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# Cocreating Value Through Open Circular Innovation Strategies: A Results-Driven Work Plan and Future Research Avenues

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## ABSTRACT

For the time being, there is limited research focused on open innovation approaches that promote the development and growth of stakeholder-driven circular economy models. This article addresses this knowledge gap. Its objectives are threefold: Firstly, it describes key elements of open innovation and circular value cocreation. Secondly, it utilizes the findings from a comprehensive systematic review to identify opportunities and challenges related to the open circular innovation paradigm. Thirdly, it presents theoretical implications and an action plan, alongside future research avenues, that highlight the importance of engaging in collaborative behaviors with stakeholders. It emphasizes a cocreation culture that encourages the sharing of resources, competencies, and capabilities, while safeguarding the organizations' intellectual properties. Such practices aim to foster coupled innovation and support circular economy strategies like resource recovery, reverse logistics, and industrial symbiosis, among others. Unlike many other articles, this contribution clearly specifies that there is scope for practitioners to develop circular economy ecosystems that increase the practitioners' bottom lines, while reducing their environmental impacts.

## 1 | Introduction

Various stakeholders in society, including the businesses themselves, are recognizing the limitations of traditional linear business models characterized by "take-make-dispose" approaches (Leitão et al. 2023; Sundar et al. 2023; Tumuyu et al. 2024). Such unsustainable practices are detrimental for our planet as they are focused on the consumption and disposal of finite natural resources, where recycling is often limited or inefficient, thereby contributing to the generation of waste, as well as to the scarcity and depletion of raw materials, environmental degradation, and emissions (Camilleri 2019). Many of them are realizing that businesses need to invest in resilient clean production systems to reduce the externalities, including the generation of waste and pollution, to the detriment of our planet (Giannetti et al. 2023).

Very often, manufacturers are collaborating with stakeholders in their value chain to reduce their dependence on new resources by reusing, refurbishing, recycling, and upcycling materials to keep them in circulation for as long as possible (Bocken and Ritala 2022; Köhler et al. 2022). They may or may not always refer to concepts like open innovation and/or to circular economy solutions. However, in many cases, responsible businesses are adopting a systems-focused approach by reconceiving their industries' processes and economic activities in how they create, exchange, and utilize resources in their operations (Agrawal et al. 2022). Some businesses are even developing superior designs of manufacturing, systems, and products to be less resource intensive, to reduce harmful materials and to minimize environmental impacts from waste and pollution (Cooney et al. 2023).

The recovery of materials and products at the end of their lifecycle has an important role to play to combat climate change and greenhouse gas emissions (Ai et al. 2024; Triguero et al. 2022). In this light, various organizations are teaming up to promote the circular economy's sustainable practices while gaining economic, competitive, and reputational benefits (Brown et al. 2020). Arguably, through collaborative open innovation approaches, companies can innovate, reduce costs, and create resilient business models that align with market demand and environmental sustainability (Jesus and Jugend 2023). A few commentators noted that there is a business case for practitioners to form partnerships to accelerate their transition toward the circular economy model (Brown et al. 2020; Camilleri 2020; Triguero et al. 2022).

The proponents of the circular economy sought to define this notion as a sustainable model that seeks to minimize waste by making the most out of extant resources by creating closed-loop systems, where materials are reused, refurbished, recycled, or repurposed, to minimize the need for raw materials (Ellen MacArthur Foundation 2017; EU 2020; Ghisellini et al. 2016). Therefore, the circular economy aims to promote regenerative processes and ecosystems, where resource input and waste output are minimized as much as possible. Hence, products are designed for durability, repairability, and upgradability in order to extend their lifecycle.

On the other hand, the open innovation paradigm is characterized when organizations source knowledge, ideas, and technologies from within as well as from outside their boundaries, to accelerate innovation (Chesbrough and Crowther 2006). This way, they hope to foster fruitful collaboration between various stakeholders, including with other businesses, governments, academia, and consumers. Open innovation approaches could be particularly relevant for complex, multidimensional challenges related to the circular economy's closed-loop systems, where the expertise and resources required often span traditional organizational and industry boundaries (Calabrese et al. 2024; Köhler et al. 2022; Triguero et al. 2022).

Although the circular economy and open innovation notions have been widely explored individually, their intersection still remains under-researched (this is clearly confirmed through the findings of this contribution's systematic review). Indeed, they offer opportunities as well as challenges. While practitioners may resort to them to share best practices for sustainable futures, it is very likely that they encounter technological, political, socio-economic and systemic barriers that can affect their cross-sector collaboration (Jesus and Jugend 2023; Sergianni et al. 2024; Sgambaro et al. 2024). Notwithstanding, the current academic literature has not yet fully clarified how these two notions can be integrated in an effective, efficient, and economic manner, to drive sustainable innovation.

This contribution aims to address this knowledge gap in the academic literature. Its underlying research questions are: (RQ1) How and in what ways could practitioners implement open circular innovation approaches? (RQ2) What are the drivers and barriers that are affecting the development and growth of open circular ecosystems? (RQ3) How could open innovation methodologies foster circular economy outcomes that add value to the practitioners' organizational performance, to their stakeholders, and to environmental sustainability? In conclusion, this article advances managerial implications that outline a results-driven work plan that integrates open innovation's cocreation practices for circular economy outcomes.

## 2 | Key Concepts

### 2.1 | Open Innovation

Open innovation involves a high degree of trust and belief among collaborating partners (Lam et al. 2021; Ogink et al. 2023). This notion suggests that companies benefit from the knowledge and capabilities of a wide array of stakeholders, including of their human resources, as well of external participants (Lippolis et al. 2023; Luan and Wang 2024). Practitioners may avail themselves of expert individuals and organizations who are not members of staff in their organization. Hence, they could collaborate with other businesses, enterprises, and startups as well as with institutions like universities to achieve their organizations' objectives (Cappellaro et al. 2019). Various commentators noted that stakeholder engagement could lead to win-win outcomes for all parties involved in open innovation partnerships (Camilleri et al. 2023; Diriker et al. 2023; Kim et al. 2024). Very often, they confirmed that when practitioners worked in tandem with external stakeholders' practitioners, they were in a better position to improve their operational performance, in terms of incremental and radical innovations, as opposed to when they were on their own (Radicic and Alkaraan 2024).

Several researchers indicated that businesses could increase their competitive advantage and enhance their research and development (R&D) capabilities when they forge collaborative agreements with consultants, disruptive startups, agile companies, reliable suppliers, and excellent universities with cutting-edge facilities as well as with their talented researchers (Beck et al. 2023; Chen 2018). This is in stark contrast with secretive, closed-innovation mentalities characterized when organizations withhold knowledge and ideas generated by their own intellectual capital and internal resources (Barbic et al. 2021; Yoshino et al. 2023). In this case, firms are very careful not to leak insider information to external stakeholders.

