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ORIGINAL RESEARCH

The Role of Entrepreneurship in Successfully Achieving Circular Supply Chain Management

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Abstract *The notion of circular supply chain management (CSCM) is increasingly attracting the attention of academia, practitioners, and other stakeholders. It entails putting circular economy policies into place across the whole supply chain and supporting the ecosystem. In addition to this, the instability of the business environment due to objective factors such as pandemics and wars requires the business world to be proactively flexible to respond to changes. Therefore, the present paper aims to respond to the call for further research and evidence on the connection between industrial symbiosis practices (ISP) and CSCM. Specifically, it empirically examined the role of entrepreneurship in facilitating CSCM to achieve its sustainability goals. Furthermore, we analyze the mechanism by which circular economy entrepreneurship promotes ISP, thereby bolstering up CSCM. The industry's concentration is on small and medium agrifood firms, which are already active competitors in emerging economies. By accumulating and evaluating primary data from questionnaire-based surveys of 486 valid replies from supply chain managers who manage at either senior or middle levels in the firm, the results provide insight into the optimization mechanisms for CSCM. These promote regenerative value and no-waste processes from a unique perspective. In this regard, this study undertakes an empirical examination and proves how circular entrepreneurship and industrial symbiosis practices drive CSCM to score its sustainability goals.*

Keywords Circular entrepreneurship · Circular supply chain management · Flexibility · Industrial symbiosis · Supply chain flexibility · Sustainability goals

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Introduction

Based on the findings of Kaza et al. (2018), it is projected that if the world persists on its current path following the traditional economic model, the global resource demand will grow significantly by 2050. In fact, it is estimated that the Earth's resource capacity will need to triple in order to meet the escalating consumption needs. In recent times, the circular economy (CE) model has emerged as a viable paradigmatic alternative to the conventional linear economic model. The proponents feel that this model will work in future to assist reach a high level of sustainability without impacting the business' profitability or limiting the number of clients or services offered. It is focused on maintaining the economic worth of resources toward their longest possible "value in use" rather than the "market exchange" (Groll, 1980) value associated with the linear economic model.

The CE's significance in addressing economic, social, and environmental issues is becoming more widely recognized, which has accelerated supply chain research (Khitous et al., 2020; Merli et al., 2018). Current literature in this area mainly focuses on terms and definitions of the

closed-loop economy. Commercial frameworks, logistics systems, sustainable materials, ecoparks, and industrial symbiosis are a few examples (Homrich et al., 2018). Furthermore, in the existing SCM literature, the integration of CE principles in SC is only modestly mentioned (Batista et al., 2018; Govindan & Hasanagic, 2018). In addition, Lahane and Kant (2021) emphasized the necessity for additional work on the supply chain's implementation of CE principles. In line with Harland (2021) and Govindan and Hasanagic (2018), many challenging areas prevent successful CE implementation. These include problems in scaling up materials to multiple stakeholders, cultural-related factors, governance, poor capabilities, and technologies.

Beyond, firms must be adaptable in their governance, strategy, and operational practices due to the recent wars in some countries and the uncertainties of the business climate caused by the COVID-19 pandemic (Dhar et al., 2022; Jaiswal, 2022). For CE, ecoindustrial networking is a well-defined method as an enabler of the circularity of materials in the economy (Chari et al., 2022). Therefore, ecoindustrial networking is part of an industrial ecosystem that can be seen as an alternative to the traditional way (going alone instead of going together) that helps businesses overcome their limitations, especially resources related to be vital and more efficient. In this context, practicing industrial symbiosis is considered as the flexibility in the way businesses operate to cope with unpredictable uncertainties in the business environment by taking advantage of each other's strengths for coexistence and development. Industrial symbiosis explains how a network of many organizations may support long-term cultural transformation and ecoinnovation jointly (Isenmann & Chernykh, 2009). Industrial symbiosis practices (ISP) are characterized by the management of shared resources among many enterprises within an established geographical area. There is a particular focus on the utilization of recycled materials (by-products, wastes from one entity) (Ashton et al., 2022).

Despite its importance, ISP have received little attention from the operations and SCM community (Herczeg et al., 2018). Indeed, research on ISP is scarce at the operational and process levels (Turken & Geda, 2020). Luthra et al. (2022) suggest that cross-industry collaboration (that is based on industrial symbiosis) is characterized by shared relationships, critical functions, resources, informative data, and capabilities which are essential for the effective application of CSCM. However, the existing literature mainly assesses the CSCM concept solely or independently from the perspective of one firm. It rarely explores the role of cross-collaboration in achieving joint CSCM.

In order to close the knowledge and application gap and produce a wealth of fresh experimental findings for the field, additional empirical study in this area of science is unquestionably required, which is in line with the most recent comparative review on the subject by Zhang et al. (2021). Additionally, to identify more impact correlations, industrial symbiosis approaches to SCM should also be further investigated (Turken & Geda, 2020). Furthermore, the food supply chain should be included to focus research on CSCM for a specific sector (Lahane & Kant, 2021; Luo et al., 2022).

This study applies the CE approach to understand how firms can enhance resource efficiency for sustainability (Colin David, 2020). From our perspective, the entrepreneur and entrepreneurship are central to the process of realizing CE. In this regard, personal motivation is very important for them to participate (Colin David, 2020; Kazancoglu et al., 2021). Based on the aforementioned arguments regarding the circular economy (CE) and industrial symbiosis (ISP), it can be assumed that integrating CE principles into entrepreneurship has the potential to foster ISP in the context of CSCM. This integration has the capacity to induce a profound transformation in entrepreneurs' perceptions, thoughts, behaviors, and actions. Nonetheless, the question that arises and needs to be answered is *how circular economy entrepreneurship associates with industrial symbiosis practices for achieving sustainable circular supply chain practices performance goals*.

The current literature demonstrates that policy-level sustainable development goals (SDGs) and corporate sustainability practices do not interact (Khaled et al., 2021). Therefore, it is difficult for businesses to imagine how their sustainable practices can contribute to realizing the SDGs of a country or the world. Furthermore, the majority of current research is model based and addresses abstract issues rather than being empirically grounded and addressing settings in a real-world application (Zhang et al., 2021). Consequently, it is important to show how a firm's efforts to put CE principles into practice are beneficial for both its overall success and the performance of the community at large. The current literature, particularly in the context of this research, is hazy on how industrial symbiosis practices and circular logistics systems management would mediate the connection between closed-loop economy entrepreneurship and sustainability performance targets.

Although the pressure to adopt the CE principles is increasing (De Jesus & Mendonça, 2018), there are many challenges in reality, especially for manufacturing enterprises (Parida et al., 2019). As reinforced by Jabbour et al. (2020), especially in emerging economies whose status is significantly dependent on SMEs, therefore, empirical evidence of CE adoption at the institutional level is crucial. The study focuses on SMEs in Vietnam's agrifood

industry. Based on the aforementioned backdrop and considering the Vietnamese market as an emerging economy in Southeast Asia, it can be said that this is a specialized empirical study.

In this study, agrifood is prioritized for analysis because of the urgency to deal with rapid population growth. The existence of by-products produced during the manufacture of the primary products is the biggest difficulty facing the agrifood business and its supply chain (Nattasha et al., 2020). Because they are commonly viewed as garbage, businesses frequently consider these by-products as waste, even when they first begin to exist (Gupta & Gupta, 2021; Khan et al., 2022; McDougall et al., 2019). This is because agrifood firms have largely entrepreneurial thinking and still follow a traditional economic model, which is leading to unsustainable practices.

Our research sought to undertake an empirical examination of how circular entrepreneurship (CEE) and industrial symbiosis practices (ISP) drive CSCM. Furthermore, we explore the mechanisms by which CEE impacts ISP, fosters CSCM, and smooths SG. In an uncertain environment, the transition toward sustainability through embedding CE principles into entrepreneurship (perception and thinking) and business practices (behaviors and actions) is argued to increase flexibility in how entrepreneurs respond to institutional challenges in the environment and stakeholder pressures. Therefore, in addition to filling the aforementioned study gap, this research is crucial, especially in light of the pandemic and war-related concerns. In this context, flexibility is essential for businesses to overcome fluctuations to survive. Theoretically, the relationship between CEE, ISP, CSCM, and SG can be disclosed by institutional and stakeholder theories.

Particularly, institutional theory clarifies how entrepreneurial behavior is standardized, reproduced, and socially dictated. Conforming to Boehmke and Hazen (2017), why do business owners in a particular industry sector have consistent behavior patterns and similar reactions to outside stimuli? With respect to the radical change required for transforming the linear economy to CE, institutional entrepreneurs are deemed critical to enabling this process to occur (Alonso-Almeida et al., 2021; Cantarelli, 2022).

In this regard, CEE is seen as a compliance by the entrepreneur to transform the traditional economic paradigm to that of the closed-loop economy. From the institutional theory's view, the entrepreneurial individual integrates circular economic principles into their entrepreneurial mindset, which governs their subsequent business activities and practices. This results in the promotion and realization of ecoindustrial networking practices.

From the standpoint of the stakeholder theory, businesses must think of the interests of all their various stakeholders. Thus, firms adopt sustainable practices because they understand that their obligations extend beyond maximizing profit. They also need to address matters that are crucial to their partners such as sustainability. Therefore, within this framework, this study is expected to further address the question of *what is the entrepreneurial logic in fostering the achievement of sustainability performance concerning the triple bottom line*.

The contributions of this research are threefold and novel. First, it contributes to expanding the existing knowledge in the areas of circular economy and entrepreneurship. This is done by offering empirical proof of the integration of circular economy principles into entrepreneurship that enables functioning CE through adopting CE practices. Second, it advances digging into the current supply chain management literature by providing a framework for SMEs in emerging economies in which it proves that integrating circular economy principles into entrepreneurship can enable circular supply chain management through industrial symbiosis practices. To this extent, these contributions are significant and novel for this research setting. Third, this research adds to extending institutional and stakeholder theory by giving evidence on operationalizing the relationship between CEE, ISP, CSCM, and SG in new settings. In an uncertain environment, this mechanism may afford building flexibility capabilities into the supply chain which is critical to addressing challenges to functioning CE (Bai et al., 2020). Beyond, this study offers a fresh viewpoint on how the Sustainable Development Goals (SDGs) can be realized from the perspective of collaboration between various levels of society (macrolevel: governmental level and microlevel: the business world). In this approach, the research explains to the corporate world how their efforts to create value help their stakeholders as well as themselves. In this way, the shift benefits not only them but also the greater community in terms of shared sustainability. This approach is promising in motivating entrepreneurs and inspiring others.

The structure of the research paper consists of seven sections. Section "Literature Review" presents an overview of the literature as well as the basic theoretical foundations that the research needs. Next, the research hypotheses, main relationships, and research model are handled in Sect. "Model and Hypothesis Development." In Sect. "Research Design and Methodology," the study design and techniques are presented. Then, Sect. "Results" deals with the outcomes of the study. Section "Discussion and Implications" provides the new outcomes of the study to discuss the findings in addition to some theoretical and practical ramifications. Finally, Sect. "Conclusion and Future Scope of Research" covers the conclusion, drawbacks, and potential study directions.

