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Special Issue

Exploring the Circular Economy – Pathways to a Sustainable System within Planetary Boundaries

Guest Editors: Fabian Takacs, Manuel Braun, Karolin Frankenberger

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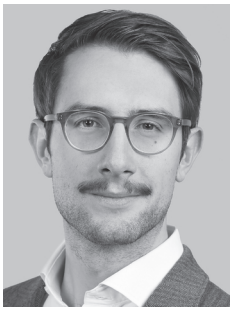

Fabian Takacs, Manuel Braun and Karolin Frankenberger

While developing the call for papers for this special issue of the Swiss Journal of Business, we wrote the following:

At a time characterized by unprecedented environmental challenges, the concept of a circular economy (CE) epitomizes systemic change with real ecological impact. Due to increasing pressure to act, environmental sustainability has witnessed a surge in visibility within both corporate strategy and communication as well as political agenda setting and discourse. Yet, the magnitude of contemporary human activities in crossing planetary boundaries remains unparalleled. A profound gap persists between awareness, intention, and action, both individually and collectively.

Many in politics and business talk about the CE. But what exactly is it, and why has so little been implemented despite the pressing urgency to transition towards a sustainable system within planetary boundaries? This special issue is dedicated to these questions. It aims to show how it can be successfully put into practice, the role of academia, and what it takes to achieve the circular transition. The CE aims at designing and implementing an alternative economic system that creates and captures value within planetary boundaries (Desing et al., 2020; Geissdoerfer et al., 2017; Kirchherr et al., 2017; Korhonen et al., 2018). At its core, the CE seeks to reduce the overall throughput of natural resources in the 'industrial metabolism' (Ayres, 1997), while maintaining material value, maximizing resource utilization, and promoting the restoration of natural systems (Bocken et al., 2016; Centobelli et al., 2020; Morseletto, 2020; Urbinati et al., 2017). The transition to a CE is not only a fundamental 'sustainability transition' (Markard et al., 2012), it also requires a reorientation of current socio-technical regimes (Geels, 2002; Kemp et al., 1998; Markard et al., 2012) towards the implementation of circular strategies, also called R-strategies—such as recycling, repurposing, refurbishing, remanufacturing, repairing, reusing, reducing, rethinking, and refusing. Applying these

strategies not only mitigates environmental impact but also strengthens economic performance through the potential to improve business impact through novel business models, customer value, and supply chain resilience. This shift has far-reaching implications and is shaped by factors on different levels, from product, business, ecosystem, industry, regulation, to society. This covers wage structures, skill levels, business models, mindsets and consumer behaviour, and the prevailing cultural paradigm (Desing et al., 2020; Frankenberger et al., 2021; Takacs et al., 2022). However, even though the last years witnessed an increase in companies integrating CE practices, adoption of regulatory frameworks, and a rise in consumer awareness, the transition to the CE is still slow and fragmented (Circle Economy, 2025).

In response to this challenging context, this special issue consists of eleven articles, four full-length research articles and seven short contributions, all of which address the transition towards a CE from various perspectives. These perspective articles aim to grasp the systemic complexity of the transition to a CE through a combination of both theoretical approaches and practical insights. In doing so, the contributing authors succeed in highlighting the necessity of this transition as well as its practical implementation from various disciplinary perspectives. It quickly becomes evident that this transition has implications for multiple disciplines, each characterized by distinct research traditions and practical relevance, necessitating their adequate representation. All articles in this special issue share a common aim: to reflect and discuss the systemic complexity and far-reaching implications of the transition towards a CE.

The contributions can be grouped into *three thematic clusters*. First, a set of articles addresses the systemic complexity and challenges of the transition from a comprehensive, theoretical as well as practical perspective. Second, a normative strand explores the purpose of business including ethical and sufficiency-driven considerations. Third, several contributions examine the entrepreneurial perspective on the transition, focusing on specific domains of business practice such as marketing, product design, and supply chains. Across all contributions, we have aimed for balance between theoretical approaches and practical insights, to offer readers a rich and engaging experience.

