stakeholders and helping the organization to create the most advantageous consumer goods to meet the needs of internal and external stakeholders (Mastrocinque et al., 2022). Waste produced in the supply chain must be reused, avoiding the disposal of different materials through resource recovery activities that allow waste to be returned to the main supply chain as valuable inputs to set up a new supply in that chain (Sgarbossa & Russo, 2017). Repair, which consists of repairing minor damage to materials or products, is also a way of meeting the needs of stakeholders, including consumers, and this contributes to product design because it improves the consumer good created and builds customer loyalty for the organization (Nazam et al., 2022).

Social dimension considering the intersection with process design: recycling through selective collection contributes as a tool to overcome the chain's operational challenges and meets the interests of stakeholders who value a chain with a leaner process design (Zhang et al., 2021). Recovery aimed at using resources that have been degraded is a solution in process design, as it makes stakeholders inclusive and collaborative along the chain to overcome operational challenges (Koh et al., 2016). Remanufacturing that involves replacing components of damaged products meets the social dimension, as it involves inclusion, diversity, and meeting the needs of stakeholders and also contributes as a tool for operational development along the chain (Kazakova & Lee, 2022). An intelligent approach in the decision-making process based on the principles of TBL with remanufacturing



and recycling is essential for the sustainable development of the circular supply chain (Mastrocinque et al., 2022). Repairs, which consist of repairing minor damage to materials or products, meet the needs of consumers in particular, build customer loyalty and, for the organization, act as a tool to solve operational challenges relating to process design (Liu et al., 2017).

Social dimension considering the intersection with Circular Flows: In recycling, the waste generated to be used through selective collection is moved as goods and resources at the end of the production process (Zhang et al., 2021). Recycling requires the involvement of stakeholders in the movement of information and inclusion in the circular supply chain to carry out selective collection (Mastrocinque et al., 2022). SSCM helps to reduce inequalities and improve social implications (Kausar et al., 2017). Reduction helps to save waste and reduce consumption for stakeholders, including customers, and also requires the inclusion and diversity of organizations for this to happen at the end of the production process (Tiep Le et al., 2021). Systematically comparing the status of sustainable consumption and production and its direction from the perspective of developing and developed countries is necessary to reduce the differences between the conditions and socio-cultural factors of sustainable consumption and production (Wang et al., 2019). Remanufacturing that involves replacing the components of damaged products helps meet stakeholders' needs and foster inclusion and collaboration between them (Zhang et al., 2021). Remanufacturing with this replacement of damaged product components makes it feasible to move goods and resources at the end of the production process (Mastrocinque et al., 2022).

Organizations seek to include these themes within their operations, but have found it difficult to implement them successfully, as they have to address the concerns of different stakeholders with varying demands (de Menezes et al., 2022). To include these diverse groups and serve disadvantaged populations, the new challenge is to evolve CSR strategies and create shared value among stakeholders (Houé & Duchamp, 2021; Nassar et al., 2019). In fact, there is a paradigm shift in supply chain management, incorporating the real needs of the people who participate in and benefit from operations (Sordi et al., 2022; Sunar & Swaminathan, 2022). CSR strategies involve social, environmental, economic, ethical, human rights and consumer concerns in organizations' business to play a supporting role with voluntary policy measures and complementary regulation of actions that generate social responsibility. The link between the constructs serves as a tool for delimiting guidelines corresponding to each dimension of the TBL utilizing promoters, as highlighted next.

Employees and management focus their efforts on implementing sustainable management at various levels and implementing green supply chain management practices to ensure the sustainability of their business (Luthra et al., 2015). In addition, these promoters influence corporate social performance through corporate culture (Shi & Veenstra, 2021). Management action is necessary to eliminate risk to establish a sustainable supply chain in terms of technological, environmental, and strategic sustainability in relation to all dimensions of sustainability (Mangla et al., 2022).

Customers need to meet society's demand for awareness at both organization and customer level to encourage the adoption of sustainable measures and gain competitiveness through stakeholder pressure (Baig et al., 2020). The involvement of primary stakeholder groups such as customers, usually occurs in social initiatives motivated by adopting sustainable practices in the chain (Morais & Silvestre, 2018). With this in mind, meeting stakeholder pressure to improve the level of customer satisfaction contributes to the smart and sustainable supply chain (Sharma et al., 2022). Dedicating resources and time to engage customers in product and process development leads to sustainability maturity (Salvador et al., 2023). Social and economic sustainability performance needs to be analyzed in terms of demand planning, innovation, manufacturing, finance, sales and customer relations, distribution and delivery, and compliance according to the TBL's economic and social dimensions (Guo & Wu, 2022).