Generally, open innovation ecosystems comprise (i) intellectual property management (Ahlfänger et al. 2022; Fu et al. 2022; Greco et al. 2022; Grimaldi et al. 2021; Jesus et al. 2024; Naveed et al. 2020; Oke 2023), (ii) open innovation culture and governance (Avnimelech and Amit 2024; Lippolis et al. 2023), (iii) inbound innovation (outside-in innovation) (Barjak and Heimsch 2023; Cappellaro et al. 2019; Pilav-Velic and Jahic 2022), (iv) outbound innovation (inside-out innovation) (de Andrés-Sánchez et al. 2022; Remneland Wikhamn and Styhre 2019), (v) coupled innovation (cocreation) (Cammarano et al. 2022), (vi) open innovation intermediaries (Caloffi et al. 2023), and (vii) corporate innovation hubs (Amann et al. 2022; Corvello et al. 2023). Practitioners may avail themselves of open innovation systems to access diverse ideas, resources, and capabilities from their own human resources' talent pool, and more importantly, from

**TABLE 1** | A definition of open innovation's key elements.

| Concept | Definition |
|---|---|
| Intellectual property management | Intellectual property management (IPM) involves processes and strategies used to protect, develop, and commercialize intellectual property (IP) rights, to maximize the value of the organization's assets, while also managing risks associated with infringement or disputes. Practitioners are entrusted to find a trade-off between their organizations' openness in terms of knowledge sharing, and the protection of their assets and IPs. |
| Open innovation culture | An open innovation culture involves creating an organizational environment that supports open innovation. It requires strategic leadership, purposeful goal setting, effective communication, incentives for stakeholders, and appropriate governance structures. |
| Inbound innovation (outside-in innovation) | Inbound innovation involves bringing external knowledge, competences, capabilities, resources, and technologies, into the organization, to complement internal R&D activities. |
| Outbound innovation (inside-out innovation) | Outbound innovation involves sharing or selling internal knowledge, intellectual property or technologies to external parties, to create additional value streams. |
| Coupled innovation (cocreation) | Coupled innovation involves inbound and outbound open innovation strategies, as practitioners collaborate with their employees and with external partners, to cocreate knowledge, risks, and rewards. |
| Open innovation intermediaries | Open innovation intermediaries facilitate open innovation. They play a critical role in bridging the gap between external, and internal innovators, to tap into new knowledge and ideas. |
| Corporate innovation hubs | Corporate innovation hubs involve setting up physical or virtual hubs in regions with rich innovation ecosystems (e.g., Silicon Valley), to engage with startups, universities, and venture capitalists. |

knowledgeable external sources. Table 1 sheds light on the most popular open innovation concepts and provides their definitions.

### 2.2 | The Circular Economy

The proponents of the circular economy describe it as an economic system that is intended to increase resource efficiencies by reducing, repairing, refurbishing, reusing, recycling, and remanufacturing materials (Ellen MacArthur Foundation 2017). Frequently, they argue that the rationale behind the circular economy mantra is to minimize waste produced during manufacturing as well as after the consumption of products and materials (Camilleri 2019; Ghisellini et al. 2016). Several academic commentators argue that its underlying goals are to raise awareness about regenerative practices that can extend the lifecycle of products and their components by converting waste into valuable resources, thereby reducing the producers' reliance on finite resources (Agrawal et al. 2022; Calabrese et al. 2024; Gambelli et al. 2024; Köhler et al. 2022; Sundar et al. 2023; Triguero et al. 2022). Very often, they noted that such closed-loop practices in production–consumption systems would eventually result in significant cost savings for practitioners and to positive environmental sustainability outcomes, in the long run. Table 2 raises awareness about mainstream circular economy practices, provides a short definition for them, and explains their methodologies.

The above circular economy approaches are increasingly being employed by responsible practitioners. Very often, they shift their operations from traditional linear manufacturing models to circular, closed-loop systems. By doing so, they reduce their businesses' environmental impact and enhance their companies' economic resilience. Yet, in many cases, their transition to become sustainable businesses requires systemic change, innovation, and ongoing collaborations (through open innovation systems) across industry sectors, with the support of a wide array of stakeholders.

## 3 | Methodology

This research involves a systematic literature review of high-impact publications on the intersection of "open innovation" and "circular economy." A search query sought to identify publications that included the two notions in their title, abstract, and/or keywords. The results indicated that there were 37 articles, published in English, through Scopus-indexed journals, up to the end of October 2024. Appendix A lists all publications related to the mentioned research inquiry. The findings identify and appraise authors who have combined both strategic management concepts in their studies. It reports their article's year of publication, the rationale/justification of their research, the theoretical base (if any), and the methodological approach that was used to capture and analyze the data.

**TABLE 2** | A list of circular economy practices and a definition of their operating procedures.

| Concept | Definition |
|---|---|
| Reduce, reuse, and recycle resources (3Rs) | Reduce, reuse, and recycle (3Rs) are strategies aimed at conserving resources, minimizing waste, and promoting sustainable production and consumption practices. Reduce involves minimizing the consumption of resources. Reuse focuses on extending the life of products or materials. Recycle refers to the processing of waste materials into new products to avoid using virgin resources. |
| Remanufacturing | Remanufacturing involves the restoration of products that have already been utilized or worn out. It would ensure that the final product meets the highest specifications in terms of functionality, reliability, performance, and quality standards expected by customers. |
| Upcycling | Upcycling is the process of creatively reusing or transforming wasteful materials that are usually discarded products, or by-products, into new items of higher value, quality or functionality. |
| Product-life extension strategy | This strategy involves the extension of the products' lifespans through regular maintenance, repair, upgrades, or by repurposing them through modifications or adaptions (for different purposes than for what they were intended). |
| Industrial symbiosis | This notion refers to the symbiotic relationships among industry practitioners. It is evidenced when companies collaborate to optimize the utilization of resources, to minimize waste or by-products, in order to reduce their environmental impact. |
| Reverse logistics | This notion refers to the development of supply chains and closed-loop systems that are designed to accommodate the return of products or materials that can be repaired, remanufactured, or recycled. Reverse logistics helps to ensure that end-of-life products are collected and brought back into the production cycle. |
| Cradle-to-cradle design | This approach refers to sustainable manufacturing philosophies that ensure that the products and their materials can be safely returned to the natural environment, at their end-of-life. Alternatively, such resources could be reused on an indefinite basis. |
| Biomimicry | This approach involves the emulation of natural designs, patterns, processes, and systems. Biomimicry is intended to promote sustainable practices including resource efficiencies and waste minimization in closed-loop systems. |
| Product-service systems | This notion refers to a business model where companies offer a combination of products and services that are meant to add value to their customers. This model encourages manufacturers to design durable and efficient products that are easy to maintain, repair, or refurbish, thereby leading to environmental and economic benefits. |
| Sharing economy | This approach promotes maximum resource utilization through shared access to products and services. For example, the customers (drivers) of car-sharing service providers can avail themselves of their vehicles without owning them. |

The list of extracted articles is comprehensive. It features the results of a search query that retrieves the complete range of Scopus-indexed journal articles focused on open innovation and circular economy (that have been published in English). It covers all available sources without applying limited criteria, filters, or restrictions. The results clearly indicate that the extracted papers are relatively recent as they were published in the last 7 years, since 2018. Interestingly, the research topic has gained significant momentum in the past year, as 17 out of 37 articles were published in the first 10 months of 2024.

A thematic analysis was carried out on the captured articles to better understand the patterned responses or meanings within the data set, in line with this contribution's underlying

research questions. The above publications were scrutinized in their entirety, in an inductive manner, in order to provide a reasonable interpretation of key paradigms related to this study. The qualitative results were systematically coded and organized into the most conspicuous themes related to open innovation processes, circular economy concepts, and synonymous terms. The themes were compared across different cases to identify similarities, differences, and unique insights, to enable the formulation of generalizable conclusions. The gathered data about open innovation's collaborative approaches and circular economy outcomes that were drawn from high-impact academic articles were integrated with cases of real-life businesses, to enable readers (including practitioners) to assess the applicability of circular processes and innovations across different industries and contexts, to increase the chances for replicability and transferability of sustainable co-creation initiatives.