In the first cluster of articles, the guest editors of this special issue—*Takacs*, *Braun*, and *Frankenberger*, together with *Wehinger*—present a systemic approach to identifying transition barriers across multiple relevant levels, including product, firm, ecosystem, industry, and society/regulatory systems. In their lead article, they not only map these barriers but also provide insights into eight underlying mechanisms that help explain how these barriers function and hinder the transition of the socio-technical regimes. Building on this framework, they offer practical examples of how such mechanisms can be disrupted to accelerate the transition across all levels—primarily through various forms of collaboration. This article serves as a conceptual overview and foundation for the diverse perspectives addressed by the authors in the remainder of this special issue.

This article is followed by three short perspective articles that illustrate the systemic perspective outlined in the lead article: an exploration of the limitations of a closed Earth system, practical examples from the context of cities, and insights from practitioners in the chemical industry. The first one of these, by *Desing*, emphasizes that a CE must operate within planetary boundaries in order to safeguard the long-term agency of humanity. Drawing from a systemic and biophysical perspective, the author addresses the resulting implications for the economic system and shows that circularity is not a panacea and

needs to be applied strategically to contribute effectively to planetary well-being. Thereby, the R-strategy 'rethinking' emerges as the most influential one. The second, by *Schuppler* and *Kirchherr*, examines how mid-sized European cities can act as key drivers of the CE by leveraging political support, urban planning, and cross-sector collaboration to implement circular strategies and inspire broader systemic change. The third, by *Schaffrannek* and *Schmidt*, highlights the (systemic) challenge faced by the chemical industry—exemplified by the company case of BASF—in shifting from fossil-based to bio-based and recycled raw materials, and illustrates how the barriers and dilemmas discussed in the lead article can be addressed and overcome. Their contribution outlines a transformative vision centered on the use of alternative feedstocks, the development of ecosystems, and the promotion of collaborative approaches. They emphasize the role of thinking in new ecosystems and scaling digital solutions as enablers of the CE.

The second cluster is introduced by a conceptual research article led by *Björck*, *Pregmark*, *Brandin* and *Schoch* which explores the strategic and systemic role of corporate purpose in the context of the CE. They position purpose as a normative, strategic and systemic driver of organizational transformation, illustrating how it can enable CE through value-driven collaboration and proposing a research agenda to explore its mechanisms, risks, and potential impact. Thereby, they distinguish corporate purpose from related constructs like CSR and develop a multidimensional framework for understanding purpose and its role in embedding circularity at the organizational and ecosystem level. In a short perspective article, *Kirchschlaeger* examines the conceptual and ethical compatibility between the CE and human rights, arguing that a CE can significantly contribute to the protection and realization of fundamental rights—especially in the face of environmental crises. To avoid new human rights violations through CE strategies (e.g., child and forced labor), the author pushes for a robust ethical framework such as 'Just Transition' to provide ethical guidance. This approach advocates for a mutually reinforcing tandem of CE and human rights promoting both environmental sustainability and social justice. The second perspective article in this cluster comes from *Leinonen* and *Lappalainen*, who connect the conclusions of the first cluster—such as respecting planetary boundaries and addressing systemic challenges—with a call for greater internalization of economic responsibility and ethical considerations in business through the adoption of sufficiency strategies. They offer a critical perspective on the CE through a post-growth lens. Central to their argument is a critique of the CE paradigm, prominent during the 2010s, which advocates for the decoupling of economic growth (i.e., monetary value creation) from material throughput (e.g., Ellen MacArthur Foundation, 2013, 2015)—a concept they argue is neither empirically substantiated nor conceptually coherent. In response, they call for the integration of sufficiency in the concept of CE, emphasizing the relevance of the R-strategies 'refusing' and 'reducing' to effectively lower overall material throughput in production and consumption.