Literature Review

Both the research literature that will be used in this study and a full summary of the pertinent literature will be provided. The key findings that can be gleaned from the leading journals in the author's area of study are compiled in Table 1. It is clear that CSCM has a significant impact on corporate success and that industrial symbiosis is crucial for CSCM adoption. This will enrich the community and business developing exceptional values which highlight the crucial role that CEE plays in the value chain and strategy

Table 1 Summary of the literature review

References	Major findings/implications	Limitations
Farooque et al., (2022)	CSCM positively and significantly affects business performance metrics (i.e., revenues and costs) if it is undertaken as a consistent strategy	Business performance simply takes into account financial-related metrics; it ignores environmental and social factors. Sample population: Chinese manufacturing enterprises across different industries. They recommend that future research work should be industry or group-specific based
Luthra et al., (2022)	Cross-sector collaboration, conceptualized on the industrial symbiosis concept, has a critical role in CSCM implementation. In practice, governance and contextual factors (such as government regulation and enforcement, collaboration, and mutual support between actors and sectors) can become key barriers to CSCM implementation	The organization's internal capabilities-related factors that may affect the implementation of CSCM have not been considered
Rovanto & Finne, (2022)	Sociocultural factors and entrepreneurial attitudes strongly impact the entrepreneur's motivation and how they approach circular economy practices. In this regard, it emphasizes a significant difference in practices between the individualist and collectivist cultural approaches	It is limited to the setting of the textile and apparel sector
Chen et al., 2022	Industrial symbiosis has a significant influence on a variety of benefits, enclosing increased productivity of direct inputs, water, and energy, cost savings in economic investment, reduced environmental negative impact, and an increase in the sustainability index	This study does not specify its limitations
Schultz et al., (2021)	The governance mechanisms can challenge the ability to implement CSCM because its implementation requires a close collaboration of enterprises with other actors inside and outside the industry and sector. The development of a circular economy-enabling environment, the creation of closed-loop business models, and strategic partnerships with partners are of utmost importance	Limited value arises in terms of applicability in some areas such as solving problems related to partnerships or limited applicability due to resource constraints of the enterprises
Saroha et al., 2021	Economic circularity exploring and leveraging entrepreneurial opportunities in the circular economy leads to value promise, value production, value acquisition, and value distribution via inventive looping models	This study's ability to generalize its findings to other contexts may consequently be impacted by its reliance on a single case
Lahane & Kant, (2021)	Entrepreneurs' attribute-related aspects in terms of support and dedication in implementing circular economy practices are the biggest obstacles to CSCM adoption at the corporate level	It may cause bias in the results because it is based on experts' subjective opinions. India is the only developing economy that is the focus of the investigation. Because this work concentrates on CSCM as a whole, future research on another specific supply chain, such as the food supply chain, is required
Farooque et al., 2019a	The government (institutional regulation, enforcement), the market (preference, pressure), and partners (collaboration, cooperation) are the three primary groups that pose the greatest obstacles to the adoption of circular economy principles throughout the food industry's supply chain	The list of barriers may not be exhaustive. Important actors in the supply chain may not sufficiently be covered, for example, farmers
Zhu et al., (2019)	A circular approach is critical to achieving goals together in terms of ecology, economy, and society. In addition, entrepreneurship is very important in building a circular business	There is limited ability to generalize research findings to other socioeconomical contexts due to this study's focus on a single farm
Herczeg et al., (2018)	Industrial symbiosis is very important in SCM in the sense of improving resource efficiency in such a way that the waste of one entity is utilized as input to another	This study does not specify its limitations

of the firm and identify variables that either help or impede the adoption of CSCM.

In this regard, CEE and ISP are assumed to be fundamental for CSCM implementation and SG fulfillment. However, in the current literature, exploring the linkage mechanism between these structures in a comprehensive way is still limited. Particularly, studies on the role of CEE in CSCM are particularly rare in this regard.

Furthermore, based on the limitations of the reviewed literature, some proposals for new research have been formulated. We suggest that further studies are necessary to examine industrial symbiosis in the scope of SCM (Turken & Geda, 2020). Also, the food supply chain should be included to focus research on CSCM for a specific sector (Lahane & Kant, 2021).

Underpinning Institutional and Stakeholder Theories

Institutional and stakeholder theories were identified to be the most appropriate theories to analyze the links discovered in the literature between the constructs. According to Aldrich and Fiol (2007) and Meyer and Rowan (1977), the institutional theory describes how social factors such as conformity and repetition influence entrepreneurial behavior. Why do business owners behave consistently and react similarly to outside stimuli in a particular industry business? For Alonso-Almeida et al. (2021), transitioning from a traditional economic model to CE requires many changes and institutional entrepreneurs promote this process. Entrepreneurship in the circular economy (CEE) might be characterized as the process of identifying and seizing chances in this field.

The institutional theory focuses on coercive, mimetic, and/or normative pressures. From the external policy environment, entrepreneurs and enterprises are socially pressured to make changes and innovations in response to CE policy demands (Gasbarro et al., 2018). Although it can be perceived as a threat, they will also see opportunities from CE government policy. It is important that these opportunities help them not only to grow sustainably, but also to encourage other actors to do likewise along the supply chain.

In the process of moving toward a zero-waste economy, supply chain management (SCM) procedures consider both closed-loop and open-loop operations simultaneously. As a result, the economic value creation of resources is maximized. This study employs institutional theory to better understand how the entrepreneurial individual can integrate circular economic principles into their mindset, to govern business activities and practices.

The theory can be used to comprehend the evolution of industrial symbiotic practices (Sarker et al., 2021). Theoretically, each enterprise can optimize its closed-loop and open-loop control actions in its network. The value production of resources in the economy is maximized by combining these networks. The result is an ever-expanding economic cycle of many actors from different networks combining to create a system of circularity (Pereira et al., 2022).

In the meantime, stakeholder theory (Freeman, 1984) contends that firms should constantly consider the passion of all of their various partners. In this regard, businesses engage in sustainable practices because they realize that their responsibility is not only to do business, but also to address the sustainability problems that are of interest to their participants. Businesses must engage in sustainable practices and economic activities simultaneously, to ensure that they keep their reputation for being sustainably responsible with their stakeholders. They are directly responsible for their stakeholders and will feel pressure from them. This subsequently entices compliance with various policy directives, campaigns, and state recommendations. In such a dynamic environment, stakeholders directly influence organizational strategy and its operational implementation, as the firm seeks to meet its sustainability performance targets (Baah et al., 2021; Heras-Saizarbitoria et al., 2021).

Circular Economy Entrepreneurship (CEE)

It is postulated that through institutional and stakeholder pressure a direct strategic response is the firm implementing circular economy entrepreneurship. Entrepreneurship is directed to transform policy measures and stakeholder directives into value-added activities by the organization. As the significance of CE is more widely acknowledged, the notion of circular economy entrepreneurship (CEE) means that enterprises can explore and exploit more new business prospects in the CE industry. It has the capacity to significantly alter how business is conducted (Cullen & De Angelis, 2021; Garcia-Saravia and van der Meer, 2022).

CEE is therefore largely considered as follows: "… *a subset of sustainable entrepreneurship*" (Colin David, 2020). Considering the difference with conventional entrepreneurship, CEE, besides the desire to do business and capture market and transactional measures of value, also has the desire to protect the ecosystem and the environment and achieve social value in use[1] or (green) environmental value (Colin David, 2020). Further, in the context of uncertainties (such as unpredictable fluctuations

[1] Value in use is a long-run measure that looks at the total value accrued from an investment or strategic decision at a policy or organizational level such as the pedestrianization of town centers, building a cycle lane, installing charging infrastructure, introducing solar or wind-power energy, and dealing with ecoefficient suppliers.

of the socioeconomy, especially after the COVID-19 pandemic and wars in some countries recently), flexibility in the way that entrepreneurship leads, governs, and strategizes becomes extremely necessary (Dhar et al., 2022; Jaiswal, 2022; Wadhwa & Rao, 2004). In this view, CEE is seen as a dynamic transformation in entrepreneurship from traditional rigidity to flexibility depending on the circumstances as long as such flexibility is for sustainable development. For this study's objectives, CEE refers to business practitioners who take part in the farm-to-table chain aimed at achieving goals for both the market and the environment.

Industrial Symbiosis Practices (ISP)

Exchanges of matter and energy fall under the umbrella of ecoindustrial networking, a branch of ecologically integrated industries. It provides a centralized method so that enterprises may act more efficiently while limiting negative environmental impacts (Salomone et al., 2020). Consequently, the idea of ecoindustrial networking refers to a situation in which several firms actively collaborate to accomplish connected goals. Enterprises can systematically collaborate in a variety of ways, such as sharing resources or complementing one another, with the goal of enhancing resource efficiency for long-term sustainability (Zhao, 2021). Examples of industrial symbiosis comprise operations such as using waste heat from industry to warm greenhouses for food production, recycling automobile tires for use as building materials, and using sewage sludge from fish farms as agricultural fertilizer.

In this sense, industrial symbiosis can foster synergies between several industries, in continuous joint efforts in system development and networks, so that they can ease circularity and enhance the overall efficiency of resource use. Industrial symbiosis can boost resource efficiency in the context of CE by reusing leftovers from one entity for use by another. The concept of industrial symbiosis is essential to CE, as mentioned by Saavedra et al. (2018), while how it is understood and manifested varies greatly depending on the situation, as suggested by D'Amato et al. (2017). Using discarded food from the catering business to supply food for the animals on farms, for example, is significantly different from using nonhazardous industrial wastes to generate energy through combustion. The Kalundborg ecoindustrial park in Denmark is regarded as Europe's first example of large-scale industrial symbiosis, which has made it easier to centralize cooperation as more and more partners are currently exchanging 20 resources with each other, covering biomass, gypsum, and steam.[2]

[2] A good illustration of industrial symbiosis, the symbiotic networks of biowaste sustainable management (please refer to www.symbiosisproject.eu).

In agreement with Baldassarre et al. (2019) and Merli et al. (2018), industrial symbiosis has a very important function in shaping and implementing CE initiatives (Korhonen et al., 2018). From this approach, industrial symbiosis practices (ISP) denote the situation in which business practitioners create symbiotic networks for waste treatment by sharing facilities, water, energy, and resources in general (Trokanas et al., 2014). As claimed by Dou et al. (2021), ISP concretize the flow of materials, energy, and resources in general, across industries in a systematic way from conception to implementation (Oughton et al., 2022). If every participant in the supply chain agrees to use this method, the industrial symbiosis network will continue to grow in the framework of SCM, which in turn provides a very important catalyst for promoting effective CSCM.

Circular Supply Chain Management (CSCM)

CSCM is a novel approach that is being widely adopted in diverse worldwide industries (Khan & Ali, 2022). Supply chain management is the direct application of the CE's concepts, with some indirect application to the supporting industrial and natural ecosystems. The supply chain draws on the wider ecosystem which indirectly provisions it with resources, assets, and capabilities. For instance, Tesla was largely built and established in the Palo Alto high technological nexus, before recently relocating to Austin, Texas. The ecosystem provisioned it with skilled engineers, R and D capital, and land development grants.

We suggest that CSCM can only be performed through system-wide innovations aiming at achieving zero-waste and maximum sustainability (Farooque et al., 2019a). Therefore, CSCM systematically and purposefully integrates different business ecosystems together. The objective is to maximize the environmental value generated from the combined resources while sustaining a life cycle that functions with zero-waste (Batista et al., 2018).

In addition, from a sustainability standpoint, there are benefits to incorporating CE philosophy into SCM. In order to increase sustainability, CSCM should encourage the adoption of CEE at every phase of the logistics system (Nasir et al., 2017). The mechanism by which CSCM leads to sustainability primarily lies at the source whereas waste is minimized as much as possible. If there is any waste, it can be converted into input resources for other entities (Farooque et al., 2019b).

As previously mentioned, the CSCM approach is comprised of both open- and closed-loop actions to heighten resource efficiency and realize zero-waste. System-wide innovation efforts are used to restore value from what is traditionally referred to as "waste" (Farooque et al., 2019a). Due to its complexity and dynamic nature, CSCM is challenging to apply in the farm-to-table supply chain.

The process encompasses various participants, ranging from major corporations to smaller entities, with memberships that frequently shift and evolve throughout the stages of farming, primary processing, logistics, creation, delivery, and expenditure.

In conformity with Nattassha et al. (2020), the presence of by-products produced during the manufacture of the primary products is the biggest difficulty facing the agri-food business and its supply chain (Nattasha et al., 2020). Businesses frequently treat these by-products as waste, even when they first start to exist, because they are frequently seen as waste. Therefore, for CSCM to be effective in a way that targets resource efficiency, optimizing both closed-loop and open-loop control actions is crucial and necessary.

Sustainability Goals of Firm Performance (SG)

The overall performance of the enterprise is abundantly explored in the existing literature. In general, corporate performance incorporates financial-related indicators (Vickery et al., 2003) and nonfinancial-related indicators (Wu & Chang, 2012). Gleißner et al. (2022) stress that sustainability in terms of finance is viewed as one of the important areas for risk management and sustainability management, based on the triple bottom line (TBL) perspective. In addition, De Jesus and Mendonça (2018) highlight that financial constraint is one of the significant barriers affecting the capability to implement CE. Despite such importance, this factor has not been adequately operationalized in the existing literature (Gleißner et al., 2022).

In this research, the concept of firm functionality is adopted in accordance with the TBL concept. In the realm of sustainability and sustainable development, this concept holds significant prominence in research focused on firm performance. It is a subject of great interest, not only among academics but also within society and the business community (Lacy et al., 2010). This approach can lead an organization to realize economic progress, environmental excellence, and social fairness concurrently (Elkington, 1998). In addition, Goyal et al. (2013) emphasize that there is a growing necessity to assess a firm's performance regarding this trend of incorporating sustainability concepts into corporate strategy. Therefore, this study is distinctive for multidimensional performance indicators from a sustainability approach perspective. In this respect, firm performance in this research encompasses financial and nonfinancial performance as a response to calls from researchers for the need to furnish corporate performance measurement entailing sustainability indicators (social, ecological, and industrial) (Smith et al., 2019).

