

Innovation Ecosystems for a Circular Economy

Special Issue Guest Editors

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Abstract

The transition to a circular economy (CE) is increasingly recognized as essential for addressing climate change, biodiversity loss, and resource scarcity, the latter now with its new geopolitical dimension. However, despite growing interest among policymakers, businesses, and scholars, progress toward circularity remains limited. This special issue examines how innovation ecosystems can facilitate the CE transition by promoting collaboration, knowledge exchange, and systemic change across industries and regions. The CE paradigm introduces new actors into innovation processes and aligns with mission-oriented policy agendas, such as the EU Green Deal. It also challenges traditional models of value creation, governance, and performance measurement. The papers in this issue examine the dynamics of CE-related innovation, including the development of new business models, the role of digital technologies, and the influence of policy and institutional frameworks. Emphasis is placed on interdisciplinary approaches, regional and global ecosystem configurations, and the socio-economic impacts of CE transitions. By bridging innovation studies and CE research, this special issue contributes to a deeper understanding of how innovation ecosystems can support sustainable industrial transformation. It also identifies key research challenges and offers a forward-looking agenda for scholars and policymakers engaged in shaping a circular and resilient economy.

Background and Objectives

The adverse effects of climate change and biodiversity loss call for urgent action to mitigate the environmental burden of human activities. In this context, the Circular Economy (CE) paradigm has been proposed as a promising framework to overcome the limitations of the current 'linear' production-consumption model, and to achieve the decoupling of economic development from finite resources through the introduction of closed resource loops (Bibas et al., 2021; Sauvé et al., 2016). The transition to a CE, in which materials and resources are kept in use, can reduce the extraction of new raw materials and, at the same time, reduce the waste and emissions from discharging used material. Hence, the CE transition towards using closed material loops can be part of the solution to create a more sustainable future (Stahel 2016).

For this reason, the CE transition has increasingly received support from governments worldwide as a lever not only to mitigate environmental pressures but also to promote resilience, entrepreneurship, and job creation. At the European level, the CE has become core to the European Union's climate and industrial policy. In particular, the European Circular Economy Action Plan has introduced legislative and non-legislative measures to promote products' eco-design, waste prevention, and internal markets for secondary raw materials. The Action Plan stresses the relevance of innovation in general, and especially of digital technologies, to power the CE transition, as already acknowledged in the policies and practices for eco-innovation uptake and CE transition. In fact, systemic eco-innovation, powered by multidimensional policies, is the key to unlocking a deep transition (e.g., de Jesus et al., 2019; Fusillo et al., 2025). More recently, CE has also been seen as a route to reducing exposure to critical materials taking on a geopolitical dimension.

However, the implementation of circular economy practices is surprisingly limited. Despite exponential growth in discussions of the circular economy among policymakers, businesses, and academics (Jakobsen et al., 2021), there has been little progress towards a fully circular economy. The circularity gap report reveals that global circularity has been declining, from 9.1% in 2017 to 6.9% in 2024 (Circle Economy, 2025). Likewise, CE is not significantly reducing the use of raw materials, and circular businesses often struggle and go bankrupt (Savini, 2025). Hence, a viable transition to a significantly more CE requires dramatic changes in business models and how industries operate. However, this can only be achieved through extensive innovation at multiple levels.

The enablers and barriers to implementing a CE have much in common with those related to adopting innovations, and there is a large potential for learning and cross-fertilization between research on CE and mainstream innovation research.

While the literature on CE is surging, there remains scant evidence on the interplay between the CE transition and innovation dynamics among different actors and at various geographical levels (Evertsen et al., 2022; Jakobsen et al., 2021; Di Stefano et al., 2023). On the one hand, circular operating models necessitate the use of alternative materials, novel processes, advanced manufacturing technologies, and innovative business models and management perspectives (Ahmad et al., 2023). As such, innovation processes associated with circularity require open and multidisciplinary approaches, often involving tensions and trade-offs, and engaging actors

across the circular value chain. Industrial innovation in the CE requires multiple actors to address technological and operational challenges that span organizational culture, levels and boundaries; however, relatively little is known about the challenges concerning partnering models, employment and skill requirements in the CE (e.g., Burger et al., 2019; Buyukyazici and Quatraro, 2025).