The third cluster of articles focuses on the practical implementation of the CE within businesses. The first one, by *Wiesner* and *Größler*, presents a systematic literature review that critically examines the concept of CE through the lens of general management and operations and supply chain management. They identify several critiques of the CE concept, such as its strong emphasis on efficiency (e.g., danger of rebound effects) and the limited technological feasibility of circular designs. Based on their categorization of different types of criticism, the authors conclude—consistent with the insights from the first

and second cluster in this special issue—that there is a need for strong interdisciplinary collaboration to critically address deeper structural limitations and to question the often overly universal framing of CE as a one-size-fits-all solution. In a perspective contribution from practice, *Pfletschinger*, *Stölzle*, and *Kreimeyer* then delve deeper into product design, identifying key challenges and proposing solutions based on interviews with manufacturing experts from the DACH region. They highlight central concepts at the intersection of the product and business models level—such as modularity, upgradeability, longevity, and material specifications—that support circularity. To fully unlock the potential of the CE, the authors argue for a holistic, system-based design approach, supported by digital tools and life cycle assessments from the early stage of product development. In another perspective article from practice, *Gerhardt* uses the example of the chemical industry to illustrate why it is crucial for Europe to engage with the CE in practice. He argues that, especially considering the European chemical industry's loss of relevance compared to competitors in Asia—due to high energy costs and regulatory burdens—the CE is a key strategic lever. The transition toward circularity holds great potential, particularly if existing chemical sites can become central hubs for processing post-consumer materials and enabling circular value chains. Achieving this requires short-term efficiency gains, long-term investment in renewables and automation, and coordinated action across industry, politics, science, and society. This cluster of articles is completed by a research article of *Gisler* and *Gollnhofer*, who examine the CE from a marketing perspective. The authors investigate the critical role of influencers and their marketing activities in promoting R-strategies such as recycling, repairing, reusing, and reducing. The focus lies on the business models adopted by these sustainability-oriented influencers and their impact on the CE transition. Based on qualitative interviews and a netnographic analysis, the authors identify three distinct business model types: educational advocates, lifestyle marketers, and change leaders. Their contribution concludes this special issue by offering a consumer- and marketing perspective.

This special issue provides a comprehensive overview of the potential and limitations of the CE and offers both theoretically grounded and practice-oriented approaches and examples of how the transition toward CE can be addressed—and ideally accelerated. A central theme that emerges across all contributions is the critical importance of collaboration.

Given the high degree of fragmentation and spatial separations of value creation processes today (because of former globalization processes), as well as the disconnection of value creation and value capture driven by the linear pattern of 'take-make-use-dispose', the articles in this issue demonstrate that **collaboration** holds significant potential for sustainably closing resource loops and reducing the material throughput within the industrial metabolism. As readers will see, collaboration can take many forms across various levels (product, business, ecosystems, etc.), ranging from personal interaction and cooperation among value chain actors, to digital platforms and marketplaces that enable circular strategies for different partners, to alliances that share infrastructure or data, to coalitions that share a collective voice to improve policy-driven incentives promoting (sustainable) behavior, and even to cooperation among competitors. Ultimately, the articles in this special issue make it clear that circular entrepreneurs must understand their circular business models as embedded within a system of diverse actors across multiple levels.

The engagement with this topic shows that circular business models alone are not enough: together, it requires decisive action by politics, society, and industries, working together to ensure that circular value propositions become economically viable and evolve into dominant practices and offerings in the market. To ensure the long-term success of these circular business models, they need to actively engage with and influence their broader environment—in line with the concept of boundary-spanning activities known from business model research. It is time to move out of the niche and change the political, regulatory, and societal frameworks so that circularity becomes dominant in socio-technical regimes—for companies as well as for society. Only then can it be possible to overcome the many dead ends and dilemma situations that currently exist in today's linear economy system.

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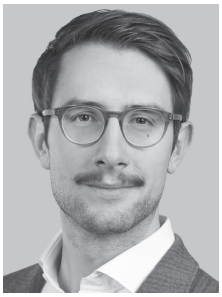
Breaking Barriers: Accelerating the Transition to a Circular Economy



Fabian Takacs, Manuel Braun, Marie Wehinger and Karolin Frankenberger

Abstract: Global resource consumption is continuously increasing, accelerating the transgression of planetary boundaries. Solving the related environmental problems requires targeted action and a systemic transition from the prevailing linear economic model to a circular one. This paper adopts a systemic approach to identify the transition barriers across relevant levels, including product, business, ecosystem, industry, and society/regulation systems. It contributes to research by structuring and mapping the barriers based on eight underlying mechanisms. These mechanisms help explain how the barriers function and why they hinder the transition of socio-technical regimes from linear to circular ones. For example, the Prisoner's Dilemma describes how short-term self-interests often overrule collective benefits and leads to suboptimal outcomes. The mechanisms also provide insights into potential solutions for addressing the barriers and accelerating the implementation of a circular economy. Illustrative examples from practice are introduced to demonstrate that "breaking barriers" is both possible and necessary—primarily through various forms of collaboration.