From the abovementioned viewpoint, in this situation, firm performance is set to be sustainable. At both the organizational and supply chain levels, it is expected that firm performance aligns with the SDGs set forth by nations and the global community, which represents the commitment to proffer the broader objectives of sustainable development at local and global scales. As stated by Van der Waal and Thijssens (2019), the common SDGs of the globe and nations emphasize the necessity of participation from the business world. Arayssi et al. (2019) note that corporate sustainable practices reflect a voluntary commitment to nonfinancial benefits and SDGs, which in turn generate value for the various stakeholder groups such as investors and society. Given the above discussions and arguments, the variable SG was developed based on TBL; accordingly, its measures should combine items which are relevant to estimate the pillar aspects for sustainability (economy, environment, and society).

Model and Hypothesis Development

This study's setting was formed based on a perspective of three-pillar sustainable development (economy, environment, and society) which is widely perceived as the triple bottom line. This research, therefore, focuses on entrepreneurship in the new age that integrates circular economy principles into entrepreneurial perspectives and practical business actions. Hence, in the area of CSCM, it is critical for firms to undertake industrial symbiosis practices in order for them to move toward a closed-loop supply chain for sustainability. Considering the debate above, an initial model has been developed, as presented in Fig. 1. The model has four interrelated variables as follows: circular economy entrepreneurship (CEE) is an independent variable, industrial symbiosis practices (ISP) and circular supply chain management (CSCM) are mediating variables, while the sustainability goals of firm performance (SG) are a dependent variable. The model itself is underpinned by the logic of institutional and stakeholder theory.

To further test and advance this categorization model, we developed a series of hypotheses for testing using a structural equation modeling (SEM) approach that uses the Smart-PLS version 3.3.7.

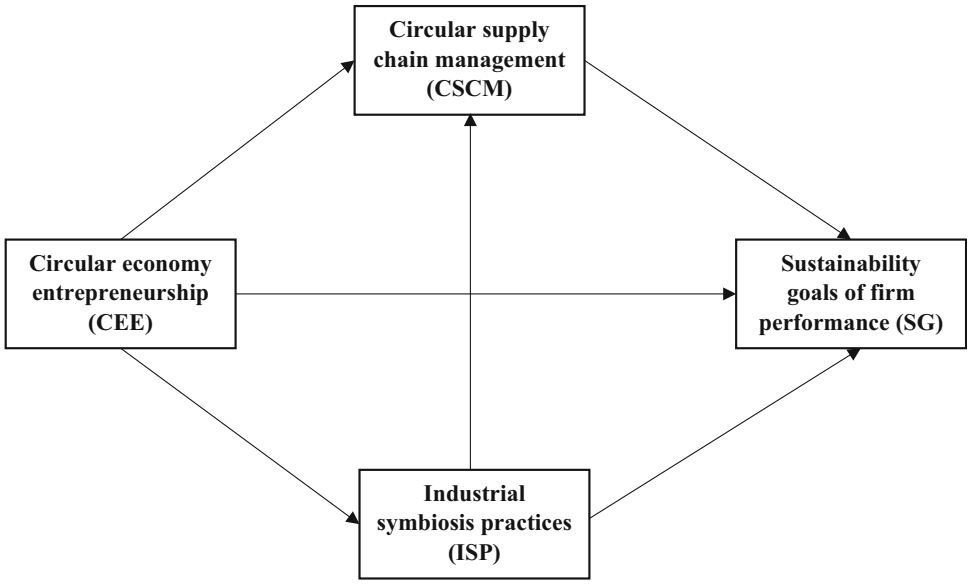

Fig. 1 The proposed literature categorization model

Hypothesis Development

The Importance of Industrial Symbiosis Practices (ISP) in the Link Between Circular Economy Entrepreneurship (CEE) And Circular Supply Chain Management (CSCM)

Theoretically, this study's phenomenon was explained via the prism of institutional and stakeholder theories. First, from the institutional theory perspective, especially institutional entrepreneurship, why entrepreneur embeds CE principles into entrepreneurship (CEE) to enable the transition from traditional entrepreneurship to CE-based entrepreneurship can be understood. Specifically, CEE with the application of CE principles in governance as a strategic perspective in response to institutional pressures may enable industrial symbiotic practices (ISP), thereby expediting CSCM. This institutional entrepreneurship theory perspective was also adopted by the recent work of Alonso-Almeida et al. (2021) in the field of entrepreneurship in the CE concept.

Conversely, at the exterior firm degree, applying this theory aims to stimulate the necessary institutional support, including the required changes by stakeholders. This is because the shift from a linear to a circular economy demands not only straightforward support but also revolutionary changes at all levels (Alonso-Almeida et al., 2021; Gasbarro et al., 2018; Llach et al., 2015) and within the supply chain (Geissdoerfer et al., 2018). Alonso-Almeida et al. (2021) found that acting like institutional entrepreneurs was effective in amending transformative and radical changes in the circular economy area. As affirmed by Zhu et al. (2019), entrepreneurship is a very fundamental factor in promoting the CE agenda in emerging businesses. The transformative and radical changes in this study were represented in the entrepreneurship mindset (CEE), which dominates managerial practices in a symbiotic approach (ISP) rather than independently as in the past. As emphasized by Saavedra et al. (2018), ISP are very important for realizing CE. In this respect, institutional entrepreneur benefits from having influence and the capability of introducing novel business models (Gasbarro et al., 2018). This process supports strategic collaboration between the firm and its stakeholders (customers and partners), which is crucial for hastening the shift to a closed-loop economy.

Additionally, this study employed a stakeholder theory approach to reinforce the justification for how the dynamics between the firm and its stakeholders affect the likelihood of implementing circular economic practices (Tapaninaho & Heikkinen, 2022). In this respect, the value creation toward sustainability is not only a firm's centric mission, but also a shared mission of firm-stakeholders at different levels through collaboration (displayed in sharing CE stories, coconstructing knowledge, upgrading industry, innovating the CE ecosystem, and updating business framework) (Tapaninaho & Heikkinen, 2022). Hence, the required synergy to advocate circular economy-based business operations and sustainability has been created as a result of the firm and stakeholders' shared realization of the possibility of value generation from these practices (Tapaninaho & Heikkinen, 2022).

The following hypotheses can be made in light of the discussion above regarding the part played by ISP in the relationship between CEE and CSCM:

1. Hypothesis 1 (H1) *ISP successfully intercede the connection between CEE and CSCM.*
2. Hypothesis 1a (H1a) *CEE favorably affects ISP.*

3. Hypothesis 1b (H1b) *ISP favorably impact CSCM.*
4. Hypothesis 1c (H1c) *CEE positively influences CSCM.*

Relationships Related to the Mediation of Circular Supply Chain Management (CSCM) in the Link Between Industrial Symbiosis Practices (ISP) and Sustainability Goals of Firm Performance (SG)

The phenomenon of ISP driving CSCM toward sustainability can be explained through the prism of institutional and stakeholder theories. From the institutional theory perspective, institutional entrepreneurship echoes the ability to generate radical change in the institutional environment in which it engages through organizational structures, business models, organizations and processes, or other alterations needed (Alonso-Almeida et al., 2021; DiMaggio & Powell, 1983; Elliot, 2016).

The target demographic (SMEs in the agrifood sector) operates in this environment, and the majority are still unsure of how to put CE principles into practice and what advantages a firm might gain from such adoption. Furthermore, SMEs in emerging economies are widely known to be resource-constrained (OECD, 2021). Therefore, ISP are seen as a breakthrough initiative that can induce radical change in terms of the entrepreneurship perspective and actions of actors in the supply chain, thereby, effectively encouraging CSCM to ultimately create sustainable values expressed in a firm's performance.

The relationship between the firm and the stakeholders in this situation affects whether CE practices can be applied (Tapaninaho & Heikkinen, 2022); consequently, the stakeholder theory perspective was considered appropriate for illuminating the phenomenon examined in this research. Taking a more comprehensive viewpoint, stakeholders have the potential to simplify value creation not only for individual businesses but also for collective value creation; on the other hand, they may increase complexity because different stakeholders may have different views on how CE practices should be organized (Kirchherr et al., 2017). Nonetheless, in the absence of stakeholder collaboration, the integration of the extended vision and sustainable development goals for the joint value may be likely hard to realize (Jonker et al., 2020). Viewed through this perspective, the stakeholder theory framework is utilized to elucidate the reasons and methods by which ISPs can empower CSCM, leading to improved performance of sustainability-focused firms.

According to D'Amato et al. (2019), ISP are viewed as the strategic efforts required to promote the switch from a traditional market economy to a closed-loop one (Diaz Lopez et al., 2019). In addition, ISP are seen as a key tool that helps to enhance the ecological performance of enterprises by lessening their emissions (Liu et al., 2017; Sun et al., 2017). Trokanas et al. (2014) suggest that symbiotic synergies are established with the main purpose of improving resource use efficiency, while reducing the negative impacts on the environment by optimizing circulation throughout the industrial ecosystem. In turn, all parties participating in the symbiotic synergies, exchanges, and local communities also benefit economically, socially, and environmentally, creating sustainable practices.

Applying ISP will help businesses lower production costs by refining the efficiency of resource use, thereby bringing about many improvements in industrial, societal, and ecological efficiency for marketplaces (Taddeo et al., 2017). Domenech et al. (2019) assert that systematic collaboration between different actors is crucial to realize CE. In other words, it is difficult to implement CE without synergistic collaboration between different actors operating in the business ecosystem. Given the above discussion, the following relationships can be hypothesized as the impact of the mediation of CSCM in the interaction between ISP and SG:

5. Hypothesis 2 (H2) *CSCM intercedes the association between ISP and SG.*
6. Hypothesis 2a (H2a) *ISP positively affect SG.*
7. Hypothesis 2b (H2b) *CSCM positively affects SG.*

Relationships Associated with the Mediation of Industrial Symbiosis Practices (ISP) and Circular Supply Chain Management (CSCM) in the Link Between Circular Economy Entrepreneurship (CEE) and Sustainability Goals of Firm Performance (SG)

The association of ISP and CSCM in the link between CEE and SG can be illustrated through the view of institutional and stakeholder theory. In this regard, CEE indicates how entrepreneurs perceive and think of how to put CE principles into practice, while ISP signify how entrepreneurs behave and act in their environment to put the CE principles into practice. This denotes a flow from perception and thinking (entrepreneurship) to behavior and action (practices) toward the joint value creation goal since joint sustainability can be understood using institutional theory and stakeholder theory perspectives. In this research context, such changes are critical that exhibit entrepreneurial flexibility in innovations as long as it is necessary to reach the sustainability goal. In this sense, flexibility is implied as the acceptance of changes regardless of the levels of efforts required to do such innovations for greater value creation for not only the firm individuals but also the larger

community. Therefore, institutional and stakeholder theories are considered to be highly pertinent to explain the phenomenon of this research.

In light of the aforementioned discussion, ISP are closely related to CSCM (Saavedra et al., 2018). Their association is invaluable in advancing the efficiency of resource use, ultimately delivering sustainable benefits in terms of economy, community, and the ecosystem (Taddeo et al., 2017). As argued by Salomone et al. (2020), ISP aim at converting residuals and by-products into input resources for other entities, while CE primarily targets an improvement of material efficiency, waste minimization, and recycling. It aims at protecting the ecosystem through responsible-driven and profitable business models (Kirchherr et al., 2017).

Conforming to Fitch-Roy et al. (2020), CE aims to reverse unsustainable economic and business patterns and create lasting prosperity. The role of CEE is very vital to the CE process. In a logistics system management context, sustainability across the entire logistics system from end user to source is highly dependent on compliant management practices. Current literature shows that the correct implementation of CE practices is considered indispensable in fulfilling resource circularity, efficiency, and optimization (Sehnem et al., 2019). Farooque et al. (2019a) note that CSCM ultimately leads to effecting sustainability goals, as it strives for zero-waste via innovation.

ISP and CSCM can jointly address the challenges that exist in the agrifood industry, namely, dealing with "waste" by optimizing the economy's process of adding value to resources by using the waste of one production activity to become the input into another (Kumar et al., 2022), thereby addressing issues of stakeholder concern. Furthermore, reducing the burden on the environment comes through carrying out the sustainability goals of firm performance, namely, the triple bottom lines of industry, community, and the ecosystem.

In light of the aforementioned explanation, the following relationships can be assumed to be related to the mediation of ISP and CSCM in the relationship between CEE and SG:

8. Hypothesis 3 (H3) *CEE definitely influences SG.*
9. Hypothesis 4 (H4) *SP intercede the link between CEE and SG.*
10. Hypothesis 5 (H5) *ISP and CSCM mediate the interrelation between CEE and SG.*

Based on the aforementioned discussion and the suggested research hypothesis, Fig. 2 depicts our model annotated with the hypothesized linkages.