On the other hand, regional analyses have emphasized the local character of the CE model, describing the main actors involved and the key technological trajectories within industrial ecosystems (Fusillo et al., 2025; Suchek et al. 2021). Within this context, it is emphasized that, more than ever, we need collaboration between different stakeholders (e.g., companies, start-ups, governments, universities, and consumers), and various types of intermediaries that facilitate interactions between them (Rainville, 2021; Coda Zabetta et al., 2025). The regional dimension is evident in how MNCs appear to adopt very different CE strategies based on location.

Thus, the objective of this special issue is twofold: (a) stimulating the debate about the interplay between the transition to the CE paradigm and the dynamics of innovation adoption and generation in organizations, regions, and countries, both from an open (global) innovation perspective and from a regional ecosystem viewpoint, and (b) drawing academic and policy-relevant insights regarding the implementation and consequences of the CE transition at the economic, social, technological and local/global levels of analysis. There is some evidence in a renewed interest by firms to adopt CE strategies, as they consider circularity as part of a broader transformation agenda supporting not just sustainability, but also resilience, resource productivity and revenue growth (WEF Circular Transformation Initiative White Paper 2025)

In the next section we illustrate the papers in this special issue, and discuss how they contribute to the mentioned debate. The concluding section elaborates on thematic issues that still require further evidence and reflection, thus drawing some implications and suggestions for promising research avenues.

Papers in the special issue

The papers collected in the present special issue lie at the intersection between CE and innovation. In particular, by integrating insights from CE, Open Innovation, and innovation ecosystem literatures, Dorrego-Viera et al. (2026) analyse the forest-based bioeconomy (FBB) ecosystem, and show how stakeholder collaboration within ecosystems supports the implementation of CE. Specifically, the study reveals how different stakeholder groups (e.g., public agencies, academia, and civil society) assume distinct yet complementary roles in addressing contextual, technical, economic, and cultural barriers to circularity. The findings provide actionable insights for policymakers and industry leaders aiming to design more targeted and inclusive collaboration strategies to accelerate CE implementation.

In a similar way, Battistella & Attanasio (2026) argue that creating a circular innovation ecosystem helps firms acquire diverse and novel knowledge, find partners, and configure environmental and social solutions through collective efforts, ultimately boosting sustainability

success. However, the development and orchestration of a circular innovation ecosystem requires ad hoc capabilities, namely, a strategy towards a purpose, organising for stakeholders' alignment, and end-to-end solution configuration and deployment.

Blasi et al. (2026) investigate the impact of combining circular business models and innovation networks on firm-level economic growth. By analysing a sample of Italian firms engaged in circular business practices, and employing fuzzy set qualitative comparative analysis (fsQCA), they identify various circular pathways leading to economic growth. Surprisingly, having an extensive collaboration network or relying on in-depth partnerships isn't always essential for success; in some cases, they are ineffective. Additionally, they find that circular practices can be effective when adopted independently, with a trade-off between reuse/recycling and selling waste to other companies.

In fact, trade-offs embedded in the CE transition are increasingly evident (see the forthcoming special issue in *Journal of International Business Studies* on "MNEs in the Age of Resilience and Sustainability Imperatives and Tensions", 2026). Within this context, Capponi et al. (2026) show how Intellectual property rights (IPRs), which allow companies to benefit economically from their innovations, can also create tensions with their CE ambitions. Relying on in-depth qualitative interviews with frontrunner circular companies, they find that when firms experience tensions between their CE and IPR strategies, they find strategies to suppress, accept, or resolve them. Most circular innovators embrace a 'business case' (Hahn et al., 2014) approach to circularity, which might limit the impact and transformative promises of a CE.

Finally, Di Stefano (2026) examines how environmental taxation and fossil fuel subsidies influence European SMEs' attitude towards circularity, measured by transition towards renewable energy (RE). Drawing on path dependence theory, the study conceptualises environmental taxation as a factor supporting firms' shift away from carbon-based trajectories and, conversely, fossil fuel subsidies as path-maintaining factors, thus highlighting the impact of misaligned policies on firms' behaviour. Specifically, the econometric findings show that environmental taxation significantly increases RE adoption, particularly among firms already committed to sustainability, while fossil fuel subsidies have no significant effect, thus confirming the importance of aligning firms' internal commitments with external pressures.