Case research investigated "how" and "why" inquiries related to this study's research questions. It is particularly suitable for the development of new theory. At the same time, it offers inspiring ideas about emergent practices (Voss et al. 2002). The selection of cases relied on a purposive sampling strategy that aimed to identify sustainable business scenarios that are rich in information and that provide valuable insights into the implementation of collaborative open innovation approaches that advance circular economy models across different industry sectors. Qualitative insights were meticulously drawn through a content analysis of online sources including academic research platforms, regulatory institutions, and nongovernmental and advocacy organizations as well as from sustainable business networks. The featured case studies clearly explain how practitioners are engaging with a wide array of stakeholders and forging collaborative partnerships with them, to achieve circular economy objectives through coupled innovation approaches.

## 4 | The Findings

The stakeholders' open innovation approaches are evidenced through collaborative practices across value chains, as practitioners are willing to share ideas and technologies with "new" partners to advance disruptive sustainable innovations (Battistella and Pessot 2024; Bocken and Ritala 2022; Brown et al. 2020). Inbound innovation practitioners can benefit from external stakeholders' knowledge and expertise to implement product-life extension strategies and resource recovery methods and to cocreate circular economy ecosystems including industrial symbiosis, reverse logistics, product-service systems/product-as-a-service, sharing economy, and leasing models (Köhler et al. 2022; Lisi et al. 2024).

### 4.1 | Resource Recovery and Industrial Symbiosis

Open innovation practitioners would benefit from external competences, capabilities, and technologies from stakeholders who are not in the company's books. Their ongoing engagement and collaboration with them may help them improve their operations as they acquire resources such as human capital, materials, energy, water, and by-products, among others. Resource sharing can help the businesses to optimize manufacturing processes, to minimize waste, and to create a more sustainable and efficient industrial ecosystem (Johnstone 2024).

Practitioners may even benefit from other businesses' externalities including by-products or unwanted waste materials and could utilize them as resources. They can leverage open innovation approaches to address resource scarcity (and resource depletion) by finding new ways to repurpose waste. They may do so by reducing material inputs and by recycling valuable resources (Berkemeier et al. 2024). For example, the heat generated from a power plant could be used to heat buildings or greenhouses located in nearby communities. Industries situated close to each other may share utilities including energy and water supply infrastructure or services, such as transportation, water treatment facilities, or waste management services. Their resource recovery can result in cost saving and operational efficiencies (Johnstone 2024).

Cross-industry collaboration and industrial symbiosis can help companies to discover new uses of waste streams to develop circular supply chains. There is scope for business leaders to engage with external stakeholders, to exchange or sell discarded resources, and by-products that would otherwise end up as waste. Arguably, one company's waste, materials and by-products can serve as resources for others. The sharing of resources among organizations can significantly enhance the practitioners' capabilities, as partners can work in tandem on sustainability initiatives and innovation projects to achieve circular economy outcomes. The stakeholders' pooling of surplus resources can lower the manufacturing costs for collaborating partners, as they allow them to access tools and materials at lower market prices.

The case of Kalundborg, Denmark, typifies such open innovation approaches (CEStakeholderEU n.d.; Valenzuela-Venegas et al. 2016). A power plant (located at Asnæs), a Novo Nordisk (a pharmaceutical company), and an oil refinery (belonging to Equinor, formerly known as Statoil), among other organizations, are working together in industrial symbiosis. In sum, these entities have created a network that optimizes materials from waste or by-products and are turning them into valuable resources. Their aim is to lower their costs while minimizing their environmental impact.

Kalundborg started as an informal exchange of waste materials between industries that are situated in close proximity to one another. For example, the excess heat from the power plant is used by Novo Nordisk for production processes, and to heat local homes. In addition, surplus water from the oil refinery is used by a local fish farm. Over the years, this collaboration has grown into a large-scale, highly efficient system, where waste from one process becomes a resource for another. Such symbiosis has significantly reduced waste, emissions, and water consumption, thereby contributing to environmental and economic sustainability.

Similarly, the municipality of Amsterdam is collaborating with a nonprofit organization, entitled, "Circle Economy." Together, they have developed a strategic plan whose objectives are to turn Amsterdam into a fully circular city by 2050 (Calisto Friant

et al. 2021; CEStakeholderEU 2016; Government.nl 2016). This initiative involves the transformation of various sectors, such as construction, energy, and waste management, among others, to adapt the city to operate closed-loop systems. Collaborative projects comprise the reutilization of materials from demolished buildings to reduce waste generated from the construction industry, the promotion of business models like "product as a service" that encourage the leasing of assets rather than owning them, the development of shared mobility solutions, and the reduction of food waste, among others (Camilleri 2021; Camilleri 2025). These circular economy practices can contribute to reducing resource utilization, consumption, and depletion of materials.

### 4.2 | Resource Recovery, Reverse Logistics, and Product-Life Extension Strategies

Practitioners can collaborate with external partners to extend the life of certain products and/or of their components. They can help each other to recover materials from used and unwanted items, including from waste, in order to reuse, refurbish, recycle, and remanufacture resources to promote sustainable supply chains (Hadi 2024). The resource recovery procedures focus on reclaiming discarded products and their component materials to reuse them as inputs for new production processes (Brown et al. 2020). Similarly, reverse logistics approaches are intended to support the collection and transportation of waste items, like plastics, metal, and electronics, among others (Pichlak and Szromek 2022). For example, returned electronics can be refurbished, remanufactured for further use, and resold. Such operational processes facilitate the flow of products in the opposite direction of traditional supply chains, as they involve returning, repairing, restoring, and recycling materials for a specific manufacturer, or for designated facilities.

The utilized materials that could have finished in a landfill can be repurposed as plausible resources in industrial production (Lisi et al. 2024). Likewise, the products collected through reverse logistics can also be refurbished or remanufactured. This form of resource recovery extends the life of products and reduces the need for new raw materials (Phonthanukitithaworn et al. 2024). There are instances where materials like organic waste, used oils, or even heat could be captured and utilized in waste-to-energy processes, and for resource extraction purposes, instead of being disposed of, in the natural environment (Ahmad et al. 2024; Liu et al. 2023). Therefore, external stakeholders could help sustainability champions in the recovery of resources, or to increase product longevity, and the lifecycles of extant products and/or of their component materials, while reducing material consumption (Panza et al. 2022; Sgambaro et al. 2024). As a result, the responsible manufacturers would be in a position to develop sustainable products that are durable, repairable, recyclable, and/or biodegradable.

For example, retail brands, including H&M, among others have teamed up with Ellen MacArthur Foundation as well as with philanthropists, nongovernmental organizations (NGOs), and disruptive innovators, to design a "new textiles economy" known as Circular Fibres Initiative (Ellen MacArthur Foundation 2021a; UNEP 2023). One of its objectives is to develop materials including sustainable fibers in order to improve their end-of-life processing. As a result, clothing and apparel materials could last longer, be worn multiple times, and may be easily rented, resold, or recycled. This collaboration set the foundation for H&M's efforts to collect and recycle used clothing through their in-store garment collection programs. Similarly, Nike has launched a Circular Innovation Challenge (Di Summa 2023). Like H&M, it invited innovators from around the world to propose ideas for new sustainability materials, design processes, and end-of-life solutions for shoes, to transform the future of footwear. Evidently, Nike's goal was to reduce waste by creating closed-loop products that are recycled or reused at the end of their lifecycle. One of the major outcomes of their challenge was the development of shoes made from recycled materials, including from factory waste and recycled plastics.

Like Nike, Adidas partnered with Parley for the Oceans, an environmental organization, as well as with material innovators and recycling experts, to address a growing consumer demand for eco-friendly and sustainable footwear, without compromising on performance or quality (Murfree and Police 2022). This collaboration is aimed at developing shoes made from recycled ocean plastics, thereby contributing to a circular product lifecycle. As a result, the company's Parley line of shoes, which was/is made from ocean plastics, has quickly become a global success, with millions of pairs sold since its launch. Other apparel brands, including Patagonia, REI, and Eileen Fisher, have joined forces with Yerdle, a technology company that provides logistics capabilities to buy back and resell their used items (Agrawal et al. 2019; Forbes 2019). By taking advantage of resale, brands take control of the growing secondary retail market. Such sustainable recovery practices provide them with an opportunity to extend the life of their existing products. Hence, they are in a position to reduce the generation of unwanted materials that end up in landfills. At the same time, they promote responsible consumption behaviors among consumers, and increase their profits, by selling refurbished items.