Research Design and Methodology

Target Population and Sampling

In this research, we concentrate on agrifood SMEs in emerging economies. Therefore, the sample population is SMEs operating in the field. In this respect, the analysis unit is the enterprise and the survey respondents are the enterprise's representatives who currently hold senior positions in the company. The sample population was recruited through associations of small and medium businesses. In this study, firm size was determined according to the criteria of number of employees in accordance with the OECD definition (2021). Accordingly, the size of an organization is described as small if it is between 10 and 49 people and medium if it is between 50 and 249 employees. The total number of sampled respondents that were recruited and eligible to participate in the survey was high at 600.

Survey Instruments

A survey was created and tested in advance using the procedure advocated by Cobanoglu et al. (2001). This ensured that the most accurate data possible could be obtained. The survey was subsequently assessed by a board of professionals who were asked to review it and then interviewed. Then, we further tested it with potential survey participants through a pilot survey. The participants in the pilot survey had a background similar to the target sample population (Cobanoglu et al., 2001).

Variables and Scales

For the purposes of this study, all measures were developed based on close collaboration between researchers and practitioners to ensure content validity (Dillman et al., 2008). As part of this process, the authors conducted a literature survey of the areas pertinent to this research topic and selected the relevant items which were then reviewed by professionals and practicing managers in the field. The goal of this process is to decide the measures that are most relevant to the research topic and the specificity of the research context in order to maximize survey efficiency. In this respect, circular economy entrepreneurship (CEE) was adopted by Cullen and De Angelis (2021) and Lynde (2020); industrial symbiosis practices (ISP) were embraced from Trokanas et al. (2014) and Dou et al. (2021); circular supply chain management (CSCM) was acquired from Farooque et al. (2019b) and Calzolari et al. (2022); sustainability goals of firm performance (SG) was approved by Calzolari et al. (2022), Hourneaux et al. (2018), and Khaled

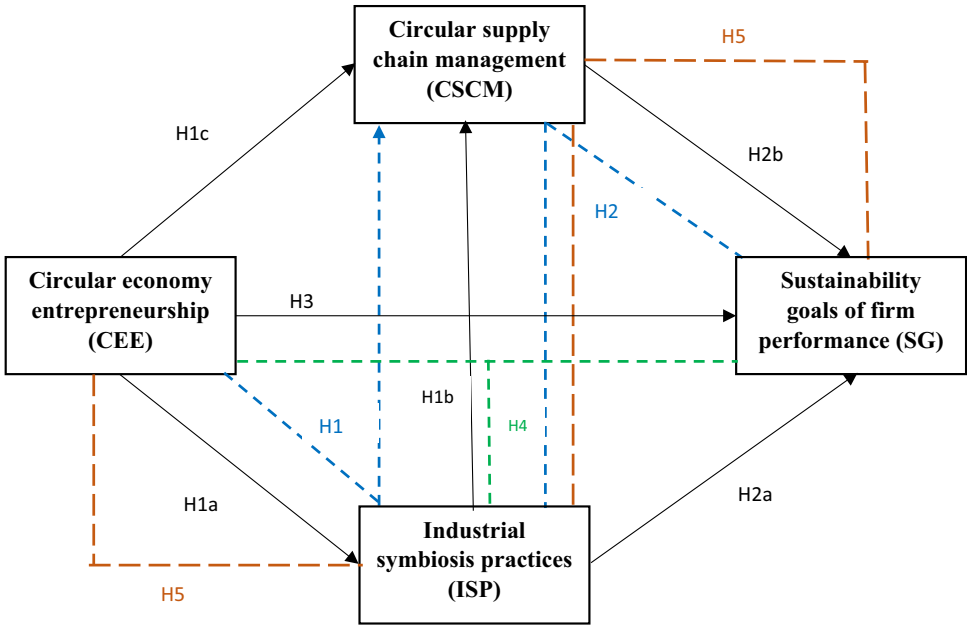

Fig. 2 Model with hypothesized relationships

et al. (2021). Table 2 exposes the items corresponding to each variable and their sources. These scales were utilized to develop the questionnaire. The scales applied a range of five points from one to five in increasing values whereby one stands for "completely disagree" or "totally unlikely" and five denotes "completely agree" or "totally likely."

Data Collection and Analysis

The survey was conducted from October 2021 to February 2022 using the internet platform. In the sample population, 600 intended respondents were sent the survey questionnaire as Appendix. At the end of the survey period, 517 questionnaires were obtained (accounting for a high 86.17% response rate). Once the incorrect answer sheets have been screened out (lack of information, incomplete answers), 486 valid completed questionnaires were attained (81%). This high rate was due to the persistence of the researchers who repeatedly sent follow-up communication and calls to encourage participation. We successfully marketed the importance of our study. Also, our respondents were interested in having access to the findings as they felt that the topic was relevant now to them.

Partially least squares structural equation modeling was employed to analyze the provided data (PLS-SEM). This technique was selected to be applied in this study because it is suitable for complex models. In this research, the model involved analyzing both direct and indirect relationships of a complex nature (Hair et al., 2017).

Results

Representativeness of Samples

The representativeness of the samples that were gathered is outlined in Table 3, which includes factors like gender, respondents' age ranges, the characteristics of their work status/positions, the age ranges of their enterprises, and the characteristics of company size. According to the authors, the characteristics of our sample accurately unveiled those of the intended audience. We were also supported by those who took part in the questionnaire's pilot testing and afterward confirmed the accuracy of these samples.

Assessment of Measurement Model

The assessment procedure was carried out using the subsequent phases. Cronbach's Alpha, composite reliability (CR), and their overall correlation were executed to gauge the scale's reliability. The findings indicate that Cronbach's Alpha and CR are both higher than 0.7 and the total correlation coefficients are both higher than 0.3. As reported by Hair et al. (2019), these parameters ensure the scale's dependability. The average variance extract (AVE) values and additional component loading were then exploited to evaluate the convergent validity. The findings, which display that factor loading values are higher than 0.7 and AVE are higher than 0.5, support convergent validity (Hair et al., 2014b). Table 4 describes an example of the aforementioned analysis.

Next, the heterotrait–monotrait ratio of correlations (HTMT) analysis and the Fornell–Larcker criterion were

Table 2 Variables and items

Variable	Items	Description	Sources
Circular economy entrepreneurship (CEE)	CEE1	We keep in mind that our primary purpose is to discover and capitalize on new chances in the closed-loop economy	Cullen and De Angelis (2021), Lynde (2020)
	CEE2	We recognize that our key responsibility is to improve resource efficiency	
	CEE3	We contemplate that our primary responsibility is to enhance sustainable economic, social, and environmental values	
	CEE4	We believe that our fundamental obligation is to sustainably improve the overall performance of the agrifood value chain	
	CEE5	We consider that our major mission is to help achieve worldwide and national sustainable development objectives	
Industrial symbiosis practices (ISP)	ISP1	We proactively expand our symbiotic network across companies and industries to seek better resource efficiency	Dou et al. (2021), Trokanas et al. (2014)
	ISP2	We promote sharing facilities in our symbiotic network to optimize resource use efficiency	
	ISP3	We encourage system integration to maximize resource value creation	
	ISP4	We always boost the flow of the materials to ensure that their value creation is as high as possible	
	ISP5	We advocate sharing a waste treatment system in our symbiotic network to optimize efficiency	
	ISP6	We stimulate visualization of the flow of resources in our symbiotic network to optimize management efficiency	
Circular supply chain management (CSCM)	CSCM1	We have a change management process to reform resource efficiency	Calzolari et al. (2022), Farooque et al. (2019b)
	CSCM2	We have put procedures and structures in place to regulate the movement of primary resources across the supply chain	
	CSCM3	We have systems and processes in place to manage a circular resource flow throughout the supply chain	
	CSCM4	We have systems and processes in place to promote resource recycling in the value chain	
	CSCM5	We have systems and processes in place to assist resource circularity in open networks across industries	
	CSCM6	We have a management system in place to minimize system leakage to control waste and emissions	
	CSCM7	We have established systems and procedures to connect all players and stakeholders throughout the ecosystem	
	CSCM8	We have a system and process in place for knowledge sharing about the closed-loop economy field in the ecosystem	
Sustainability goals of firm performance (SG)	SG1	Consumption of primary resources decreases over time	Calzolari et al. (2022), Hourneaux et al. (2018), Khaled et al. (2021)
	SG2	The extent of conversion to using recycled materials rises over time	
	SG3	The extent of waste declines over time	
	SG4	Greenhouse gas emissions reduce over time	
	SG5	We provide stable employment for society and the community over time	
	SG6	Over time, more is done to advance social well-being	
	SG7	Our operating costs decrease over time	
	SG8	Financial performance escalates over time	

then exploited to evaluate discriminant validity. If the square root of the AVE is larger than the correlation value, discriminant validity is demonstrated (Fornell & Larcker, 1981). Table 5 elucidates that the square root of AVE for each column is higher than the correlation values. Hence, discriminant validity is satisfied.

Table 3 Indicative characteristics of gathered samples

Characteristics	$N = 486$	Percentage (%)
Gender		
Male	236	48.56
Female	250	51.44
Age ranges of respondents (years)		
34–< 40	95	19.55
40–< 45	117	24.07
45–< 50	145	29.84
> 50	129	26.54
Components of positions		
Non-ownership executive	366	75.31
Ownership executive	120	24.69
Age ranges of businesses (years)		
6–< 10	79	16.26
10–< 15	124	25.51
15–< 20	156	32.10
> 20	127	26.13
Components of company size		
Small-sized	327	67.28
Medium-sized	159	32.72

Additionally, Table 6 of the HTMT analysis results reveals that all of the output values are less than 0.85. This outcome supports discriminant validity.

Goodness of Fit Analysis

The following values were assessed as part of the analysis of goodness of fit (GoF): SRMR (Henseler et al., 2016), NFI (Hair et al., 2019), and R^2 (Falk & Miller, 1992). When the GoF value is above 0.36, the model has a good fit (Wetzels et al., 2009). In this research, we obtained a value for GoF of 0.72. The results also show that the NFI value is 0.917, which is greater than 0.9. In contrast, for SRMR, the value is 0.041, which is smaller than the proposed upper point value of 0.08 (Henseler et al., 2016). This outcome confirms the model's strong fit once more. Finally, examining the value of R^2, the results emphasize that ISP have R^2 of 0.450, CSCM has R^2 of 0.571, and SG has R^2 of 0.681, which are greater than 0.1 (Falk & Miller, 1992). We are therefore confident that our model is robust and the goodness of fit analysis is highly favorable.

Assessment of Structural Model

This process was undertaken by assessing the results from conducting bootstrapping analysis, which is depicted in Table 7. Before this step, common method bias and multicollinearity problems were evaluated using VIF (the variance inflation factor). The findings indicate that the VIF levels are below 3.3 (from 1.000 to 2.371). This result establishes that multicollinearity and common method bias are not issues in this study (Hair et al., 2014a; Kock, 2015).

For intermediate relationships, the intermediate level was further assessed using VAF (variance accounting for), in accordance with the procedure outlined by Hair et al. (2014b). In Figs. 3 and 4, SEM analysis diagrams with and without the use of the bootstrapping technique are portrayed.

The findings of the bootstrapping technique are displayed in Table 7. This demonstrates the validity of the research hypothesis. Specifically, this result supports the statement that CEE positively and effectively affects ISP ($\beta = 0.671$, $t = 23.841$, and $p < 0.001$). Thus, H1a is accepted. Likewise, ISP favorably and notably impact CSCM ($\beta = 0.485$, $t = 11.967$, and $p < 0.001$); therefore, H1b is reinforced. Additionally, CEE was found to have a beneficial and outstanding relationship with CSCM ($\beta = 0.340$, $t = 8.018$, and $p < 0.001$). Thus, H1c is confirmed. In addition, H1 is reinforced ($\beta = 0.326$, $t = 10.570$, $p < 0.001$, $20\% \leq \text{VAF} = 49\% \leq 80\%$, and $p < 0.001$) asserting that ISP somewhat intermediate the interrelation between CEE and CSCM.

Furthermore, H2a is confirmed ($\beta = 0.264$, $t = 5.353$, and $p < 0.001$) bolstering up the statement that ISP positively and significantly affect SG. Likewise, the findings support that CSCM has an efficacious and compelling impact on SG ($\beta = 0.445$, $t = 7.327$, and $p < 0.001$). We observed that CSCM partially mediates the link between ISP and SG ($\beta = 0.151$, $t = 5.053$, $p < 0.001$, $20\% \leq \text{VAF} = 42\% \leq 80\%$, and $p < 0.001$); thus, H2 is supported.