Overall, these five papers highlight four important themes:

- (a) *The importance of collaboration among different stakeholders in circular ecosystems.* In line with the findings of a recent literature review (Tabas et al., 2025), a key aspect of developing and implementing CE principles is that they typically involve multiple stakeholders. CE requires cross-sectoral collaboration—not just among firms and startups, but also among municipalities, NGOs, consumers, and, most importantly, academia (Coda Zabetta et al., 2026). Hence, CE introduces non-traditional actors into innovation ecosystems, and research on innovation ecosystems can greatly benefit from studying the context of CE because it introduces a systems-level challenge that demands new forms of collaboration, governance, and value creation. Moreover, innovation ecosystems in CE often span regional, national, and global levels, offering rich cases for studying multi-level governance and distributed innovation. Hence, the CE context is expanding the boundaries

of the ecosystem. In fact, recent literature reviews (e.g., Aryee et al., 2025; Alka et al., 2024) show a rapid growth in publications on the topic of circular ecosystems, defined as “interdependency and co-evolution among autonomous actors to co-create value using circular economy strategies” (Aryee et al., 2025, p. 1365). Within this context, the first two papers (Dorrego-Viera et al. and Battistella & Attanasio) offer a layered view of circular innovation ecosystems, mapping stakeholder roles and detailing orchestrator capabilities. Specifically, the first paper emphasizes the importance of multi-stakeholder collaboration in overcoming barriers to CE implementation, and highlights how ecosystem collaboration is central to circular innovation, while the second paper shows how orchestrators play a strategic role in coordinating these ecosystems through bundles of routines (sensing, seizing, reconfiguring).

- (b) *The emergence of new business models.* Another main topic in CE research is the development and implementation of new business models (e.g., product-as-a-service, reverse logistics) that reshape value creation and capture. Hence, the transition to a more CE can be linked to the literature on user innovation, as consumers become co-creators (e.g., through repair or reuse), and to innovation ecosystem research, which can study how these new business models emerge, scale, and interact within broader networks. In fact, the third paper (Blasi et al.) adds strategic insight into how business models and networks combine to drive economic outcomes. Namely, the paper demonstrates that no single circular business model (CBM) element guarantees success; rather, different strategic configurations, which are combinations of CBMs and innovation network features, can drive economic growth. In other words, equifinality is key, i.e., multiple paths can lead to successful CE outcomes. This points to the need for a broader strategic network configuration perspective (e.g. Srari & Gregory 2008) in CE research that incorporates capability development, equifinality and business model innovation.
- (c) *Trade-offs and tensions inherently embedded in the circular transition.* The complexity of current social and environmental challenges inherently associated with the goals of CE generates many conflicts and tensions at the individual, organization, and/or systems levels. These tensions, often framed within paradox theory (Carmine & De Marchi, 2023), can undermine CE transformation. Within this context, the fourth paper (Capponi et al.) introduces a legal-strategic lens, showing how CE ideals may conflict with traditional IPR strategies. The paper reveals that firms often suppress or ignore tensions between CE goals and intellectual property rights (IPR), thus limiting their transformative potential.
- (d) *The role of regulation and the need for harmonization in facilitating CE.* The literature agrees on the beneficial role of incentives and funding in supporting firms in the transition towards circularity and on stimulating entrepreneurship in this field. Subsidies to research are also needed to promote technological innovation, the development of a better take-back system, the adoption of secondary resources (See Losa (2025) for a systematic literature review of the state of the art of EU public policies on CE). The fifth paper (Di Stefano) shifts focus to policy, dealing with the need of an aligned mix of public instruments to shape SME behavior in the transition to climate neutrality.

Conclusion and future research agenda

Innovation ecosystems and CE are both broad, multidisciplinary, and evolving concepts. CE can mean anything from recycling to regenerative design, while innovation spans from incremental improvements to radical disruptions. This lack of definitional clarity makes it difficult to establish consistent research frameworks, compare findings across studies, and develop robust theoretical models. Moreover, research in this area often spans different disciplines such as engineering, economics, environmental science, business, and policy. Interdisciplinary work is valuable but requires navigating different terminologies and methodologies, aligning epistemological assumptions, and collaborating across academic silos. However, we believe that using the CE concept and insights from CE research can enrich innovation research in several ways. Indeed, CE research introduces non-linear, regenerative innovation models that challenge traditional growth paradigms. Hence, the use of CE perspectives can help expand the relevance of innovation research into new areas. It also draws attention to parts of the innovation literature that deal with similar issues, such as eco-innovation, frugal innovation, and systemic innovation.