Alternatively, for-profit businesses may collaborate with other organizations, including with competitors, to reduce waste related to single-use packaging, that could inevitably end up in landfills, and/or in our oceans. TerraCycle, a United States–based company specializing in recycling hard-to-recycle materials, is a case in point, of such organizations, as its "Loop" platform aims to reduce single-use packaging, by offering consumers reusable, refillable containers for everyday products (Conick 2019; WEF 2023). Launched in 2019, Loop represents a major step toward implementing circular economy principles. It is intended to eliminate waste from disposable packaging through a "return and reuse" system. For the record, Terracycle entered into a partnership with multinational brands like Nestlé, Unilever, and Procter & Gamble, among other retailers Consumers can purchase these brands' products through Loop's platform, and when finished, they can return their empty packages for cleaning and reuse. The partnerships among these big brands has dramatically reduced the need for single-use plastic packaging. As a result, a number of companies have been able to extend the lifecycle of their packaging materials, while offering consumers a more sustainable alternative to traditional packaging. The Loop model has expanded to major retailers like

Carrefour in Europe and Walgreens in the United States, among others, demonstrating that open innovation efforts across different sectors can scale circular practices globally (WEF 2025).

For instance, there is scope for businesses to collaborate with research institutions as well as with NGOs, to develop open innovation solutions that are intended to reduce waste and pollution that are damaging the natural environment and the biosphere (Pichlak and Szromek 2022). For instance, Interface (a flooring company) and the Zoological Society of London have launched the Net-Works Program (Luqmani et al. 2017; ZSL 2025). Essentially, this program involves the utilization of discarded fishing nets and their recycling into nylon yarn, to develop sustainable carpets. Net-Works is designed to tackle the growing environmental problem of discarded fishing nets in some of the globe's poorest coastal communities, including those in the Philippines and Cameroon, among others. This program is aimed at reducing pollution in the oceans, as plastic materials can be ingested by marine animals and/or destroy their habitat. It raises awareness on the use of dangerous resources that are polluting the world's natural environment. Moreover, it offers economic opportunities for the governments of developing countries, as they enable them to provide new sources of income for local communities. Through such sustainable initiatives, Interface has integrated a circular economy approach into its supply chain. It created a model that combines environmental conservation with social impact.

In a similar vein, Unilever, one of the world's largest consumer goods companies, is collaborating with external innovators, research institutions and startups to address the challenge of plastic waste. In short, this multinational business indicated that it is seeking external ideas to reduce plastic waste, to use better plastic that is designed to be recycled, and/or to avoid using plastic by switching to alternative materials (Arijeniwa et al. 2024; Phelan et al. 2022). Unilever's engagement with external partners has helped the organization to utilize responsible material designs, sustainable packaging, and recycling technologies that align with circular economy principles. For example, one of the key success factors of Unilever's open innovation initiative was the development of a fully recyclable plastic detergent bottle that is made from 100% recycled materials. Additionally, this multinational organization continuously raises awareness about its reuse and refill stations for personal care products, in various supermarkets, in different contexts around the globe, thereby reducing the need for single-use packaging. The diverse ideas sourced through external partners are significantly contributing to minimizing the use of virgin plastics by its distributors in the value chains, as well as by their consumers.

Likewise, Proctor & Gamble (P&G) collaborates with external scientists, startups, research institutions, and industry partners in its Connect + Develop program that is intended to develop sustainable products and solutions (Huston and Sakkab 2006). This laudable program seeks external ideas related to sustainable packaging and product designs that are congruent with the company's circular economy goals. Since its inception, P&G has developed new packaging materials that are easier to recycle, such as its clear, recyclable plastic for shampoo bottles. The company has also introduced concentrated product formulations that reduce packaging waste and shipping emissions. P&G's open innovation model allowed the company to access diverse ideas and to rapidly implement responsible and sustainable solutions that align with its circular economy vision.

Another good example of circular economy practices is clearly illustrated when organizations leverage open innovation approaches to adopt waste-to-resource technologies to accelerate their transition to a zero-waste economy. A number of manufacturing firms including automotive businesses are already recovering materials and reutilizing resources from used vehicles at their end-of-life. Renault, one of Europe's largest car makers, has teamed up with Veolia, a global environmental services company and Solvay, a global chemical and advanced materials company, to develop closed-loop recycled resources for automotive parts (Ellen MacArthur Foundation 2021b; Muller et al. 2021). These companies collaborate to utilize end-of-life vehicles to recover metals, plastics and other materials from them, as they are no longer in use. This allows Renault to operate its business sustainably, as the French car maker incorporates recycled materials in its new automobiles. The automotive company's manufacturing plant in Flins, France, became a leading facility in Europe for vehicle disassembly and material recovery, thereby contributing to the circular economy agenda.

### 4.3 | Product-Service Systems/Product-as-a-Service

Other manufacturing practitioners operating in different industries are adopting product-service systems that are also known as product-as-a-service business models. Such circular economy approaches involve companies offering products in combination with services (Sgambaro et al. 2024). The businesses offering product-service systems emphasize about the value derived from accessing and utilizing their maintained products rather than owning them. This economic model clearly specifies that customers do not have to purchase the products they use. Hence, consumers would benefit from utilizing the products and from its performance. Frequently, the practitioners operating business models that are very similar to leasing systems would provide additional services including maintenance, upgrades, and training, among others, along with their products, to add value to customers. As the service providers would usually retain the ownership of their products, it is in their interest to design them as efficient as possible, as they are meant to serve their purpose for a long time, without the need for regular maintenance (Chen 2018). Preferably, they should be designed in a very sustainable manner. Their components ought to be easily recyclable, and preferably modular and lightweight, to increase their likelihood of offering extended product lifespans.

A case in point is Signify (that was formerly known as Philips Lighting). Currently, the Dutch multinational conglomerate is collaborating with various municipalities and businesses (Bocken 2021; Camilleri 2019). The company is adopting a product-service system strategy, as it provides lighting systems as a service to its clients including to municipalities and to businesses, rather than merely selling light bulbs. This enables Signify to retain ownership of its equipment, to maintain its infrastructure as well as to upgrade and recycle its products at their end-of-life. In plain words, its customers will be only expected to pay for the light they use.

Arguably, this business model is clearly promoting the circular economy. It encourages the manufacturers and/or service providers to use efficient materials, as well as to increase the recycling of resources and materials. Hence, they will be in a better position to reduce their waste.

### 4.4 | Sharing Economies and Leasing Systems

There are other sustainable business models that are related to product-service systems (Sergianni et al. 2024). In this case, their payment structure is typically based on subscription models, leases, and/or may involve pay-per-use arrangements. Customers including individuals and organizations, such as institutions, businesses, and NGOs, will be expected to pay for the duration of the service(s) they receive, or to pay the amount of the products they consume. Like the product-service systems (that were mentioned in the previous section), such circular economy models are shifting the focus from ownership to access (Eisenreich et al. 2021).

Such sustainable propositions can extend product lifecycles, reduce the generation of waste, and encourage resource-efficient practices. The proprietors who lease their assets are responsible for their ongoing maintenance and repairs. Hence, it is in their interest to design and develop high-quality, durable items and components that are easy to replace, refurbish, recycle, and repair. If they do so, they would require fewer raw materials, minimize their reliance on new resources, and also decrease their waste output.