Besides, it is also confirmed that CEE has a favorable and considerable connection with SG ($\beta = 0.213$, $t = 4.600$, and $p < 0.001$); hence, H3 is proven. The outcomes also explicit that ISP mediate fractionally the relationship between CEE and SG ($\beta = 0.177$, $t = 5.175$, $p < 0.001$, $20\% \leq \text{VAF} = 37\% \leq 80\%$, and $p < 0.001$). Additionally, ISP and CSCM simultaneously play a limited mediation in the relationship between CEE and SG ($\beta = 0.145$, $t = 5.817$, $p < 0.001$, $20\% \leq \text{VAF} = 41\% \leq 80\%$, and $p < 0.001$). Therefore, H4 and H5 are supported. For intermediate relationships, further assessment was performed using the lower and upper confident intervals. The findings unfold that the values of the confidence interval support our conviction that the mediating roles of ISP and CSCM are significant in the observed associations.

Table 4 Cronbach's alpha, factor loading, CR, and AVE

Variables	Items	Factor loading	Cronbach's Alpha	CR	AVE
Circular economy entrepreneurship (CEE)	CEE1	0.782	0.843	0.888	0.614
	CEE2	0.783			
	CEE3	0.789			
	CEE4	0.772			
	CEE5	0.791			
Industrial symbiosis practices (ISP)	ISP1	0.781	0.875	0.905	0.615
	ISP2	0.790			
	ISP3	0.784			
	ISP4	0.783			
	ISP5	0.771			
	ISP6	0.795			
Circular supply chain management (CSCM)	CSCM1	0.703	0.888	0.911	0.562
	CSCM2	0.785			
	CSCM3	0.754			
	CSCM4	0.708			
	CSCM5	0.738			
	CSCM6	0.778			
	CSCM7	0.757			
	CSCM8	0.767			
Sustainability goals (SG)	SG1	0.877	0.955	0.962	0.762
	SG2	0.876			
	SG3	0.879			
	SG4	0.872			
	SG5	0.864			
	SG6	0.870			
	SG7	0.878			
	SG8	0.869			

Table 5 Fornell–Larcker criterion

	CEE	CSCM	ISP	SG
CEE	0.783			
CSCM	0.666	0.749		
ISP	0.671	0.713	0.784	
SG	0.686	0.775	0.725	0.873

Discussion and Implications

The primary finding of this study is the positive direct and indirect connections that we have established between circular economy entrepreneurship, industrial symbiosis practices, and circular supply chain management. Their positive interaction positively supports the sustainability performance goals for SMEs in the agrifood industry of an upsurging economy. Accordingly, the integration of circular economic principles and entrepreneurial thinking fosters the practice of industrial symbiosis. This is in the form of creating symbiotic networks for waste treatment by firms jointly sharing facilities, water, energy, and resources in general.

In turn, this simplifies the realization of SCM in accordance with CE principles, ultimately prompting the realization of sustainability goals. According to our knowledge, empirical studies with respect to this direct association are scarce in the existing published works. Thus, the results of this research indirectly support previous research like Zhu et al. (2019). Our main result is that entrepreneurship is essential for promoting the closed-loop economy, especially in emerging economies. Salomone et al. (2020) also observe that ISP are helpful in endorsing resource efficiency CE initiatives and reducing negative environmental effects (Baldassarre et al., 2019; Genovese et al., 2017; Merli et al., 2018; Nasir et al., 2017). We confirm that CSCM can induce positive sustainability

Table 6 Heterotrait–monotrait ratio of correlations (HTMT)

	CEE	CSCM	ISP	SG
CEE				
CSCM	0.767			
ISP	0.780	0.808		
SG	0.764	0.804	0.792	

performance, thereby confirming the works of Liu et al. (2017) and Sun et al. (2017) that ISP can help firms boost environmental functionality by lowering emissions.

In addition, this study provides support to earlier studies of Cullen and De Angelis (2021) and Colin David (2020). As we have demonstrated, CEE focuses on identifying and seizing novel possibilities inside the circular economy. Having a perspective that extends beyond mere business operations and profit-driven motives and encompasses a genuine concern for safeguarding the environment and natural ecosystems, while actively contributing to the development of the business ecosystem, the agrifood supply chain differs from other industries because of its features, such as its full reliance on natural resources, with the downstream risks being outweighed by the upstream ones, and the heavy influence of seasonality on productivity.

Table 7 Bootstrapping results

Hypothesis	Paths	Coefficient	*t*-Statistics	*p*-Value	CI 2.5%	CI 97.5%	VAF %	Conclusion
H1a	CEE—> ISP	0.671	23.841	0.000	0.619	0.726	n/a	Supported
H1b	ISP—> CSCM	0.485	11.967	0.000	0.399	0.564	n/a	Supported
H1c	CEE—> CSCM	0.340	0.018	0.000	0.256	0.428	n/a	Supported
H1	CEE—> ISP—> CSCM	0.326	10.570	0.000	0.266	0.385	49	Supported
H2a	ISP—> SG	0.264	5.353	0.000	0.157	0.346	n/a	Supported
H2b	CSCM—> SG	0.445	7.327	0.000	0.335	0.577	n/a	Supported
H2	CEE—> CSCM—> SG	0.151	5.053	0.000	0.101	0.222	42	Supported
H3	CEE—> SG	0.213	4.600	0.000	0.122	0.300	n/a	Supported
H4	CEE—> ISP—> SG	0.177	5.175	0.000	0.103	0.237	37	Supported
H5	CEE—> ISP—> CSCM—> SG	0.145	5.817	0.000	0.102	0.196	41	Supported

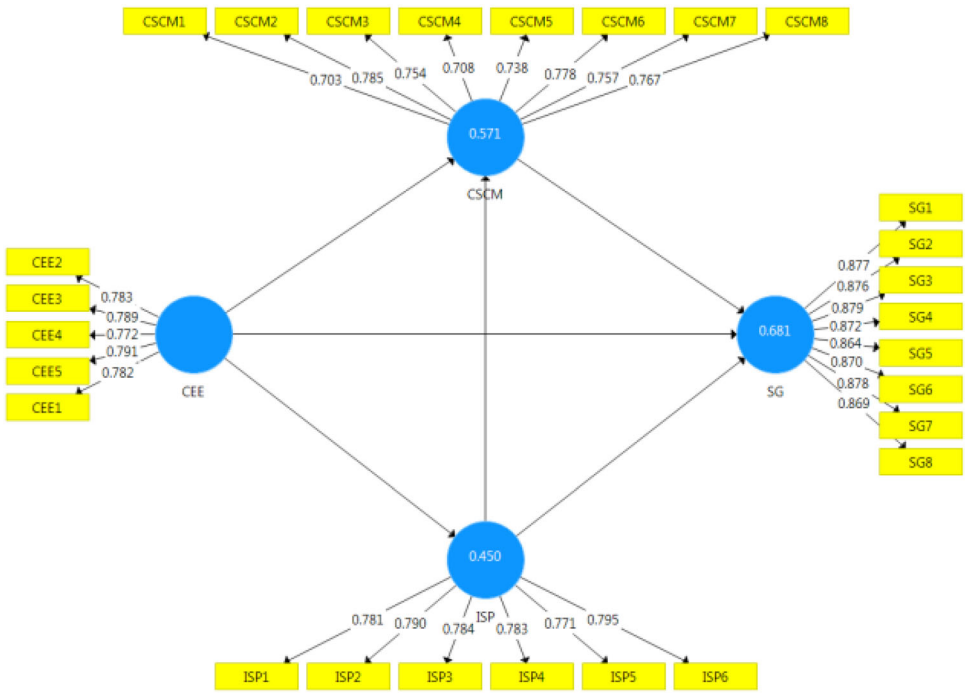

Fig. 3 Schematic of SEM analysis without the use of bootstrapping method

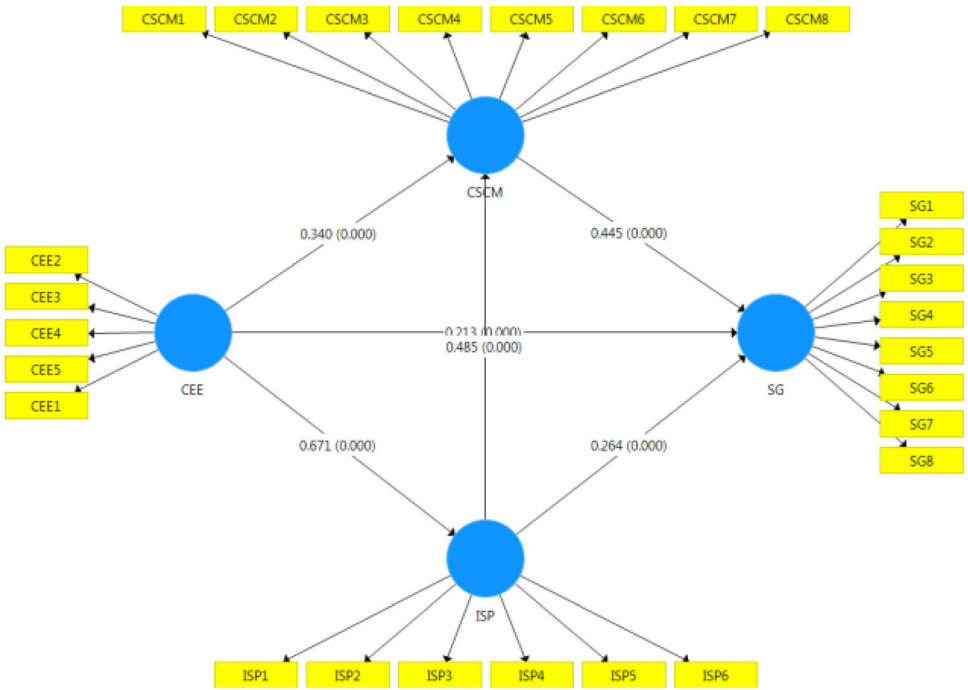

Fig. 4 Schematic of SEM analysis using the bootstrapping method

Besides the factors of weather and pests (Nattassha et al., 2020), habitual farming, and harvesting practices, knowledge and skills gap are also significantly challenging for supply chain managers.

In emerging economies such as Vietnam, where many individuals and organizations have limited understanding of the circular economy, the deficiency in incentives and extended vision and a reluctance to adopt innovative approaches are significant factors causing this problem. The most troublesome aspect of by-products' existence in the agrifood sector and logistics network is that they are considered rubbish and must be disposed of immediately (Nattassha et al., 2020).

In the sense that CSCM can aid businesses in accomplishing SG as well as monetarily linked performance criteria, this study expands on earlier ones, particularly Farooque et al. (2022). Moreover, it advocates the claims by Luthra et al. (2022) and Herczeg et al. (2018) that cooperation between partners from various industries and industrial symbiosis is essential for CSCM implementation (Batista et al., 2018; Mangla et al., 2018).

These factors, besides governance, can either promote or hinder CSCM implementation, depending on which circumstances it can trigger. To this extent, it supports the statement of Lahane and Kant (2021) who assert that an entrepreneur's attitude can be a barrier to CSCM enactment. For instance, strategic orientation, support, and commitment may hinder the adoption of circular economic practices.

Further, this study confirms the work of Rovanto and Finne (2022) about the potential influence of entrepreneur's attitudes on how enterprises approach their circular economy practices. CEE is viewed as a strategic tool to assist businesses in identifying and utilizing business opportunities provided by the circular economy. By invoking industrial symbiosis activities that ultimately result in the attainment of sustainability goals, the CSCM will be actualized more quickly if the concepts of the circular economy are employed.

Our work confirms the findings of Chen et al. (2022) about the compelling function of industrial symbiosis in delivering multidimensional benefits to increase the sustainability index of industrial firms. Likewise, this study expands on Schultz et al.'s studies (2021) which assert that governance mechanisms have a decisive influence on CSCM enactment; it entails an entrepreneur's dynamics in promoting collaboration and cooperation inside and outside the firm through strategic alliances.

CEE is characterized by incorporating circular economy philosophies and principles into the entrepreneurial mindset. Hence, business activities and practices are made socially, ecologically, and economically responsible. In this sense, it creates a governance mechanism that enables ISP to be the foundation for expediting CSCM, ultimately enticing SG attainment (De Angelis et al., 2018; Kusi-Sarpong et al., 2021).

Additionally, it backs up the claim made by Saroha et al. (2021) that CEE is crucial for delivering values through innovative models that incorporate the principles and

practices of the closed-loop economy. We also support the notion of Zhu et al. (2019) by confirming that a circular economy approach is a strategic approach that addresses all the economic, social, and ecological benefits toward sustainability. In this respect, entrepreneurship is essential in building circular businesses. We concur with Farooque et al. (2019b) that the incorporation of closed-loop economy practices into SCM depends on the extent to which partners collaborate and cooperate; ultimately, it is down to trust.