In our call for papers, we envisioned several key areas that require stronger evidence and further research. The evidence provided by the collection of papers in the present special issue tackles different areas and inevitably opens new avenues for further research. Specifically, they deal with the issue of *Determinants and Enablers* and analyse the nature of interactions and partnerships between firms, universities, institutions, and different intermediaries in enabling the CE, as well as the role of open innovations and (intra- and inter-firm) organizational challenges, and the role of industrial policies for innovation-driven CE transition. Additionally, the evidence also highlights the importance of acknowledging tensions and trade-offs embedded in the circular transition. Other important trade-offs, in addition to the one analysed in the present issue (i.e., CE and IPRs), may also emerge (e.g., CE and resilience) and require managerial and policy attention.

We also acknowledge the need to embrace a disruptive perspective, both on the technological side and on the organization side. As far as the former, circular innovation may require disruptive innovation (Christensen, 1997), displacing incumbent market offerings and reshaping industrial structure, fundamentally challenging and transforming the prevailing non-circular “take-make-use-dispose” model (Bauwens et al., 2022). Likewise, CE transition often requires organizational disruption, such as reconfiguring supply chains, creating new activities and/or relocating existing activities.

Digital innovation has become key in advancing the circular transition, e.g. by enhancing efficiency, enabling data-driven decision-making, and fostering greater engagement among stakeholders (GACERE, 2025; Procedia et al., 2018; Rossi & Srai 2025, Fusillo et al., 2025). However, more research is needed about the role of digital technologies (e.g. IoT, AI, blockchain, and big data analytics) and digital innovations (such as digital passports, traceability, data-sharing incentivization, and digital platforms) across various phases of the product lifecycle (from extraction to production, distribution, use, and reverse logistics), in the optimization of resource use, enhancement of recycling, and reduction of waste. In relation to

that, more evidence is needed about the critical role digitalization can play in bridging the circularity divide between high- and low-income countries (e.g., Barrie et al., 2022).

More research is also needed on the economic, social, and geographical consequences of the CE transition, e.g., the impact of CE on employment, skill requirements, skill reconfiguration, and wage differentials, as well as the related changes in education programs. A more recent phenomena is the current geopolitical context and how CE transitions may be impacted, in some cases accelerated (reducing exposure to scarce critical minerals) and in others frustrated due to the fragmentation of global supply chains and associated trade-barriers.

Empirical measurement is a joint challenge of both CE and innovation research. Quantifying circularity (e.g., reuse, recycling, resource efficiency) is not straightforward. Similarly, measuring innovation outcomes—especially those related to social or environmental impacts—is complex. CE measurements may constitute a viable pathway to capture the sustainability impacts of innovation. However, we envision several methodological challenges. Measuring CE technologies and innovations may require new data and methods, and developing relevant indicators for CE adoption is crucial to modelling and managing tensions and trade-offs related to CE at different levels of analysis (firm, region, industry) (Manera and Quatraro, 2025).

CE emphasises value retention, resource loops, and service-based models, prompting innovation scholars to rethink value creation beyond product-centric approaches. Transitioning to a circular model requires rethinking not just the design of products and the flow of materials, but the structure and dynamics of entire value chains. However, more research is needed on how responsibilities and benefits are distributed among actors, and how coordination and control are exercised across multiple tiers (Di Stefano & Piscitello, 2026).

CE research frequently engages with policy instruments, regulatory frameworks, and public-private partnerships (Rossi & Srai 2024), providing innovation scholars with insights into mission-oriented innovation and policy-driven transitions. In fact, an adequate policy landscape is considered among the most effective ways to foster circular transition. However, in the European Union, these policies are still fragmented and inconsistent. The CE transition aligns well with mission-oriented innovation (e.g., EU's Green Deal), where ecosystems are mobilized around societal goals and regulators play a proactive role in shaping innovation trajectories (Suchek et al., 2021). Thus, research can explore how policies can help ecosystems to organize around shared visions, system transitions, and long-term sustainability goals rather than short-term market gains (e.g., de Vasconcelos Gomes et al., 2023).

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