Trading partners are key to meeting an organization's sustainability goals (Manavalan & Jayakrishna, 2019). Sustainability issues in the supply chain can be addressed by financial aid and incentives to trading partners in the sustainable supply chain (Shaw et al., 2022).

Suppliers are key to the practice of CSR related to CE, because it is necessary to list sustainable supplier technology in the era of CE and Industry 4.0 (Xie et al., 2022). Suppliers and their actions can be improved to further incorporate innovation strategies and end-of-life management activities within organizations' CSR activities (Hickle, 2017). Suppliers are needed to accelerate the shift in focus toward sustainability and make use of technology to meet the organization's sustainability goal (Manavalan & Jayakrishna, 2019). They are also important for putting SSCM into practice (Chand & Tarei, 2021). Additionally, suppliers contribute to reducing risks for focal companies by meeting stakeholder expectations regarding sustainability (Jamalnia et al., 2023), as social integration has a synergistic effect of increasing sustainable sourcing, which is further strengthened in supply chains in relation to suppliers and sustainable production (Shan et al., 2022).

Competitors serve as a parameter to highlight promoters and their relationship with Industry 4.0 to improve sustainability efforts in relation to competitors themselves (Ghosh et al., 2020). The aim of highlighting competitors is to investigate how to integrate CE and Industry 4.0 into SSCM to improve operational efficiency and sustainability performance (Lu et al., 2024). Investors collaborate to encourage sustainability practices, culture, and collaboration (Chopra et al., 2021). In addition, investors are needed to make SSCM innovation financially available in their quest to adopt and implement sustainable supply chain innovation practices (Gupta et al., 2020).

The government is of paramount importance in supply chain management because the process of moving to a sustainable supply chain is complex and it helps to achieve this effectively through policies and legislation, which are the main causal factor of sustainability (Menon & Ravi, 2021). Through government regulations, the government encourages the implementation of a sustainable supply chain and helps organizations build a strategy to implement sustainability in their supply chains and achieve economic stability (Jalilian & Mirghafoori, 2019).