Theoretical Implications

The theoretical ramifications of this study include the following. First, knowledge regarding circular supply chain management was expanded in this study. Research that offers a thorough empirical evaluation model of the variables influencing CSCM adoption from the perspective of entrepreneurship serves as evidence for this. It is especially important to promote entrepreneurship in the circular economy, as well as realizing that this transformation model will encourage symbiotic activities among businesses in the sector, which will promote the management of circular logistics networks to actualize sustainable development objectives.

By presenting actual proof of the connection between CEE and ISP, this study also adds to the existing literature on the scopes of industrial symbiosis and circular entrepreneurship, thereby enabling CSCM to effectuate its sustainability goals and targets. To this extent, this research unfolds a novel method of how the flexibility of entrepreneurship generates value-driven sustainability. Interestingly, this sustainability considers the uncertainties of the pragmatic ecosystem and national, regional, and global sustainable development goals. As highlighted by Turken and Geda (2020), further research exploring industrial symbiosis regarding chain control is necessary. Conversely, Lahane and Kant (2021) emphasized that further research was needed on CSCM, especially with respect to the agrifood logistics system.

From the theoretical perspective, this study also makes a contribution by shedding light on the driving forces pushing supply chains toward executing their sustainability goals. The present research contributes to extending the theory, by yielding an empirically proven connection between corporate sustainable practices and sustainability goals in the circular economy domain. This contribution is particularly meaningful as we bring forth scientific knowledge from small and medium enterprises that are not known in this field.

Finally, this study expands institutional and stakeholder theory by demonstrating the applicability and validity of the theory. The current literature on institutional theory explains why entrepreneurs and enterprises are determined to make changes and innovations (Bhattacharya, 2021). This is in response to the demands for a shift toward a closed-loop economy. As they perceive opportunities from the closed-loop economy, it is noteworthy that these opportunities help them not only to grow sustainably for themselves, but also to support all their actors in the supply chain and surrounding ecosystem. In addition, stakeholder theory suggests that when business activities and behaviors are performed responsibly and ethically, businesses will receive incentives and (financial and nonfinancial) support from their stakeholders. This keeps their business operations competitive and will help them to realize their sustainability goals.

Managerial Implications

Business professionals might find this study's managerial implications to be particularly fascinating. First, this study suggests that a circular approach based on entrepreneurial thinking to practicing and managing can help SMEs to reach their sustainability performance goals. We suppose that entrepreneurs should be flexible in their way of thinking, leading, strategizing, and operating in order to utilize the external resources in the network to seize development chances in the closed-loop economy. Particularly, in the context of SMEs, this flexibility also helps businesses solve resource constraints to react to business alterations to survive. In this respect, such practices and behaviors can help expand and strengthen their industrial symbiotic ecosystem and maintain sustainable entrepreneurship for sustainable development. In addition, it is worth emphasizing that enterprises should search for and develop innovative business models as a way of flexibility to match their circular economic model in the new era, with entrepreneurship playing a central role in these business models.

The second managerial implication is that the agrifood industry may successfully apply supply chain management that incorporates the closed-loop economy. It is also worth emphasizing that the circular approach from thought to action and management can offer compelling and sustainable benefits. However, to enact this, entrepreneurs are required to put a lot of concerted efforts and resources into developing the necessary innovation through their thinking, behaviors, models, systems, processes, technologies, practices, and networks.

For SMEs based in emerging economies, especially in the agrifood industry, with limitations in terms of their knowledge of the circular economy and resources, such change requirements must be said at least, to be very challenging (Prabhu and Srivastva, 2023). Therefore, it is suggested that enterprises should consider the necessary

innovations needed as a prerequisite for making them fit in with their difficult transitions to a circular economy. Accordingly, such necessary innovations should be seen as investments rather than costs. Enterprises then need to be innovating and growing while following their sustainability path.

The study's third managerial application is the favorable expansion of industrial symbiotic ecosystems in both similar and dissimilar industries. This is beyond the scope of the supply chain in which they are participating. Enterprises in the network should visualize the flow of materials, the flow of resources between businesses in the network to enhance resource value development and minimize resource waste in the economy. This is done by radically restoring the residual waste of one productive entity into the inputs of another. Importantly, entities in the symbiosis network can jointly integrate waste treatment systems to optimize their efficiency.

Notably, there are still challenges that make the shift to a model of the closed-loop economy in the agricultural-food industry of upsurging economies challenging when production and distribution techniques are still sluggish and archaic. The current industrial practice that exists in the logistics networks is that by-products are considered garbage and are therefore disposed of as waste immediately (Nattassha et al., 2020). Therefore, we recommend that businesses exploit both their closed-loop and open-loop control systems. Hence, the waste from one agrifood entity can be converted into input resources for other agrientities. For instance, they can become organic fertilizers (Farooque et al., 2019a).

Conclusion

The study's findings help to further explain the three key research topics that served as its foundation and its overarching objective. Accordingly, it responds to the first research question by outlining the path by which CEE drives ISP to smooth CSCM for SG. CEE stimulates adopting circular economic philosophies and principles into the culture, strategy, and governance mechanisms in a flexible manner. In addition, CEE is proven to regulate its operations and practices responsibly and ethically toward sustainability. This in turn drives ISP to ease CSCM implementation that ultimately results in the effectuation of sustainability goals.

In response to the second question, ISP emphasize transparency, shared sociocultural norms, networks, and beliefs. From an organizational perspective, these factors help businesses understand one another's capabilities and develop strategic alliances based on economic drivers, while also exercising social and environmental responsibility. On the other hand, from an operational perspective, ISP enable the engagement of enterprises in collecting, processing, storing, and distributing by-products to other manufacturers. In turn, this opens the door for CSCM actualization, leading to improved resource efficiency as well as environmental and social efficiency that eventually results in attaining SG.

We address the third research question by proposing a novel logic that entrepreneurs should integrate their circular economic philosophies and principles with entrepreneurial thinking. Hence, their business operations and practices are made more socially, ecologically, and economically responsible. Importantly, their entrepreneurship should align well with surrounding industrial symbiosis patterns and appropriate practices, thereby easing CSCM implementation and faster acquirement of SG.

Above all, the main finding about CE and SCM researched in the agrifood industry can be regarded as novel contributions to the field (Ben Amara & Chen, 2021). Furthermore, this study helps to close the research-practice divide in the existing literature. It responds to the need for more practical and context-specific research as highlighted by Zhang et al. (2021). Specifically, this research gives a holistic approach to explore the association between circular entrepreneurship and industrial symbiosis. Our research is designed to be applicable to practice and the results should help assist SMEs working in the field of agrifood.

Limitations and Future Scope of Research

In proposing future research, it is essential to consider some limitations of this study. To begin with, this research solely focuses on SMEs. Therefore, future research should consider other organizational forms and produces more diverse results, enabling comparisons to be made. Second, this study approach is purely based on quantitative methods. Future studies may consider mixed-method combinations to triangulate and cross-reference macro- and microfindings together. Also, this would potentially expedite more robust and time-based data investigations that explore phenomena as they evolve and change over time, thereby overcoming the problem of cross-sectional bias that often besets quantitative work. Nonetheless, access to such a kind of investigation is often too problematic. Third, the backdrop of an emerging Southeast Asian economy is the main emphasis of this study. Each different regional context has its idiosyncrasies and unique characteristics and, therefore, regardless of how slight they may be, it is likely to produce different consequences. Future investigations therefore may consider researching other developing economies in other regions to enrich the validity of our

results. This would also enable detailed international comparisons to be made and become stronger, more robust theoretical models to be developed that cross-cut different cultures and international contexts.

Appendix–Questionnaire

We are carrying out empirical research on "The role of entrepreneurship in successfully achieving circular supply chain management." The objective of this study was to respond to the call for further research and evidence on the connection between industrial symbiosis practices (ISP) and Circular supply chain management (CSCM). Specifically, it empirically examined the role of entrepreneurship in facilitating CSCM to achieve its sustainability goals (SG). To this end, we would like to invite you to participate in this study by answering the following survey questions. Your participation and all information provided by you through this survey are strictly confidential. We appreciate your support.

If you have any concerns or questions, please kindly get in touch with Dr. Thanh Tiep Le, Ho Chi Minh City University of Economics and Finance. E-mail: tieplt@uef.edu.vn. Mobile phone: + 84 906 946 968.

Part I. Respondents' Personal Information

Instruction: Please check the box (only one) that corresponds to your response.

1. **Your gender**

   ☐ Female
   ☐ Male

2. **Your age**

   ☐ From 34 to less than 40
   ☐ From 40 to less than 45
   ☐ From 45 to less than 50
   Above 50

3. **Components of positions**

   ☐ Non-ownership executive
   ☐ Non-ownership executive
   ☐ Ownership executive

4. **Ages range of business (years)**

   Please tick the box (only one) that matches your answer.
   ☐ From 6 to less than 10
   ☐ From 10 to less than 15
   ☐ From 15 to less than 20
   ☐ Above 20

5. **Your company size**

   Company size is determined on the basis of the total permanent employees of your company.
   ☐ Small-sized (10–49)
   ☐ Medium-sized (50–249)

Part II. Survey Questions

Instruction: The following questions are based on a five-point Likert scale. Points from 1 to 5 show the level (ascending) of your agreement with each statement. Specifically, "1" represents "absolutely not"; "2" represents "not sure"; "3" represents "likely"; "4" represents "yes"; and "5" represents "absolutely yes." Therefore, for each of the following questions, please select a point (only one) that is as accurate as your response to each corresponding question.

Code	Statement	Response				
		1	**2**	**3**	**4**	**5**
CEE1	We keep in mind that our primary purpose is to discover and capitalize on new opportunities in the circular economy					
CEE2	We keep in mind that our key responsibility is to improve resource efficiency					
CEE3	We keep in mind that our primary responsibility is to enhance sustainable economic, social and environmental values					
CEE4	We keep in mind that our fundamental obligation is to sustainably improve the overall performance of the agrifood value chain					
CEE5	We keep in mind that our major mission is to help achieve worldwide and national sustainable development objectives					
ISP1	We proactively expand our symbiotic network across companies, industries to seek better resource efficiency					

Appendix continued

Code	Statement	Response				
		1	2	3	4	5
ISP2	We promote sharing facilities in our symbiotic network to optimize resource use efficiency					
ISP3	We promote system integration to maximize resource value creation					
ISP4	We always improve the flow of the materials to ensure its value creation is as high as possible					
ISP5	We promote sharing a waste treatment system in our symbiotic network to optimize efficiency					
ISP6	We promote visualization of the flow of resources in our symbiotic network to optimize management efficiency					
CSCM1	We have a change management process to improve resource efficiency					
CSCM2	We've put procedures and structures in place to regulate the movement of primary resources across the supply chain					
CSCM3	We have systems and processes in place to manage a circular resource flow throughout the supply chain					
CSCM4	We have systems and processes in place to promote resource recycling in the value chain					
CSCM5	We have systems and processes in place to promote resource circularity in open networks across industries					
CSCM6	We have a management system in place to minimize system leakage to control waste and emissions					

Appendix continued

Code	Statement	Response				
		1	2	3	4	5
CSCM7	We have established systems and procedures to connect all players and stakeholders throughout the ecosystem					
CSCM8	We have system and process in place for knowledge sharing about the circular economy field in the ecosystem					
SG1	Consumption of primary resources decreases over time					
SG2	The extent of conversion to using recycled materials increases over time					
SG3	The extent of waste decreases over time					
SG4	Greenhouse gas emissions reduce over time					
SG5	Provide stable employment for society and community over time					
SG6	Over time, more is done to advance social well-being					
SG7	Our operating costs decrease over time					
SG8	Financial performance increases over time					

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References

Aldrich, H. E., & Fiol, C. M. (2007). Fools rush in? The institutional context of industry creation. In Á. Cuervo, D. Ribeiro, & S. Roig (Eds.), *Entrepreneurship* (pp. 105–127). USA: Academy of Management.