The partnership between FROG Bikes (a manufacturer of children's bikes) and Bike Club (a subscription service for bikes) represents a good example of open innovation practices, as the two businesses joined forces to lease bikes for families, and to exchange bikes as children outgrow them (Eurofound 2018). Essentially, Frog Bikes maintains, refurbishes, and reuses its bikes with new customers, once existing consumers need to upgrade to bigger ones. They strive in their endeavors to maximize the use of their resources. In reality, such a sharing economy initiative has extended the life of the bikes and has significantly reduced the likelihood that they end up in landfills when kids outgrow them. Indeed, the Bike Club's leasing model is promoting a circular approach by prioritizing maintenance, reuse, and resource efficiency, over ownership and disposal.

Similarly, Floow2, a Dutch business-to-business sharing platform, collaborates with hospitals, construction companies, and other firms to share underutilized equipment, vehicles, and office spaces (Ellen MacArthur Foundation 2021c). This sharing economy company invites businesses from various industry sectors, including healthcare and construction, among others, to list their idle assets (that can be rented). Floow2 facilitates the sharing economy of high-cost resources such as medical equipment and/or construction tools. Its platform enables its customers (including hospitality, clinics, healthcare centers, and construction companies, among others) to optimize their operations, by utilizing leased technologies and systems, without the need to purchase them. This sharing economy approach reduces unnecessary investments in new equipment, minimizes waste, and improves resource efficiencies across multiple sectors.

## 5 | Discussion

This research raises awareness of practitioners' crowdsourcing initiatives and collaborative approaches, such as sharing ideas and resources with external partners, expert consultants, marketplace stakeholders (like suppliers and customers), university institutions, research centers, and even competitors, as the latter can help them develop innovation labs and to foster industrial symbiosis (Calabrese et al. 2024; Sundar et al. 2023; Triguero et al. 2022). It reported that open innovation networks would enable them to work in tandem with other entities to extend the life of products and their components. It also indicated how and where circular open innovations would facilitate the sharing of unwanted materials and resources that can be reused, repaired, restored, refurbished, or recycled through resource recovery systems and reverse logistics approaches. In addition, it postulates that circular economy practitioners could differentiate their business models by offering product-service systems, sharing economies, and/or leasing models to increase resource efficiencies and to minimize waste.

Arguably, the cocreation of open innovations can contribute to improve the financial performance of practitioners as well as of their partners who are supporting them in fostering closed-loop systems and sharing economy practices. They enable businesses and their stakeholders to minimize externalities like waste and pollution that can ultimately impact the long-term viability of our planet. Figure 1 presents

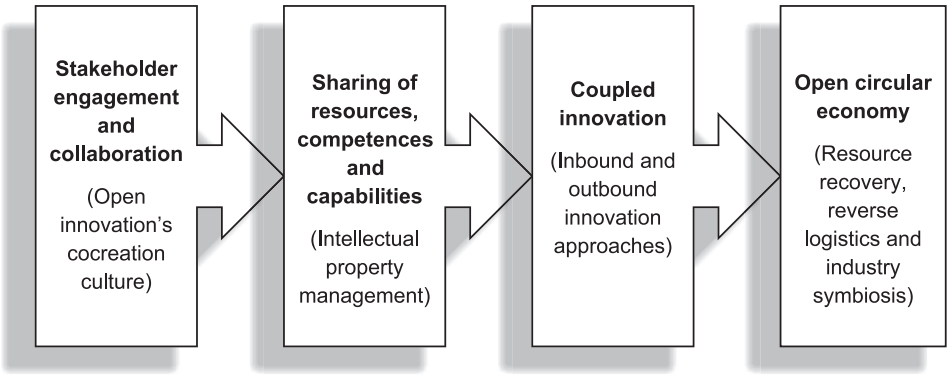


**FIGURE 1** | The intersection of open innovation and the circular economy.

a conceptual framework that clarifies how open innovation cocreation approaches can be utilized to advance circular, closed-loop models while adding value to the businesses' financial performance.

The collaborative efforts between organizations, individuals, and various stakeholders can lead to sustainable innovations, including to the advancement of circular economy models (Jesus and Jugend 2023; Tumuyu et al. 2024). Such practices are not without their own inherent challenges and pitfalls. For example, resource sharing, the recovery of waste and by-products from other organizations, and industrial symbiosis involve close partnership agreements among firms and their collaborators, as they strive in their endeavors to optimize resource use and to minimize waste (Battistella and Pessot 2024; Eisenreich et al. 2021). While the open innovation strategies that are mentioned in this article can lead to significant efficiency gains and to waste reductions, practitioners may encounter several difficulties and hurdles, to implement the required changes (Phonthanukitithaworn et al. 2024).

**TABLE 3** | A results-driven work plan that integrates open innovation's cocreation methodologies for circular economy outcomes.

| Open circular innovation methodology | Description |
|---|---|
| Forging closer relationships among stakeholders across value chains | Practitioners can collaborate with stakeholders across industries and sectors, to cocreate innovative solutions to optimize resource utilization through recycling, repurposing, and/or by reusing materials to extend product lifecycles and reduce waste. For example, they may partner with organizations including startups that specialize in sustainable innovations, such as biodegradable materials or advanced recycling technologies. |
| Accessing external ideas and technologies | Practitioners can tap into external insights to acquire a better understanding about their possible transition to circular, closed-loop models. They may avail themselves of new technologies that belong to their collaborators. |
| Addressing resource scarcity and waste management | Practitioners ought to address resource scarcity (and resource depletion) by finding new ways to repurpose waste, by reducing material inputs and by recycling valuable resources. Cross-industry collaboration can lead to resource efficiencies, the discovery of new uses of waste streams, or the development of circular supply chains. |
| Fostering circular designs | Practitioners can collaborate with designers, engineers, and sustainability experts in their supply chains to create products and items that are easier to reuse, repair, disassemble, recycle, and upgrade. External stakeholders may bring in fresh perspectives and new circular designs, modular systems, and methodologies, such as biomimicry or cradle-to-cradle design, as products can either be biodegrade or could be disassembled and reused without generating waste. |
| Creating new business models | Practitioners can reconceive traditional business models by collaborating with external stakeholders to explore new ways to deliver values. They may consider implementing the following: (i) resource sharing and industrial symbiosis (ii) resource recovery systems, reverse logistics, and product-life extension strategies, (iii) product-service systems/product-as-a-service, sharing economy and leasing models, among others. |
| Raising awareness about good practices | Practitioners are encouraged to exchange good practices, technologies, and strategies to drive circular innovations across industries and regions. The dissemination of knowledge about sustainable closed-loop solutions can accelerate and scale the adoption of circular economy models among other organizations. |