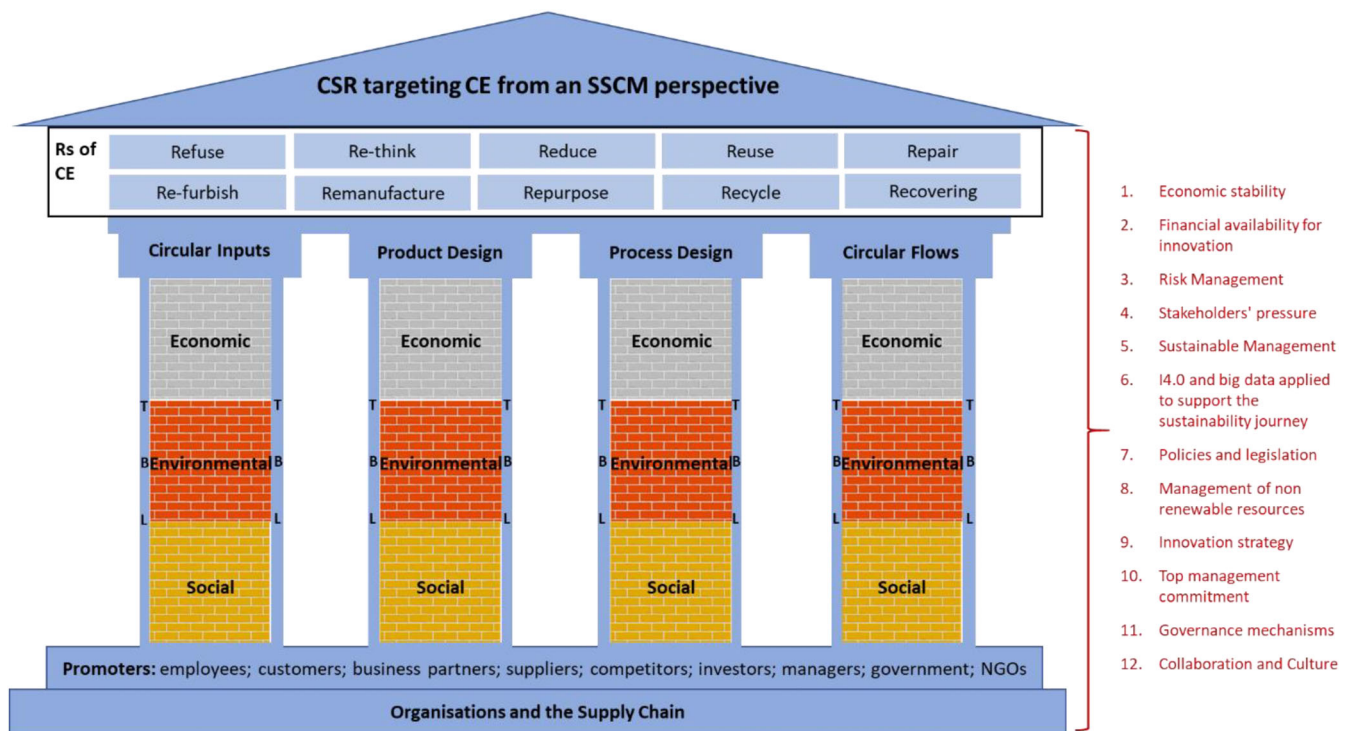


FIGURE 3 Framework for corporate social responsibility (CSR) aiming at circular economy (CE) from the perspective of sustainable supply chain management (SSCM): Building blocks for 15.0.

Finally, the involvement of additional NGOs seems to be the norm for social initiatives motivated by the formulation of more sustainable policies and legislation (Morais & Silvestre, 2018). This promoter is identified as highly important in the involvement of CSR practices with regard to sustainable development (Ye et al., 2020).

4 | DISCUSSION

Building upon the constructs presented in the previous subsection, Figure 3 illustrates the proposed framework for CSR aiming CE from the perspective of SSCM with the respective implementation guidelines. The framework works on the basis of the supply chain structure and the promoters responsible for carrying out each component of CE (i.e., circular inputs, product design, process design and circular flows), which are interconnected as if they were “beams” that support the “pillars” of the “house.” According to Expert 2, the “house” has a structure similar to the lean manufacturing model. These “pillars” comprise building blocks distributed into the TBL dimensions, which are necessary for sustaining this “house” and implementing CSR with a view to CE. The “roof” of the “house” hosts the Rs of CE. All the constructs work together to implement CSR with a view to CE from an SSCM perspective. This implementation can be carried out through 12 guidelines, as described next. It is important to note that the way in which the framework's constructs behave and play their roles, as well as the implementation of the guidelines, can be influenced by the context studied. This corroborates Expert 1, who suggests including

the issue of flexibility in selecting the 12 guidelines depending on the moment or maturity of the organization. Expert 3 highlights the need to assess the degree to which promoters influence the guidelines for conducting CE and CSR.

Legitimacy theory, which posits that successful organizational operations require conformance with community expectations to be deemed “legitimate,” provides a crucial backdrop to this framework (Deegan, 2019). Within this theory, organizations are seen as part of a broader social system without an inherent right to resources. This perspective explains why companies report on their social and environmental performance and is widely applied in sustainability literature (L'Abate et al., 2024; Vourvachis & Woodward, 2015). Legitimacy theory also plays a significant role in other research fields, suggesting that companies use legitimacy strategies to align their identity and conduct with societal norms, potentially improving transparency and stakeholder relations (Zampone et al., 2023).

Legitimacy theory highlights the crucial role of social norms, ethical values, and human actions in the context of business operations, particularly in the digital age (Huang & Shen, 2024). As businesses (e.g. networked enterprises) increasingly operate within the digital world, the need for legitimacy, both internal and external, becomes more pronounced (Wang & Cardon, 2019). Internal legitimacy focuses on actions, norms, and values within the economic system, significantly influenced by Internet developments. External legitimacy, on the other hand, pertains to the interactions between the economic system and its broader environment, encompassing natural, social, and artificial spheres. This dual nature of legitimacy underscores the



necessity for businesses to align their operations with ethical values and social norms to maintain their license to operate and secure necessary resources (Gonzalez, 2020).

To gain legitimacy, companies typically adopt strategies that involve conforming to existing institutional regimes, selecting supportive environments, or manipulating environmental structures to create new legitimating beliefs. These strategies range from passive conformity to active manipulation (Oliver, 1991). While legitimacy is a strong motivator for CSR engagement, other factors also play a role, such as the alignment of CSR with core business strategies to enhance both social and financial performance (Babiak & Trendafilova, 2011). Firms increasingly recognize that environmental responsibility can aid in accessing resources, easing capital constraints, and signaling compliance with societal expectations, thus enhancing both political and business legitimacy (Amaeshi et al., 2016).