Arayssi, M., Jizi, M., & Tabaja, H. H. (2020). The impact of board composition on the level of ESG disclosures in GCC countries. *Sustainability Accounting, Management and Policy Journal, 11*(1), 137–161. https://doi.org/10.1108/SAMPJ-05-2018-1036

Ashton, W. S., Chertow, M. R., & Althaf, S. (2022). Industrial symbiosis: Novel supply networks for the circular economy. In Circular economy supply chains: from chains to systems. (pp. 29–48). Emerald Publishing Limited

Baah, C., Opoku-Agyeman, D., Acquah, I. S. K., Agyabeng-Mensah, Y., Afum, E., & Faibil, D. (2021). Examining the correlations between stakeholder pressures, green production practices, firm reputation, environmental and financial performance: Evidence from manufacturing SMEs. *Sustainable Production and Consumption, 27*, 100–114. https://doi.org/10.1016/j.spc.2020.10.015

Bai, C., Sarkis, J., Yin, F., & Dou, Y. (2020). Sustainable supply chain flexibility and its relationship to circular economy-target performance. *International Journal of Production Research, 58*(19), 5893–5910. https://doi.org/10.1080/00207543.2019.1661532

Baldassarre, B., Schepers, M., Bocken, N., Cuppen, E., Korevaar, G., & Calabretta, G. (2019). Industrial symbiosis: Towards a design process for eco-industrial clusters by integrating circular economy and industrial ecology perspectives. *Journal of Cleaner Production, 216*, 446–460. https://doi.org/10.1016/j.jclepro.2019.01.091

Batista, L., Bourlakis, M., Smart, P., & Maull, R. (2018). In search of a circular supply chain archetypeea content-analysis-based literature review. *Production Planning & Control, 29*(6), 438–451. https://doi.org/10.1080/09537287.2017.1343502

Ben Amara, D., & Chen, H. (2021). Evidence for the mediating effects of eco-innovation and the impact of driving factors on sustainable business growth of agribusiness. *Global Journal of Flexible Systems Management, 22*(3), 251–266. https://doi.org/10.1007/s40171-021-00274-w

Bhattacharya, A. (2021). Achieving sustainability in supply chain operations in the interplay between circular economy and Industry 4.0. *Production Planning & Control*. https://doi.org/10.1080/09537287.2021.1981032

Boehmke, B. C., & Hazen, B. T. (2017). The future of supply chain information systems: The open source ecosystem. *Global Journal of Flexible Systems Management, 18*(2), 163–168. https://doi.org/10.1007/s40171-017-0152-x

Calzolari, T., Genovese, A., & Brint, A. (2022). Circular Economy indicators for supply chains: a systematic literature review. *Environmental and Sustainability Indicators, 13*, 100160. https://doi.org/10.1016/j.indic.2021.100160

Cantarelli, C. C. (2022). Innovation in megaprojects and the role of project complexity. *Production Planning & Control, 33*(9–10), 943–956. https://doi.org/10.1080/09537287.2020.1837934

Chari, A., Niedenzu, D., Despeisse, M., Machado, C. G., Azevedo, J. D., Boavida-Dias, R., & Johansson, B. (2022). Dynamic capabilities for circular manufacturing supply chains—Exploring the role of Industry 4.0 and resilience. *Business Strategy and the Environment, 31*(5), 2500–2517. https://doi.org/10.1002/bse.3040

Chen, X., Dong, M., Zhang, L., Luan, X., Cui, X., & Cui, Z. (2022). Comprehensive evaluation of environmental and economic benefits of industrial symbiosis in industrial parks. *Journal of Cleaner Production, 354*, 131635. https://doi.org/10.1016/j.jclepro.2022.131635

Cobanoglu, C., Moreo, P. J., & Warde, B. (2001). A comparison of mail, fax and web-based survey methods. *International Journal of Market Research, 43*(4), 1–15. https://doi.org/10.1177/147078530104300401

Colin David, R. (2020). Entrepreneurial motivation to participate in the circular economy. In N. Baporikar (Ed.), *Handbook of research on entrepreneurship development and opportunities in circular economy* (pp. 271–283). IGI Global. https://doi.org/10.4018/978-1-7998-5116-5.ch014

Cullen, U. A., & De Angelis, R. (2021). Circular entrepreneurship: A business model perspective. *Resources, Conservation and Recycling, 168*, 105300. https://doi.org/10.1016/j.resconrec.2020.105300

D'Amato, D., Droste, N., Allen, B., Kettunen, M., Lähtinen, K., Korhonen, J., Leskinen, P., Matthies, B. D., & Toppinen, A. (2017). Green, circular, bio economy: A comparative analysis of sustainability avenues. *Journal of Cleaner Production, 168*, 716–734. https://doi.org/10.1016/j.ecolecon.2018.12.026

D'Amato, D., Korhonen, J., & Toppinen, A. (2019). Circular, green, and bio economy: How do companies in land-use intensive sectors align with sustainability concepts? *Ecological Economics, 158*, 116–133. https://doi.org/10.1016/j.ecolecon.2018.12.026

De Angelis, R., Howard, M., & Miemczyk, J. (2018). Supply chain management and the circular economy: Towards the circular supply chain. *Production Planning & Control, 29*(6), 425–437. https://doi.org/10.1016/j.jclepro.2017.09.053

De Jesus, A., & Mendonça, S. (2018). Lost in transition? Drivers and barriers in the eco-innovation road to the circular economy. *Ecological Economics, 145*, 75–89. https://doi.org/10.1016/j.ecolecon.2017.08.001

del Mar Alonso-Almeida, M., Rodriguez-Anton, J. M., Bagur-Femenías, L., & Perramon, J. (2021). Institutional Entrepreneurship enablers to promote circular economy in the European Union: Impacts on transition towards a more circular economy. *Journal of Cleaner Production, 281*, 124841. https://doi.org/10.1016/j.jclepro.2020.124841

Dhar, B. K., Stasi, A., Döpping, J. O., Gazi, M. A. I., Shaturaev, J., & Sarkar, S. M. (2022). Mediating role of strategic flexibility between leadership styles on strategic execution: A study on Bangladeshi private enterprises. *Global Journal of Flexible Systems Management, 23*(3), 409–420. https://doi.org/10.1007/s40171-022-00310-3

Diaz Lopez, F. J., Bastein, T., & Tukker, A. (2019). Business model innovation for resourceefficiency, circularity and cleaner production: What 143 cases tell us. *Ecological Economics, 155*, 20–35. https://doi.org/10.1016/j.ecolecon.2018.03.009

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2008). *Internet, mail, and mixedmode surveys: The tailored design method*. Hoboken: Wiley.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*(2), 147. https://doi.org/10.2307/2095101

Domenech, T., Bleischwitz, R., Doranova, A., Panayotopoulos, D., & Roman, L. (2019). Mapping industrial symbiosis development in Europe_ typologies of networks, characteristics, performance

and contribution to the circular economy. *Resources, Conservation and Recycling, 141*, 76–98. https://doi.org/10.1016/j.resconrec.2018.09.016

Dou, Y., Sun, L., Fujii, M., Kikuchi, Y., Kanematsu, Y., & Ren, J. (2021). Towards a renewable-energy-driven district heating system: key technology, system design and integrated planning. *Renewable-Energy-Driven Future*. https://doi.org/10.1016/B978-0-12-820539-6.00010-8

Elkington, J. (1998). *Cannibals with forks: The triple bottom line of 21st century business* (2nd ed.). Minnesota: Capstone Publishing Ltd.

Elliot, V. H. (2016). Institutional entrepreneurship and change: A contemporary history of the Swedish banking industry and its performance management systems. *Journal of Accounting & Organizational Change, 12*(2), 223–251. https://doi.org/10.1108/JAOC-06-2013-0059

Falk, R. F., & Miller, N. B. (1992). *A primer for soft modeling*. USA: University of Akron Press.

Farooque, M., Zhang, A., & Liu, Y. (2019a). Barriers to circular food supply chains in China. *Supply Chain Management, 24*(5), 677–696. https://doi.org/10.1108/SCM-10-2018-0345

Farooque, M., Zhang, A., Liu, Y., & Hartley, J. L. (2022). Circular supply chain management: Performance outcomes and the role of eco-industrial parks in China. *Transportation Research Part E: Logistics and Transportation Review, 157*, 102596. https://doi.org/10.1016/j.tre.2021.102596

Farooque, M., Zhang, A., Thürer, M., Qu, T., & Huisingh, D. (2019b). Circular supply chain management: A definition and structured literature review. *Journal of Cleaner Production, 228*, 882–900. https://doi.org/10.1016/j.jclepro.2019.04.303

Fitch-Roy, O., Benson, D., & Monciardini, D. (2020). Going around in circles? Conceptual recycling, patching and policy layering in the EU circular economy package. *Environmental Politics, 29*(6), 983–1003. https://doi.org/10.1080/09644016.2019.1673996

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.2307/3151312

Freeman, R. E. (2010). *Strategic management: a stakeholder approach*. Cambridge: Cambridge University Press.

Garcia-Saravia Ortiz-de-Montellano, C., & van der Meer, Y. (2022). A theoretical framework for circular processes and circular impacts through a comprehensive review of indicators. *Global Journal of Flexible Systems Management, 23*(2), 291–314. https://doi.org/10.1007/s40171-022-00300-5

Gasbarro, F., Rizzi, F., & Frey, M. (2018). Sustainable institutional entrepreneurship in practice: Insights from SMEs in the clean energy sector in Tuscany (Italy). *International Journal of Entrepreneurial Behavior & Research, 24*(2), 476–498. https://doi.org/10.1108/IJEBR-11-2015-0259

Geissdoerfer, M., Morioka, S. N., de Carvalho, M. M., & Evans, S. (2018). Business models and supply chains for the circular economy. *Journal of Cleaner Production, 190*, 712–721. https://doi.org/10.1016/j.jclepro.2018.04.159

Genovese, A., Acquaye, A. A., Alejandro Figueroa, S., & Koh, L. (2017). Sustainable supply chain management and the transition towards a circular economy: evidence and some applications. *Omega, 66*, 344–357. https://doi.org/10.1016/j.omega.2015.05.015

Gleißner, W., Günther, T., & Walkshäusl, C. (2022). Financial sustainability: Measurement and empirical evidence. *Journal of Business Economics, 92*(3), 467–516. https://doi.org/10.1007/s11573-022-01081-0

Govindan, K., & Hasanagic, M. (2018). A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. *International Journal of Production Research https*. https://doi.org/10.1080/00207543.2017.1402141

Goyal, P., Rahman, Z., & Kazmi, A. A. (2013). Corporate sustainability performance and firm performance research: Literature review and future research agenda. *Management Decision, 51*(2), 361–379. https://doi.org/10.1108/00251741311301867

Groll, S. (1980). The active role of use value' in marx's economics. *History of Political Economy, 12*(3), 336–371.

Gupta, A. K., & Gupta, N. (2021). Environment practices mediating the environmental compliance and firm performance: An institutional theory perspective from emerging economies. *Global Journal of Flexible Systems Management, 22(3)*, 157–178. https://doi.org/10.1007/s40171-021-00266-w

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis*. NY: Pearson Education Limited.

Hair, J. F. J., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). USA: Sage.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J. F., Jr., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014b). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review, 26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Harland, C. (2021). Discontinuous wefts: Weaving a more interconnected supply chain management tapestry. *Journal of Supply Chain ManagemEnt, 57*(1), 27–40. https://doi.org/10.1111/jscm.12249

Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management & Data Systems, 116*(1), 2–20. https://doi.org/10.1108/IMDS-09-2015-0382

Heras-Saizarbitoria, I., Urbieta, L., & Boiral, O. (2021). Organizations' engagement with sustainable development goals: From cherry-picking to SDG-washing? *Corporate Social Responsibility and Environmental Management, 29*(2), 316–328. https://doi.org/10.1002/csr.2202

Herczeg, G., Akkerman, R., & Hauschild, M. Z. (2018). Supply chain collaboration in industrial symbiosis networks. *Journal of Cleaner Production, 171*, 1058–1067. https://doi.org/10.1016/j.jclepro.2017.10.046

Homrich, A. S., Galva, G., Gamboa Abadia, L., & Carvalho, M. M. (2018). The circular economy umbrella: trends and gaps on integrating pathways. *Journal of Cleaner Production, 175*, 525–543. https://doi.org/10.1016/j.jclepro.2017.11.064

Hourneaux, F., Jr., Gabriel, M. L. D. S., & Gallardo-Vázquez, D. A. (2018). Triple bottom line and sustainable performance measurement in industrial companies. *Revista De Gestão, 25*(4), 413–429. https://doi.org/10.1108/REGE-04-2018-0065

Isenmann, R., & Chernykh, K. (2009). The role of ICT in industrial symbiosis projects-environmental ICT applications for eco-industrial development. *In EnviroInfo, 2*, 223–234.