**TABLE 4** | A nonexhaustive list of future research avenues related to open circular innovation.

| Research topic | Possible research questions |
|---|---|
| Open circular innovation culture and governance | • How, why, where, and when can open circular innovation practitioners foster cross-functional collaboration, teamwork, and fruitful communications across departments, and with external stakeholders?<br>• How, why, where, and when are practitioners formulating and enforcing comprehensive, results-oriented policies on intellectual property management, stakeholder roles, and data-sharing mechanisms?<br>• How, why, where, and when are practitioners utilizing incentive systems to reward cross-stakeholder collaboration?<br>• How, why, where, and when are practitioners measuring their performance?<br>• Which key performance indicators (KPIs) and metrics are practitioners using to assess the outcomes of their open circular innovation initiatives? |
| Balancing openness and intellectual property protection | • How, why, where, and when can open circular innovation practitioners manage their intellectual property (IP)?<br>• What strategies and tools (e.g., nondisclosure legal agreements and/or licensing agreements) can practitioners use to safeguard their proprietary knowledge, to foster trust and collaboration among stakeholders?<br>• How and in what ways can practitioners evaluate the effectiveness of their data-sharing models (e.g., precompetitive data sharing and/or open-source initiatives)?<br>• Are practitioners capable of promoting open innovation approaches without compromising their competitive advantages?<br>• What is the impact of patent pooling and cross-licensing agreements on the development of open circular business models? |
| Inbound, outbound, and coupled innovation strategies | • How, why, where, and when are open circular innovation practitioners resorting to outbound, and coupled innovation strategies?<br>• Which stakeholders (e.g., universities, startups, competitors, and technology intermediaries) are participating in the practitioners' open circular innovation networks?<br>• How and in what ways are practitioners engaging in outbound innovation initiatives (e.g., via spin-offs, joint ventures, and licensing agreements)?<br>• What are the benefits and challenges of coupled innovation strategies?<br>• How and in what ways are practitioners cocreating value with external partners to develop circular solutions? |
| Role of intermediaries in open circular ecosystems | • How, why, where, and when are open circular innovation practitioners recruiting intermediaries (e.g., consulting firms, crowdsourcing platforms, and technology scouting companies), to help them bridge the gaps between stakeholders?<br>• How and in what ways are intermediaries supporting the practitioners' open circular innovation initiatives?<br>• What are the intermediaries' roles in resolving challenges and mitigating risks during open circular innovation processes?<br>• Which best practices are practitioners using to foster knowledge transfer and resource sharing? |

(Continues)

**TABLE 4** | (Continued)

| Research topic | Possible research questions |
|---|---|
| Innovation hubs and circular business models | • How, why, where, and when are open circular innovation practitioners developing centralized ecosystems and/or corporate innovation hubs?<br>• How and in what ways are the open circular innovations designed, led, organized, and controlled?<br>• How and to what extent are the practitioners successful in promoting collaboration among diverse stakeholders, including for-profit, as well as not-for-profit organizations?<br>• How and to what extent are the practitioners measuring the effectiveness of accelerator programs, competitions, and incubators in driving the adoption of circular business models? |
| Sector-specific and regional perspectives | • What are the challenges and opportunities in implementing open circular economy practices?<br>• What are the contextual factors (e.g., policies, market dynamics, and cultural issues) could influence the successful adoption of open circular innovation approaches? |

Different entities will have their own organizational culture, strategic goals, and modus operandi that may result in coordination challenges among stakeholders.

Organizations may become overly reliant on sharing resources or on their symbiotic relationships, leading to vulnerabilities related to stakeholder dependencies (Battistella and Pessot 2024). For instance, if one partner experiences disruptions, such as operational issues or financial difficulties, it can adversely affect the feasibility of the entire network. Notwithstanding, organizations are usually expected to share information and resources when they are involved in corporate innovation hubs and clusters. Their openness can lead to concerns about knowledge leakages and intellectual property theft, which may deter companies from fully engaging in resource-sharing initiatives, as they pursue outbound innovation approaches.

Other challenges may arise from resource recovery, reverse logistics, and product-life extension strategies (Johnstone 2024). The implementation of reverse logistics systems can be costly, especially for small and micro enterprises. The costs associated with the collection, sorting, and processing of returned products and components may outweigh the benefits, particularly if the market for recovered materials is not well established (Panza et al. 2022; Sgambaro et al. 2024). Moreover, the effectiveness of resource recovery methodologies and of product-life extension strategies would be highly dependent on the stakeholders' willingness to return products or to participate in recycling programs. Circular economy practitioners may have to invest in promotional campaigns to educate their stakeholders about sustainable behaviors. There may be instances where existing recovery and recycling technologies are not sufficiently advanced or widely available, in certain contexts, thereby posing significant barriers to the effective implementation of open circular innovations. Notwithstanding, there may be responsible practitioners and sustainability champions that may struggle to find reliable partners with appropriate technological solutions that could help them close the loop of their circular economy.

In some scenarios, emerging circular economy enthusiasts may be eager to shift from traditional product sales models to innovative product-service systems. Yet, such budding practitioners can face operational challenges in their transitions to such circular business models. They may have to change certain business processes, reformulate supply chains, and also redefine their customer relationships, to foster compliance with their modus operandi. These dynamic aspects can be time-consuming, costly, and resource intensive (Eisenreich et al. 2021). For instance, the customers who are accustomed to owning tangible assets may resist shifting to a product-service system model. Their reluctance to accept the service providers' revised terms and conditions can hinder the adoption of circular economy practices. The former may struggle to convince their consumers to change their status quo, by accessing products as a service, rather than owning them (Sgambaro et al. 2024). In addition, the practitioners adopting products-as-a-service systems may find it difficult to quantify their performance outcomes related to resource savings and customer satisfaction levels and to evaluate the success of their product-service models, accurately, due to a lack of established metrics.

In a similar vein, the customers of sharing economies and leasing systems ought to trust the quality standards and safety features of the products and services they use (Sergianni et al. 2024). Any negative incidents reported through previous consumers' testimonials and reviews can undermine the prospective customers' confidence in the service provider or in the manufacturer who produced the product in the first place. Notwithstanding, several sharing economy models rely on community participation and localized networks, which can pose possible challenges for scalability. As businesses seek to expand their operations, it may prove hard for them to consistently maintain the same level of trust and quality in their service delivery. Moreover, many commentators argue that the rapid growth of sharing economies often outpaces existing regulatory frameworks. The lack of regulations, in certain jurisdictions, in this regard, can create uncertainties and gray areas for businesses as well as for their consumers.

## 6 | Conclusions

### 6.1 | Theoretical Implications

This contribution reported that the integration of cocreation approaches related to open innovation and to the circular economy's closed-loop models is gaining more traction in the emerging academic literature. Frequently, a number of researchers are referring to theoretical underpinnings that guide them in their research designs and, to frame their analyses, to better understand the link between the two notions. Very often, they have advocated that practitioners ought to manage and address the interests of multiple stakeholders, if they want to implement open innovation initiatives, and if they are interested in facilitating the adoption of circular economy practices (Beck et al. 2023). This argumentation is congruent with the stakeholder theory. Arguably, practitioners who collaborate with stakeholders can benefit from their knowledge, competences and, capabilities (Liu et al. 2023). Notwithstanding, the practitioners' open innovation efforts and stakeholder engagement can contribute to increase their legitimacy and sustainability credentials in societies where they operate their business. Therefore, one may argue that open innovation approaches can serve as a proactive strategy to bolster the legitimacy of the practitioners' sustainability efforts and to reaffirm their license to operate in society.

The organizations' collaborative relationships with stakeholders would probably be evidenced through their exchanges of resources, benefits, and costs. This argumentation reflects the social exchange theory (Fang et al. 2024) that can be used to clarify the open innovation practitioners' motivations to share knowledge or technologies to implement circular economy models in tandem with other parties, usually for mutual, reciprocal benefits. In this case, the theory could be employed to better understand how such exchanges could be extended beyond financial transactions, as they can add value to social and environmental deficits in society (Singh et al. 2024).

Inbound or coupled innovation practitioners will usually benefit of their partners' financial and human resources. Their relationships with external parties may place them in a better position to add value to their organizations' bottom lines and environmental performance. At the same time, they allow them to cocreate circular economy models for their partners too (Pan et al. 2024). This reasoning is synonymous with the relational view theory (Köhler et al. 2022), as this theory focuses on the value generated through interorganizational relationships and stakeholder networks. In a nutshell, such theory suggests that the benefits derived from partnerships go beyond economic gains, as they lead to shared sustainability outcomes, and to positive multiplier effects for all parties. Hence, the relational view theory may be utilized by researchers to investigate how collaborations, partnerships, and alliances could contribute to cocreate circular economy business models through the sharing of resources, competences, and capabilities.