The first guideline is economic stability. The promoters responsible for its implementation are generally the government and management. It is the most influential guideline that can affect sustainability goals and is useful in designing the supply chain management strategy to achieve its sustainability goals, including the economic dimension of TBL (Wan Ahmad et al., 2016). All 7 experts interviewed agreed that the main challenge is to reconcile this economic stability with social and environmental aspects. This alignment underpins the organization's cognitive legitimacy by ensuring financial viability that aligns with sustainability objectives, a fundamental perception of an organization's legitimacy (Suchman, 1995).

The second guideline corresponds to financial availability for innovation. The promoters responsible for this guideline are mostly the investors. Expert 4 suggested specifying an investor within the promoters, which are development agencies. Expert 6 emphasized that this guideline is important to connect product design and process design. The effects of the implementation of CE practices on financial performance should consider the mediating effect exerted by SSCM to make its operations more efficient and demonstrate the effects of sustainability on the organization's financial performance through financial availability for innovation in the production process (Rodríguez-González et al., 2022). This contributes to pragmatic legitimacy by showcasing the organization's commitment to technological advancement and sustainability. Sustainability depends on innovation and the importance of financial availability for SSCM innovation cannot be underestimated because it is a critical criterion for sustainable innovation (Kusi-Sarpong et al., 2019).

The third guideline is risk management. The promoter responsible for this guideline can be the management that identifies the risk at each stage of the supply chain process, which makes it a paramount in sustainable supply chain risk management (Mangla et al., 2022). A sustainable supply chain risk management framework is necessary as economic risk management dominates environmental and social risk management (Warasthe et al., 2022). Risk management is integral to the management and performance of sustainable supply chains and offers a prioritization of sustainability initiatives that can be applied by professional sustainability experts (Reefke & Sundaram, 2017). Expert 6 pointed out that it is important to consider not only the

economic risk, but also the social and environmental risk linked to this guideline. In addition, expert 4 added operational risk as also to be to consider herein. Effective risk management enhances moral legitimacy by demonstrating ethical considerations in organizational practices.

The fourth guideline is stakeholders' pressure. Customers can be responsible for this guideline as well as government, investors, and NGOs. Expert 1 suggested adding investors as a responsible promoter since they exert great pressure to assert their interests. There is a positive effect of stakeholder pressure on green economic incentives for SSCM (Centobelli et al., 2021). Since an organization or its supply chain can achieve the TBL view for sustainability if it manages to raise the social status of its stakeholders (Singh & Srivastava, 2022). Organizations' commitments to CSR initiatives are demonstrated by the commitment of organizations' resources to building relationships with the community and their stakeholders and this process involves pressure from stakeholders (Patuelli et al., 2022). Expert 6 indicated that this guideline applies to process design and product design to the social, environmental, and economic dimensions as stakeholders are pushing for the product to be cheaper, ecologically sustainable and with a socially responsible internal policy on the part of organizations throughout the production process. This aligns with the cognitive legitimacy, as responding to stakeholders' demands enhances the organization's legitimacy perception.

The fifth guideline deals with sustainable management. Those promoters responsible for implementing this guideline are generally employees, management, government, and suppliers. Managers have considerably improved sustainable management within the organization over time with in-organization procedures ranging from formulating environmental strategies to reviewing the results achieved to ensure continuous improvement of sustainable management (Grekova et al., 2014). This guideline is based on the role of the supply chain relationship with sustainability to improve CE capacity through government, employees, and suppliers (Centobelli et al., 2021). CSR is related to sustainable management, which is necessary for the evolution of research in this field and for supply chain management (Ye et al., 2020). Environmental performance affects the implementation of SSCM practices, specifically sustainable production and sustainable sourcing (Shou et al., 2020). Although several studies examine the impact of CSR on organizations, there is still a significant gap in knowledge about the links between CSR, sustainable consumption and production and green supply chain management and how they collectively contribute to sustainability (Hu & Chen, 2023). This is why, according to expert 6, it is necessary to consider the three TBL dimensions in sustainable management. This guideline enhances moral legitimacy by integrating ethical considerations into business operations.

The sixth guideline is I4.0 and big data applied to support the sustainability journey. Big data technologies have triggered a paradigm shift in supply chain decision making toward profitability and sustainability with an organizational vision of environmental performance and a willingness to optimize materials and energy crucial to the environmental and social sustainability of the supply chain (Jain