Jabbour, C. J. C., Seuring, S., de Sousa Jabbour, A. B. L., Jugend, D., Fiorini, P. D. C., Latan, H., & Izeppi, W. C. (2020). Stakeholders, innovative business models for the circular economy and sustainable performance of firms in an emerging economy facing institutional voids. *Journal of environmental management, 264*, 110416. https://doi.org/10.1016/j.jenvman.2020.110416

Jaiswal, P. (2022). Impact of leader's behavioural flexibility on intra- and inter-organizational governance flexibility. *Global Journal of Flexible Systems Management, 23*(Suppl 1), S29–S38. https://doi.org/10.1007/s40171-022-00314-z

Jonker, J., Berkers, F., Derks, M., Montenegro Navarro, N., Wieclawska, S., Speijer, F., Engels, H. (2020). Collaborative business models for transition. *TNO Report*, 1–42

Kaza, S., Yao, L.C., Bhada-Tata, P. and Van Woerden, F. (2018). *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development, World Bank, Washington, DC

Kazancoglu, Y., Ozkan-Ozen, Y. D., Sagnak, M., Kazancoglu, I., & Dora, M. (2021). Framework for a sustainable supply chain to overcome risks in transition to a circular economy through Industry 4.0. *Production Planning & Control, 34*(10), 902–917. https://doi.org/10.1080/09537287.2021.1980910

Khaled, R., Ali, H., & Mohamed, E. K. A. (2021). The sustainable development goals and corporate sustainability performance: Mapping, extent and determinants. *Journal of Cleaner Production, 311*, 127599. https://doi.org/10.1016/j.jclepro.2021.127599

Khan, F., & Ali, Y. (2022). Implementation of the circular supply chain management in the pharmaceutical industry. *Environment, Development and Sustainability, 24*(12), 13705–13731. https://doi.org/10.1007/s10668-021-02007-6

Khan, M. A., Stoll, O., West, S., & Wuest, T. (2022). Equipment upgrade service provision in the context of servitization: Drivers, capabilities, and resources. *Production Planning & Control*. https://doi.org/10.1080/09537287.2022.2063199

Khitous, F., Strozzi, F., Urbinati, A., & Alberti, F. (2020). A systematic literature network analysis of existing themes and emerging research trends in circular economy. *Sustainability, 12*(4), 1633. https://doi.org/10.3390/su12041633

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation & Recycling, 127*, 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration, 11*(4), 1–10. https://doi.org/10.4018/ijec.2015100101

Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E. (2018). Circular economy as an essentially contested concept. *Journal Cleaner Production, 175*, 544–552. https://doi.org/10.1016/j.jclepro.2017.12.111

Kumar, V., Vrat, P., & Shankar, R. (2022). Factors influencing the implementation of industry 4.0 for sustainability in manufacturing. *Global Journal of Flexible Systems Management, 23*(4), 453–478. https://doi.org/10.1007/s40171-022-00312-1

Kusi-Sarpong, S., Gupta, H., Khan, S. A., Chiappetta Jabbour, C. J., Rehman, S. T., & Kusi-Sarpong, H. (2021). Sustainable supplier selection based on industry 4.0 initiatives within the context of circular economy implementation in supply chain operations. *Production Planning & Control, 34*(10), 999–1019.

Lacy, P., Cooper, T., Hayward, R., & Neuberger, L. (2010). *A new era of sustainability: UN global compact, accenture CEO study 2010*. New York: Accenture Institute for High Performance.

Lahane, S., & Kant, R. (2021). Evaluating the circular supply chain implementation barriers using Pythagorean fuzzy AHP-DEMATEL approach. *Cleaner Logistics and Supply Chain, 2*, 100014. https://doi.org/10.1016/j.clscn.2021.100014

Liu, Z., Adams, M., Cote, R. P., Geng, Y., Chen, Q., Liu, W., Sun, L., & Yu, X. (2017). Comprehensive development of industrial symbiosis for the response of greenhouse gases emission mitigation: Challenges and opportunities in China. *Energy Policy, 102*, 88–95. https://doi.org/10.1016/j.enpol.2016.12.013

Llach, J., Alonso-Almeida, M. D. M., García-Castellví, A., & Bagur-Femenias, L. (2015). A fresh approach to context influence, development and performance in environmental management. *Business Strategy and the Environment, 24*(8), 855–872. https://doi.org/10.1002/bse.1850

Luo, N., Olsen, T., Liu, Y., & Zhang, A. (2022). Reducing food loss and waste in supply chain operations. *Transportation Research Part E: Logistics and Transportation Review, 162*, 102730. https://doi.org/10.1016/j.tre.2022.102730

Luthra, S., Sharma, M., Kumar, A., Joshi, S., Collins, E., & Mangla, S. (2022). Overcoming barriers to cross-sector collaboration in circular supply chain management: a multi-method approach. *Transportation Research Part E: Logistics and Transportation Review, 157*, 102582. https://doi.org/10.1016/j.tre.2021.102582

Lynde, R. (2020). Innovation & entrepreneurship driving food system transformation. *Physiology & Behavior, 220*, 112866. https://doi.org/10.1016/j.physbeh.2020.112866

Mangla, S. K., Luthra, S., Mishra, N., Singh, A., Rana, N. P., Dora, M., & Dwivedi, Y. (2018). Barriers to effective circular supply chain management in a developing country context. *Production Planning & Control, 29*(6), 551–569. https://doi.org/10.1080/09537287.2018.1449265

McDougall, N., Wagner, B., & MacBryde, J. (2019). An empirical explanation of the natural-resource-based view of the firm. *Production Planning & Control, 30*(16), 1366–1382. https://doi.org/10.1080/09537287.2019.1620361

Merli, R., Preziosi, M., & Acampora, A. (2018). How do scholars approach the circular economy? A systematic literature review. *Journal of Cleaner Production, 178*, 703–722. https://doi.org/10.1016/j.jclepro.2017.12.112

Meyer, J., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology, 83*(2), 340–363. https://doi.org/10.1086/226550

Nasir, M. H. A., Genovese, A., Acquaye, A. A., Koh, S. C. L., & Yamoah, F. (2017). Comparing linear and circular supply chains: A case study from the construction industry. *International Journal of Production Economics, 183*, 443–457. https://doi.org/10.1016/j.ijpe.2016.06.008

Nattassha, R., Handayati, Y., Simatupang, T. M., & Siallagan, M. (2020). Understanding circular economy implementation in the agri-food supply chain: the case of an Indonesian organic fertiliser producer. *Agriculture & Food Security, https*. https://doi.org/10.1186/s40066-020-00264-8

OECD. (2021). SME and Entrepreneurship Policy in Viet Nam, OECD Studies on SMEs and Entrepreneurship, OECD Publishing, Paris

Oughton, C., Kurup, B., Anda, M., & Ho, G. (2022). Industrial symbiosis to circular economy: What does the literature reveal for a successful complex industrial area? *Circular Economy and Sustainability*. https://doi.org/10.1007/s43615-022-00153-1

Parida, V., Burström, T., Visnjic, I., & Wincent, J. (2019). Orchestrating industrial ecosystem in circular economy: A two-stage transformation model for large manufacturing companies. *Journal of Business Research, 101*, 715–725. https://doi.org/10.1016/j.jbusres.2019.01.006

Pereira, V., Behl, A., Jayawardena, N., Laker, B., Dwivedi, Y. K., & Bhardwaj, S. (2022). The art of gamifying digital gig workers: A theoretical assessment of evaluating engagement and motivation. *Production Planning & Control*. https://doi.org/10.1080/09537287.2022.2083524

Prabhu, H. M., & Srivastava, A. K. (2023). CEO transformational leadership, supply chain agility and firm performance: A TISM modeling among SMEs. *Global Journal of Flexible Systems Management, 24*(1), 51–65. https://doi.org/10.1007/s40171-022-00323-y

Rovanto, S., & Finne, M. (2022). What motivates entrepreneurs into circular economy action? Evidence from Japan and Finland. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-022-05122-0

Saavedra, Y. M. B., Iritani, D. R., Pavan, A. L. R., & Ometto, A. R. (2018). Theoretical contribution of industrial ecology to circular

economy. *Journal of Cleaner Production, 170*, 1514–1522. https://doi.org/10.1016/j.jclepro.2017.09.260

Salomone, R., Cecchin, A., Deutz, P., Raggi, A., & Cutaia, L. (Eds.). (2020). *Industrial symbiosis for the circular economy: operational experiences, best practices and obstacles to a collaborative business approach*. Cham: Springer International Publishing.

Sarker, M. R., Moktadir, M. A., & Santibanez-Gonzalez, E. D. (2021). Social sustainability challenges towards flexible supply chain management: Post-COVID-19 perspective. *Global Journal of Flexible Systems Management, 22*(Suppl 2), S199–S218. https://doi.org/10.1007/s40171-021-00289-3

Saroha, M., Garg, D., & Luthra, S. (2021). Analyzing the circular supply chain management performance measurement framework: The modified balanced scorecard technique. *International Journal of System Assurance Engineering and Management*. https://doi.org/10.1007/s13198-021-01482-4

Schultz, F. C., Everding, S., & Pies, I. (2021). Circular supply chain governance: A qualitative-empirical study of the European polyurethane industry to facilitate functional circular supply chain management. *Journal of Cleaner Production, 317*, 128445. https://doi.org/10.1016/j.jclepro.2021.128445

Sehnem, S., Vazquez-Brust, D., Pereira, S. C. F., & Campos, L. M. S. (2019). Circular economy: Benefits, impacts and overlapping. *Supply Chain Management, 24*(6), 784–804. https://doi.org/10.1108/SCM-06-2018-0213

Smith, W. L., Hillon, Y. C., & Liang, Y. (2019). Reassessing measures of sustainable firm performance: A consultant's guide to identifying hidden costs in corporate disclosures. *Business Strategy and the Environment, 28*(2), 353–365. https://doi.org/10.1002/bse.2254

Sun, L., Li, H., Dong, L., Fang, K., Ren, J., Geng, Y., Fujii, M., Zhang, W., Zhang, N., & Liu, Z. (2017). Eco-benefits assessment on urban industrial symbiosis based on material flows analysis and emergy evaluation approach: A case of Liuzhou city, China. *Resources, Conservation Recycling, 119*, 78–88. https://doi.org/10.1016/j.resconrec.2016.06.007

Taddeo, R., Simboli, A., Morgante, A., & Erkman, S. (2017). The development of industrial symbiosis in existing contexts. Experiences from three Italian clusters. *Ecological Economics, 139*, 55–67. https://doi.org/10.1016/j.ecolecon.2017.04.006

Tapaninaho, R., & Heikkinen, A. (2022). Value creation in circular economy business for sustainability: A stakeholder relationship perspective. *Business Strategy and the Environment, 31*(6), 2728–2740. https://doi.org/10.1002/bse.3002

Trokanas, N., Cecelja, F., Yu, M., & Raafat, T. (2014). Optimising environmental performance of symbiotic networks using semantics. *Computer Aided Chemicals Engineering, 33*, 847–852. https://doi.org/10.1016/B978-0-444-63456-6.50142-3

Turken, N., & Geda, A. (2020). Supply chain implications of industrial symbiosis: A review and avenues for future research. *Resources, Conservation and Recycling, 161*, 104974. https://doi.org/10.1016/j.resconrec.2020.104974

Van der Waal, J. W. H., & Thijssens, T. (2019). Corporate involvement in sustainable development goals: Exploring the territory. *Journal of Cleaner Production, 252*, 119625. https://doi.org/10.1016/j.jclepro.2019.119625

Vickery, S. K., Jayaram, J., Droge, C., & Calantone, R. (2003). The effects of an integrative supply chain strategy on customer service and financial performance: An analysis of direct versus indirect relationships. *Journal of Operations Management, 21*, 523–539. https://doi.org/10.1016/j.jom.2003.02.002

Wadhwa, S., & Rao, K. S. (2004). A unified framework for manufacturing and supply chain flexibility. *Global Journal of Flexible Systems Management*, 5(1), 29–36.

Wetzels, M., Odekerken-Schröder, G., & Van Oppen, C. (2009). Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. *MIS quarterly, 33*(1), 177–195. https://doi.org/10.2307/20650284

Wu, I. L., & Chang, C. H. (2012). Using the balanced scorecard in assessing the performance of e-SCM diffusion: A multi-stage perspective. *Decision Support Systems, 52*, 474–485. https://doi.org/10.1016/j.dss.2011.10.008

Zhang, A., Wang, J. X., Farooque, M., Wang, Y., & Choi, T.-M. (2021). Multi-dimensional circular supply chain management: A comparative review of the state-of-the-art practices and research. *Transportation Research Part E: Logistics and Transportation Review, 155*, 102509. https://doi.org/10.1016/j.tre.2021.102509

Zhao, K. (2021). Industrial symbiosis: Practices in China's industrial parks. *Field Actions Science Reports, Special Issue, 23*, 54–59.

Zhu, Q., Jia, R., & Lin, X. (2019). Building sustainable circular agriculture in China: Economic viability and entrepreneurship. *Management Decision, 57*(4), 1108–1122. https://doi.org/10.1108/MD-06-2018-0639

Key Questions

(1) How does circular economy entrepreneurship associate with industrial symbiosis practices for scoring circular supply chain management and sustainability performance goals?
(2) How will industrial symbiosis practices and closed-loop supply chain control mediate the link between closed-loop economy entrepreneurship, thereby procuring sustainability performance goals?

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