Organizations ought to be in a position to adapt, renew, and reconfigure their resources in response to continuous changing environments (Singh et al. 2024). Arguably, it is in their interest to avail themselves of external knowledge and innovations, to help them develop their flexibility and capacity for a smooth transition toward circular business practices. This reasoning is related to the dynamic capabilities approach and to the resource-based view (RBV) theories (Köhler et al. 2022). While the former can help researchers to better clarify how, why, where, and when external collaboration could improve the organizations' dispositions to integrate, build, and reconfigure its internal and external resources to implement sustainable projects including circular economy practices, the latter is traditionally inward-looking as it is usually focused on a firm's internal resources.

Yet, recently, there were modern extensions of the RBV theory, as many commentators are acknowledging the significance of forging external stakeholder relationships, who could provide their expert support, knowhow, and tangible resources, to aspiring circular economy practitioners (Pan et al. 2024). Krmela et al. (2022) referred to the attention-based view theory, when they advocated that there is scope for organizations to collaborate with stakeholders and to build their extant networks, to be in a better position to implement sustainability-related initiatives. In sum, this perspective suggests that practitioners can shift from their traditional myopic view, where they focus their attention on their organizations' internal assets, to a more open and outward-looking approach, as they value external insights to drive sustainable innovations and circular business models.

Indeed, practitioners can leverage their transition from linear economic models to circular systems, if they avail themselves from expert consultants, and resources (Leitão et al. 2023; Sundar et al. 2023). Actually, this line of thought resonates with the sociotechnical transition theory (Tumuyu et al. 2024) that raises awareness about the importance of embracing incremental changes in innovations for the advancement of society. This theory posits that organizations are expected to implement changes and modifications within organizational levels. These may well include inbound innovation agreements with external stakeholders that are willing to share their knowledge, competences, and technologies, to accomplish sustainable development goals, as well as circular economy objectives like resource efficiencies, waste reduction, sustainable production, and consumption, among others (Phonthanukitithaworn et al. 2024).

The above theoretical perspectives can be adopted as conceptual frameworks by prospective researchers, to better comprehend how, why, where, and when open innovation approaches can drive circular economy outcomes. They could inspire academic colleagues to investigate the organizations' motivations to collaborate with external stakeholders and to appraise their commitment to sharing competences, resources, and technologies with other entities, to promote sustainable, open circular transitions, in different contexts.

### 6.2 | Practical Implications

This research raises awareness about the rationale for budding as well as established circular economy innovators to forge, or to continue forging strong relationships with external stakeholders to achieve sustainable outcomes. It reports that cocreation processes may result in win-win situations for practitioners and their collaborators, leading to operational efficiencies, waste minimization models, as they share knowledge and resources with other organizations, to extend the life of materials, and

items, as much as possible, in diverse contexts. The businesses' genuine dispositions for stakeholder engagement and their readiness to foster a more inclusive approach with their partners will probably enable them to improve their resource utilization, extend their product lifecycles, and decrease waste accumulation, among other sustainable innovation initiatives.

The findings from the systematic review and from the short case studies clearly specify that fruitful collaborations between businesses, academia, governments, nonprofits, and local communities can yield sustainable innovation systems, improve the circularity of resources across various industries, and reduce their waste generation. Such responsible initiatives demonstrate that cross-sectoral partnerships are crucial for building closed-loop systems and regenerative practices that enable the conservation of resources, and reduce the consumption rate of raw materials, while minimizing waste and pollution.

This contribution indicates that the shifting of traditional business models, for example, from the proprietary ownership of goods to product-service systems, in terms of on-demand access and usage of resources, through leasing, subscription models, redistribution, and/or via industrial symbiosis, may ultimately result in added value for both the service providers and their customers or stakeholders. Service providers can generate steady, recurring revenue streams if they lease goods, instead of relying on one-time sales. Conversely, their customers will benefit from reduced upfront costs if they lease (as opposed to outright purchases). Their leased resources and/or subscription packages would offer them the flexibility to benefit from products and/or services without committing themselves to long-term ownership of goods, their ongoing maintenance, and other responsibilities. They allow them to access the latest equipment or products without worrying about their servicing and obsolescence.

Similarly, in redistribution and industrial symbiosis models, practitioners collaborate with others, to distribute and share resources, such as waste materials, energy, heat, or by-products, as well as unused or surplus items, with their stakeholders. Such collaborative approaches improve resource efficiencies within mutually beneficial circular economy ecosystems. At the same time, they reduce the waste disposal costs of those businesses producing externalities; they decrease the procurement costs for those stakeholders that are receiving the former's unwanted resources, materials, and by-products, in an efficient manner.

In reality, individual businesses cannot adopt sustainable development models including open innovation's cocreation approaches and to the circular economy's closed-loop practices by themselves. They need partnership agreements and synergies with other firms, particularly with those that are located in close proximity to their premises. The geographical closeness of their partners can facilitate communications and can even enhance operational efficiencies for their resource exchange to materialize as smoothly as possible.

In conclusion, this contribution implies that open circular innovation can be achieved by forging closer relationships with stakeholders across value chains, to access their external ideas and technologies, in order to address resource scarcity and waste. Hence, the organizations operating within innovation hubs will be in a good position to foster sustainable designs, to create circular business models, and to raise awareness about exemplary practices with other businesses. Table 3 clarifies how open innovation could be considered as a powerful tool to accelerate the transition to the circular economy model.

The practitioners' transition to a circular economy through open innovation presents significant opportunities as well as possible difficulties and pitfalls (that were duly mentioned in this article). Prospective circular innovators need to understand the complexities involved in resource sharing, industrial symbiosis, resource recovery, product-life extension, product-service systems, and sharing economies. They are expected to address the challenges that may arise from their engagement with different stakeholders. Sustainability-focused organizations can truly achieve open circular innovations if they are willing to foster a culture of collaboration and if they are disposed to develop supportive policies that encourage cocreation of innovations together with their external partners. They have to be truly committed to support one another through open channels of communications, and ought to be prepared to share their resources to realize the full potential of circular business models.

### 6.3 | Limitations and Future Research Directions

The convergence of the results and conclusions of this research was drawn from reliable data sources, including from a meticulous systematic review of journal articles, that involved the scrutinization of extracted articles in their entirety, to identify the themes of study, focused on the intersection of open innovation and circular economy, as well as from desk research about sustainable business practices that are currently being employed by real-life organizations in various contexts. The results from the systematic review have clearly confirmed that, for the time being, there is still a knowledge gap in academia, related to the integration of circular economy and open innovation approaches. Therefore, the proposed paradigm, namely, open circular economy, presents fertile ground for future academic inquiry.

Prospective researchers may rely on different methodologies, and analytical procedures, including primary and/or secondary research activities, to explore cocreated open innovation networks as well as their operational frameworks, tools, and metrics, in depth and breadth. Table 4 identifies plausible research directions for academic colleagues who are interested in raising awareness, in this regard, across different industry sectors and regions.

Further studies on the proposed research directions hold great potential to increase the knowledge and understanding among different stakeholders, including of practitioners, academia, and policy makers, among others, of how, why, where, and when open circular economy approaches can add value to the businesses, to the environment, and to society at large.