et al., 2022). Smart technologies by connecting industry 4.0, sustainability and CE, can be integrated into the supply chain as a business strategy to increase collaboration and cooperation between the different levels of the supply chain to achieve sustainable development goals (Kayikci et al., 2022). The impact of digital transformation present in I4.0 and big data on green supply chain management is a mediator in the correlation with sustainable development in the environmental, social and economic dimensions of TBL (Ma et al., 2023). In this context, their integration enables the transition from the linear concept to the CE concept (Daú et al., 2019). In addition, green supply chain management and CE practices mediate the influence of I4.0 technologies, contributing to sustainable supply chain performance because the adoption of I4.0 technologies drives the construction of a modern and sustainable supply chain and significantly and positively affects sustainability performance (Karmaker, Al Aziz, et al., 2023). Big data analytics capabilities significantly contribute to supply chain risk management and innovative green product development that ultimately enhanced innovation and learning performance leading to a significant and positive relationship with sustainable supply chain performance (Nisar et al., 2022). The promoters responsible for execution can be business partners, suppliers, and customers. This guideline becomes necessary to meet changing customer requirements because suppliers and business partners need to accelerate the shift in focus toward sustainability and make use of technology such as Big Data, to meet the organization's sustainability goal and carry out the Industry 4.0 transformation from a sustainability perspective (de Mattos Nascimento et al., 2022; Manavalan & Jayakrishna, 2019). Suppliers, business partners can effectively contribute to improving SSCM using Big Data in various industry sectors and explore the use of artificial intelligence to make supply chain management more sustainable (Damoah et al., 2021). This aligns with pragmatic legitimacy by demonstrating technological leadership and efficiency improvements.

Continuing with the sixth guideline, the need for innovation with regard to customer demands with Industry 4.0 provides evidence of the impact on the performance of SSCM. The implementation of big data and I4.0 has the potential to improve sustainability at the organization and supply chain levels and improve the effectiveness of the TBL dimensions in supply chain management (Mastos et al., 2020). The relationship of SSCM with Industry 4.0 by these promoters has a significant effect on the organization's adoption of Big Data and contributes to achieve successful SSCM (Narwane et al., 2021). Moreover, other technologies for example Quantum computing has the potential to revolutionize various industries, including supply chain management because this can lead to significant cost savings and improved efficiency in supply chain operations (Awan et al., 2022) Expert 5 states that this guideline, taking technologies into account, impacts the economic aspect, the social and environmental aspect and the design of the process, as well as circular inputs and circular flows. Both for manufacturing, cost, and disposal of these technologies.

The seventh guideline corresponds to policies and legislation. The government is mainly responsible for this guideline, but other

promoters play an important role as NGOs, business partners and customers. Expert 4 mentions that some agencies monitor the implementation of this legislation. Expert 6 states that all dimensions of TBL are impacted by this guideline, emphasizing the social one. The lack of rigorous implementation of government laws and policies and the lack of financial support from the government and bodies such as NGOs and business partners are barriers related to the implementation of social sustainability issues in the supply chain that can be addressed by increasing customer awareness and coercive pressure from regulatory bodies (Shaw et al., 2022). Policy and legislation are considered fundamental guidelines, which are important for implementing supply chain management in the industry (Kausar et al., 2017). Policies and legislation related to the promotion of tax strategies contribute to sustainable practices and environmental concerns in supply chains, which indicates that the successful implementation of sustainable practices increases the impact of taxation and environmental strategies in promoting sustainability in the supply chain and also the positive influence of taxation strategies on sustainable and environmental responsibility (Zobi et al., 2023). This supports cognitive legitimacy by ensuring compliance with legal standards and societal expectations.

The eighth guideline is the management of non-renewable resources. The government is a main responsible for this guideline, however other promoters can also play an important role herein. It is important to think about managing these resources because they cannot be reused at the end of the production process. Managing the consumption of non-renewable resources is among the most important infrastructures that can effectively manage business challenges in the sustainable chain (Jalilian & Mirghafoori, 2019). By managing the consumption of non-renewable resources, the government is thinking about how best to make them as environmentally friendly as possible, which contributes to more SSCM (Jalilian & Mirghafoori, 2019). Expert 4 adds that the role of organizations responsible for disposing of the non-circular product should be considered together with the government in this guideline to make this disposal as environmentally friendly as possible.

The ninth guideline is Innovation Strategy. It is necessary because it provides managerial and political insights to guide the formation of a strategic operations structure and resource allocation for organizations in their quest to adopt and implement sustainable innovation practices in the supply chain. The promoters responsible for its execution are generally suppliers, management, and employees, as they are the ones who provide the raw material, decision-making power and manpower to overcome the barrier related to innovation strategy in SSCM. These barriers to innovation strategy are related to lack of technical expertise and training, lack of R&D and innovation capacity, popularity of traditional technologies, high initial investment in cutting-edge technology, fear of extra workload, and loss of flexibility (Gupta et al., 2020). Expert 4 pointed out that besides the promoters mentioned, the customer's problem drives innovation; the commercial partner also influences the organization's innovation strategy. This aligns with moral legitimacy by promoting responsible innovation aligned with societal values.



The tenth guideline is top management commitment. The promoter responsible for this is management itself. The management practices that organizations can implement to design an CE business model and create and capture value are fundamental to achieve a value proposition and interface for the customer through the commitment of senior management (Ünal et al., 2019). Thus, the adoption of CE in the supply chain becomes critical due to the barrier difficulties related to the implementation of CSR which corresponds to the lack of top management support and commitment to adhere to circular practices for adopting the CE Rs (Lahane & Kant, 2021). Organizations' commitments to CSR initiatives are demonstrated by the commitment of organizations' resources, including the duty of senior management to building relationships with the community and its stakeholders (Patuelli et al., 2022). Moving to a sustainable supply chain is complex, but top management commitment helps build a strategy and promptly assess the capacity to implement sustainability in supply chains (Menon & Ravi, 2021). Green supply chain management targets the environmental dimension of sustainable development, which shows the impact on the approval of SSCM practices, considering the importance of early adoption of environmental practices through the commitment of top management (Amrani Souhli et al., 2023). Expert 6 states that top management commitment is important in transitioning to I4.0. A lack of commitment can become a barrier to digital transformation. In addition, a lack of skilled labor can have a negative effect on this guideline.

The eleventh guideline is governance mechanisms. The promoters responsible for its execution are mainly management and government because they monitor the sustainability dimensions of these governance mechanisms, which are related to compliance and performance management. Governance mechanisms are integral to the management and performance of sustainable supply chains and offer a prioritization of sustainability initiatives formulated by management and government that can be applied prescriptively by professional sustainability experts (Reefke & Sundaram, 2017). Governance mechanisms influence the social performance of supply chain management and even contribute to the management of the industry's reverse supply chain (Flygansvør et al., 2018). Expert 7 mentions that in addition to TBL, ESG is on the rise when the context is related to governance mechanisms. Expert 4 points out that it is important to consider investors, as organizations controlled by investors demand robust governance mechanisms. This guideline strengthens moral legitimacy by ensuring that ethical governance standards are upheld.

The twelfth guideline is collaboration and culture. The promoters responsible for its implementation are generally employees, management, and investors, because the relationship and collaboration between them determines the organization's culture internally and externally. The influence of corporate social performance on corporate financial performance depends on culture. Specifically, corporate financial performance is higher in organizations where CSR initiatives are congruent with the cultural environment (Shi & Veenstra, 2021). Collaboration and culture between and within organizations influence sustainable performance's environmental, economic, and even social components (Flygansvør et al., 2018; L'Abate et al., 2024). There is an

incipient relationship between collaboration and culture and the sustainable supply chain, because the promoters mentioned employees, management and investors are focused mostly on economic and environmental dimensions of sustainability while neglecting the social one (Shoukhyar & Seddigh, 2020). The sustainable supply chain becomes necessary to meet the organization's sustainability goal from important supply chain management perspectives necessary for business, technology and sustainable development through a management strategy involving collaboration and culture (Manavalan & Jayakrishna, 2019). Expert 4 stated that all promoters are involved in this, for example, organizations should collaborate with suppliers, as well as business partners, NGOs and even benchmarking competitors to collaborate with each other. This guideline enhances cognitive legitimacy by fostering a collaborative culture aligned with societal values.

Therefore, the 12 guidelines integrate into three categories of legitimacy strategies. Pragmatic legitimacy strategies focus on demonstrating commitment to technological advancement and operational efficiency. The guidelines concerning financial availability for innovation, I4.0 and big data application, and collaboration and culture highlight the importance of innovation and technological leadership. By showcasing the ability to innovate and efficiently utilize resources, organizations can enhance their pragmatic legitimacy, appealing to stakeholders who prioritize economic and operational benefits. Moral legitimacy strategies, on the other hand, emphasize ethical governance and responsible innovation. Guidelines such as risk management, sustainable management, governance mechanisms, and management of non-renewable resources reflect the organization's ethical considerations and responsibility toward society. These strategies enhance the organization's moral legitimacy by ensuring that business practices align with societal values and ethical standards. Cognitive legitimacy strategies are deeply rooted in maintaining fundamental perceptions of legitimacy, which are challenging to alter. Economic stability, stakeholder pressure, policies and legislation, and top management commitment guidelines ensure that the organization's operations align with societal expectations and legal standards, reinforcing its cognitive legitimacy.