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## Appendix A

### A List of Articles Focused on the Intersection of Open Innovation and Circular Economy

| Authors/year | Rationale of research | Research theme | Theoretical base | Methodology |
|---|---|---|---|---|
| Ahmad et al. (2024) | The researchers elaborate about the integration of open innovation, circular economy practices, and sustainability principles. They also identify sustainability performance indicators including environmental, economy, and social dimensions. | Sustainability performance indicators | | Systematic literature review |
| Ai et al. (2024) | The researchers link circular economy, open innovation, and green innovation. | Green innovation | | Quantitative (regression analysis) |
| Battistella and Pessot (2024) | The researchers explore how businesses leverage open innovation (OI) practices to tackle social challenges related to social innovation capabilities of stakeholders. | Social innovation | | Case studies |
| Beck et al. (2023) | The researchers investigate how stakeholder value creation contributes to achieving the sustainable development goals. | Stakeholder value creation | Stakeholder theory | Mixed methods research |
| Berkemeier et al. (2024) | The researchers raise awareness about their open innovation project involving enterprises, local authorities and societal actors. | Resource efficiency | | Case study |
| Bocken and Ritala (2022) | The researchers put forward a circular business model strategy framework. | Resource and innovation strategies | | Discursive |
| Brown et al. (2020) | The researchers explore the concept of collaborative innovation that can advance incremental and radical circular business models. | Collaborative innovation | | Case studies |
| Calabrese et al. (2024) | The researchers examine collaborative and network-based open innovation strategies. | Circular business models | | Case studies |
| Cappellaro et al. (2019) | The researchers promote community empowerment initiatives to develop local governance capacities and technology adoption. | Smart community cocreation | | Case study |
| Chen (2018) | The researcher identifies key factors of sustainable product-service systems and incorporates them into his proposed guiding principles. | Sustainable product-service systems | | Review and a case scenario |
| Dantas et al. (2022) | The researchers investigate the antecedents and consequences of circular entrepreneurship within emerging markets. | Circular entrepreneurship | | Qualitative (semistructured interviews) |

| Authors/year | Rationale of research | Research theme | Theoretical base | Methodology |
|---|---|---|---|---|
| Eisenreich et al. (2021) | The researchers explore the drivers and barriers for a transition toward open circular innovation. | Stakeholder collaboration | | Qualitative (semistructured interviews) |
| Fang et al. (2024) | The researchers investigate the open innovations of a focal firm as well as its supply chain's circular economy performance. They also explore how a focal firm's trust congruence with partners can influence their open processes and product innovations. | Trust among stakeholders | Social exchange theory | Quantitative (regression analysis) |
| Gambelli et al. (2024) | The researchers explore future market opportunities for products derived from insects, for food and nutrition. | Sustainable production (of insects for nutrition) | | Qualitative (engagement with stakeholders and experts) |
| Hadi (2024) | The researchers explore how open circular innovation, circular-based dynamic capabilities, and circular ambidexterity could influence the businesses' circularity. | Circular ambidexterity | | Quantitative (structural equations modeling) |
| Jesus and Jugend (2023) | The researchers elaborate how open innovation contributes to the adoption of the circular economy. | Stakeholder collaboration | | Systematic literature review |
| Jesus et al. (2024) | The researchers analyze how open innovation affects the implementation of the circular economy and the mediating role of Industry 4.0 technologies, by using absorptive capacity as a moderating factor. | Collaboration and the adoption of Industry 4.0 technologies | | Quantitative (structural equations modeling) |
| Johnstone (2024) | The researcher investigates servitization strategies that can support a firm's circular economy ambitions. She also considers the effects of resources and capabilities on the implementation of the circular economy. | Servitization strategies for circular business models | | Qualitative (semistructured interviews) |
| Köhler et al. (2022) | The researchers rely on the relational view and dynamic capabilities' theoretical bases to better understand cross-sectoral open innovation collaborations that advance circular economy practices. | Cross-sectoral collaboration in networks | Relational view theory and dynamic capabilities theory | Qualitative (semistructured interviews) |
| Krmela et al. (2022) | The researchers build on the attention-based view theory and on the legitimacy theory, to investigate the business models of companies that are part of collaborative networks of the circular economy. | Business models in collaborative circular economy networks | Attention-based view theory | Qualitative (narrative interviews and focus group meetings) |

| Authors/year | Rationale of research | Research theme | Theoretical base | Methodology |
|---|---|---|---|---|
| Lisi et al. (2024) | The researchers examine the role of interorganizational collaboration in circular economy initiatives. | Interorganizational collaboration | | Content analysis |
| Liu et al. (2023) | The researchers investigate how regional communities can promote circular economy innovation. | Regional circular economy innovation | | Case study |
| Medina-Salgado et al. (2021) | The researchers raise awareness about the potential of life cycle costing with and without circular practices in an open innovation context. | Life cycle costing of circular economy models | | Case study |
| Naveed et al. (2020) | The researchers theorize how external innovation resources and ongoing research and development as well as the coupling of digitalization and bioeconomy could advance the circular economy. | Coevolutionary coupling in a digitalized bioeconomy | | Analysis of financial performance |
| Oke (2023) | The researcher explores how technological innovations can help organizations promote proenvironmental initiatives. | The utility of digital technologies | | Literature review |
| Pan et al. (2024) | The researchers investigate the relationship between inbound open innovation and circular economy as well as on their mutual effects on other enterprise innovation outputs. | Enterprise innovation output | Resource-based view theory and stakeholder theory | Analysis of financial performance |
| Panza et al. (2022) | The researchers explore open product development processes in support of sustainability, with a major focus on the circular economy. They advance a theoretical framework. | Open product development | | Literature review |
| Payán-Sánchez et al. (2021) | The researchers link open innovation approaches with sustainable ecosystems. | Open innovation for sustainable development | | Bibliometric analysis |
| Phonthanukitithaworn et al. (2024) | The researchers promote circular economy strategies involving 5R principles including repairing, reducing, recycling, reusing, and rotting. They raise awareness and encourage stakeholder engagement to improve waste management. | Waste management | | Quantitative (multiple regression analysis) |
| Pichlak and Szromek (2022) | The researchers explore the determinants of the companies' ecoinnovation activities that promote the circular economy applications and closed-loop systems. | Ecoinnovation | | Literature review |

| Authors/year | Rationale of research | Research theme | Theoretical base | Methodology |
|---|---|---|---|---|
| Sergianni et al. (2024) | The researchers investigate how open innovation supports the development of the circular economy. They focus on the knowledge exchange among stakeholders that lead to circular innovation. | Knowledge exchange | | Case studies |
| Sgambaro et al. (2024) | The researchers discuss how companies can exploit open innovation to implement circular economy initiatives. They put forward an innovation framework that can be used for the transition to the circular economy. | Collaborative interactions among stakeholders | | Literature review |
| Singh et al. (2024) | The researchers investigate how big data and knowledge capabilities can affect sustainable supply chain performance, which will in turn have an impact on the circular economy performance. | Big data and knowledge management | | Quantitative (structural equations modeling) |
| Thomas and Evrard (2023) | The researchers explore the dynamics of stakeholder engagement and open-source hardware business models to leverage the economic growth of cities and regions. | Open-source hardware business models | | Case study |
| Triguero et al. (2022) | The researchers analyze the factors influencing the adoption of environmental innovations toward a circular economy. They investigate the effects of internal resources and capabilities, external support and networks on circular ecoinnovations. | Ecoinnovation requirements | | Quantitative (multiple regression analysis) |
| Tumuyu et al. (2024) | The researchers investigate whether the organizational culture, production processes, and resource management are affecting the businesses' transition to the circular economy. | The organizations' transition to a circular economy model | Socio-technical transition theory | Qualitative (narrative interviews and focus group meetings) |
| Yoshino et al. (2023) | The researchers examine the factors that may support small and medium-sized enterprises that may result in the development of proactive ecoinnovations. | Ecoinnovation among small and medium-sized enterprises | | Quantitative (binary logistic regression) |

*Note:* The above articles are sorted in alphabetical order.