Furthermore, the 12 guidelines also align with the three models of business legitimacy. The economically and legally responsible corporation (Type I) focuses on economic success and legal compliance. Guidelines such as economic stability, financial availability for innovation, risk management, and policies and legislation are critical here, as they ensure the organization's financial viability and adherence to legal standards. The ethically and socially responsible corporation (Type II) goes beyond economic and legal criteria, incorporating ethical norms and social responsibilities. Guidelines like sustainable management, stakeholder pressure, governance mechanisms, and management of non-renewable resources align with this model, emphasizing the need for ethical practices and social responsibility (Rendtorff, 2019b). The proactive corporation (Type III) integrates economic success, legal responsibility, and proactive legitimacy strategies. This model is reflected in guidelines such as I4.0 and big data application, innovation strategy, top management commitment, and

collaboration and culture, highlighting the organization's proactive stance on sustainability, innovation, and ethical governance. These guidelines demonstrate how CSR and CE approaches can enhance organizational legitimacy by integrating economic, social, and environmental dimensions.

Finally, this transformational framework comprises 12 guidelines that can be considered as building blocks for the I5.0 transition, as they align with the vision of human-centric, flexible, and regenerative production. The shift to I5.0 requires modern organizations to interact closely with their external environments. The guidelines facilitate this transition by promoting sustainability, innovation, and collaboration. For instance, the integration of I4.0 technologies with CE and CSR practices aligns with the I5.0 vision by enhancing SSCM. The guidelines concerning sustainable management, governance mechanisms, and stakeholder pressure ensure that organizations adhere to ethical standards and societal expectations, fostering a collaborative culture (Rendtorff, 2019a). This interdisciplinary approach to business legitimacy integrates economic, social, and environmental aspects, ensuring that modern organizations can adapt to changing external environments and stakeholder demands. By aligning with these guidelines, businesses can develop new models that are not only economically viable but also socially responsible and environmentally sustainable, supporting the overall legitimacy and resilience of the organization in a dynamic business landscape. This artifact involves various stakeholders (e.g., government, management, investors, customers, suppliers, NGOs, and employees), emphasizing the role of innovation, technology, circularity, risk management, and collaboration in achieving sustainability goals. The integration of these guidelines ensures a comprehensive approach to sustainability, fostering legitimacy and supporting the transition to a more sustainable and resilient supply chain ecosystem.

The framework of the 12 guidelines aligns closely with sustainable solutions to the global climate problem by fostering corporate practices that integrate the Sustainable Development Goals into their core operations (Rendtorff, 2023). The UN's SDGs emphasize a sustainable future for humanity, and businesses play a crucial role in achieving these goals. Businesses can adopt values-driven management to support sustainable development, by committing to producing renewable and green energy, integrating of sustainability into business strategy, demonstrating that economic success and environmental responsibility can coexist (Rendtorff, 2023). This approach, described as "shared value creation," shows how companies can contribute to a sustainable future for both business and society, thereby addressing the global climate challenge.

Industry 5.0, CE, and CSR are complementary paradigms that collectively aim to transform industrial systems toward greater sustainability and social benefit (Potočan et al., 2021). Industry 5.0 envisions human-centric and resilient manufacturing enabled by advanced technologies, with a focus on customization and worker wellbeing. This aligns closely with CE principles, which seek to design out waste, keep materials in use, and regenerate natural systems. Both concepts prioritize resource efficiency, innovation, and long-term thinking—key pillars of CSR as well (Morea et al., 2021).

The integration these can drive holistic value creation across economic, environmental, and social dimensions. For example, Industry 5.0's emphasis on human-machine collaboration and reskilling workforces aligns with CSR's focus on employee development and ethical labor practices (Ghobakhloo et al., 2023). Meanwhile, circular business models enabled by Industry 5.0 technologies can reduce environmental impacts while also addressing societal challenges like resource scarcity (Turner et al., 2022). By adopting these complementary approaches, companies can pursue responsible growth strategies that balance profitability with positive contributions to people and planet.

5 | CONCLUSIONS

The research introduces a ground-breaking CSR framework tailored for the implementation of CE within the context of SSCM, aligning with the imperatives of the I5.0 paradigm. The framework, meticulously derived from a comprehensive scoping review of 83 articles and further refined through expert input, comprises several key constructs, including the supply chain structure and promoters, organized around four pillars representing the components of CE and embracing the TBL dimensions. With its 12 guidelines, the framework stands as a practical tool, offering tangible implications for organizations aspiring to seamlessly integrate CSR with a focus on CE within the SSCM perspective.

The synergy between CSR and CE within the framework of I5.0 envisions a shift toward human-centric, flexible, and regenerative production systems. This transition is characterized by the proactive corporate citizenship model, which integrates cognitive, moral, and pragmatic legitimacy. Such a model requires businesses to go beyond mere compliance with market and legal norms, embracing broader ethical and social responsibilities. Adopting values-driven management, CSR, and global sustainability norms exemplifies this proactive approach, ensuring that businesses not only meet but exceed societal expectations (Rendtorff, 2019b). Thus, the practical application of concepts like CSR, SSCM, and CE emphasize ethical principles such as autonomy, dignity, integrity, and vulnerability, aiming to include stakeholders in decision-making processes. This transition from I4.0 to I5.0 highlights the importance of new business models that are responsive to societal needs and environmental sustainability, driven by political and ethical considerations (Rendtorff, 2019b).

Moreover, the integration of digital technologies with CSR and CE fosters sustainable business practices that are resilient and adaptable to changing environmental, social, and technological landscapes (Rendtorff, 2019a). By leveraging the digital technologies, businesses can enhance transparency, stakeholder engagement, and ethical governance, thereby strengthening their legitimacy in the eyes of the public. This holistic approach aligns with the principles of I5.0, promoting a balance between economic success and social responsibility, ultimately contributing to the development of sustainable and resilient supply chains that are vital for the future of business and society.

In terms of academic contributions, the article addresses a research gap in the literature regarding conceptual frameworks



dealing with the connection of CSR and CE, as well as with their related components. In terms of contributions to practitioners, the article offers an innovative artifact to support organizations in successfully implementing a holistic corporate sustainable vision in their industry settings. In terms of social impact contributions, the research provides greater awareness to various stakeholders of the need to implement CSR with a sustainability focus. For example, promoters will benefit from considering the CSR perspective when putting SSCM into practice. In this sense, it is also expected to better meet stakeholders' expectations and improve their relationships throughout their operations in the supply chain.

On a broader scale, the framework carries significant implications for corporate governance in the era of "Corporate Governance 5.0" (European Commission, 2022). It prompts a fundamental shift in the governance approach, steering away from short-term gains based on shareholder primacy toward a stakeholder-centric model. The framework, with its emphasis on a human-centered perspective, social sustainability through CSR, and the incorporation of regenerative and green supply chain management through CE, aligns directly with the principles of Corporate Governance 5.0. It provides a strategic tool for corporations to navigate this paradigm shift and meet the evolving expectations of stakeholders in a more inclusive and socially responsible manner.

Furthermore, the framework's implications extend to the pillars of I5.0—sustainability, human-centricity, and resilience. Guideline #4, addressing stakeholder pressure and emphasizing a human-centric perspective, directly contributes to human-centricity. Guideline #6 strategically integrating I4.0 and big data aligns with the sustainability pillar, leveraging digital technologies for circularity and sustainability. Guideline #11, highlighting governance mechanisms, is pivotal for resilience, ensuring organizational alignment with the I5.0 paradigm. Additionally, guideline #12, emphasizing collaboration and culture, underscores the importance of fostering resilience and adaptability in the face of dynamic industry landscapes.


This research also has limitations that offer avenues for future investigation. A first one is the focus only on peer-reviewed academic journals for the scoping review. Although they are well-known sources associated to research quality, peer-reviewed conference publications can be an additional source of valuable information for literature reviews and could be considered in future research. The use of just the Scopus database is an additional research limitation that could be overpassed in future research by the use of other databases as Web of Science and EBSCO. Another research limitation is associated with the need for a better understanding of the impact of contingencies on the application of the proposed framework. The framework is an artifact to support organizations in building CSR toward CE that offers flexibility in the selection of guidelines, depending on the moment or maturity of the organization, as well as the context analyzed. So, a guideline can be applied and interchanged in more than one of the four components of CE. It is therefore suggested that the influence of context on the application of the framework be explored further in future research, for example, through the lenses of contingency theory. Another suggestion would be to apply the

framework in an industry setting employing a single or multiple case study in an organization and thus make it possible to put the potential benefits generated into practice and continue with a further stage of refinement and validation of the framework. Additionally, although the TBL approach has been widely adopted within the different studies covered in this re-search, there is a need to explore more the social dimension of sustainability and its impact and influence in CSR aiming at CE, and relate it with diversity, equity, and inclusion, which is also recommended for future investigations. Another suggestion for future research is the linking on how emerging technologies, such as quantum computing (Awan et al., 2022), will change the SCCM, CSR and CE, which can provide a forward-looking perspective on the potential transformations in supply chain management. Finally, future investigations should enhance the framework's relevance in the evolving landscape of Corporate Governance 5.0 and I5.0.

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