Keywords: Circular Economy, Systemic barriers, Systemic change, Socio-technical regimes, Collaboration

Barrieren überwinden: Den Wandel zur Kreislaufwirtschaft beschleunigen

Zusammenfassung: Der globale Ressourcenverbrauch nimmt kontinuierlich zu und beschleunigt damit die Überschreitung planetarer Grenzen. Die Lösung der damit verbundenen Umweltprobleme erfordert gezielte Massnahmen und einen systemischen Wandel vom vorherrschenden linearen Wirtschaftsmodell hin zu einem zirkulären. Dieser Artikel verfolgt einen systemischen Ansatz, um die Transformationsbarrieren auf verschiedenen relevanten Ebenen zu identifizieren – darunter Produkt-, Unternehmens-, Ökosystem-, Industrie- sowie gesellschaftliche und regulatorische Systeme. Er leistet einen Beitrag zur Forschung, indem er die Barrieren anhand von acht zugrunde liegenden Mechanismen strukturiert und darstellt. Diese Mechanismen erklären, wie die Barrieren funktionieren und weshalb sie den Wandel von linearen zu zirkulären sozio-technischen Regimen

behindern. So beschreibt etwa das Gefangenendilemma, wie kurzfristige Eigeninteressen häufig kollektive Vorteile überlagern und dadurch zu suboptimalen Ergebnissen führen. Gleichzeitig geben diese Mechanismen Hinweise auf potenzielle Lösungsansätze, um die Barrieren zu überwinden und die Umsetzung einer zirkulären Wirtschaft zu beschleunigen. Anhand praxisnaher Beispiele wird veranschaulicht, dass das „Durchbrechen von Barrieren“ sowohl möglich als auch notwendig ist – insbesondere durch verschiedene Formen der Zusammenarbeit.

Stichwörter: Kreislaufwirtschaft, Systemische Barrieren, Systemwandel, Sozio-technisches Regime, Zusammenarbeit

1. Introduction: Relevance of a Circular Economy

A circular economy (CE) is regarded as a promising alternative economic system that entails fundamentally different configurations of the *socio-technical regime* (Geels, 2022; Markard et al., 2012a), offering pathways to reduce pressures on already critically exceeded planetary boundaries (Desing et al., 2020; Geissdoerfer et al., 2017; Merli et al., 2018; Richardson et al., 2023; Rockström et al., 2009). The idea is to reshape resource flows within today's production and consumption systems in more environmentally sustainable ways through *circular strategies*, also called R-strategies (Potting et al., 2017)—regenerate, reduce, reuse, repair, remanufacturing, and recycle. These strategies fundamentally affect mechanisms of value creation and value capture within companies and across the broader economic system, enabling an alignment with the principles of a CE (Bocken et al., 2018; Frankenberger et al., 2021; Urbinati et al., 2017). The aim is to narrow, slow down, and close resource flows (Bocken et al., 2016; Geissdoerfer et al., 2018), thereby eliminating waste, reducing primary resource extraction, and increasing resource productivity (Ellen MacArthur Foundation, 2013), as well as regenerating nature (Morseletto, 2020).

In contrast to the prevailing socio-technical regime of the linear economy, establishing a CE is deemed as a sustainability transition (Markard et al., 2012a). This transition remains deeply challenging, as it requires transforming the current configurations of the regime organized around linear resource flows into circular ones (Geissdoerfer et al., 2023; Govindan & Hasanagic, 2018a; Grafström & Aasma, 2021; Guldmann & Huulgaard, 2020; Kirchherr et al., 2018). Although the environmental rationale and need for this transition is well established, the extent of its actual implementation remains limited (only about 7 % of the global economy currently operates as a CE) (Circle Economy, 2025). Indeed, global resource use has more than tripled over the past 50 years and continues to grow at a rate of 2.3 % annually (International Resource Panel, 2024).

Research has offered clear insights into the key structures and rules that define a socio-technical regime aligned with the principles of a CE, including circular business models (Geissdoerfer et al., 2020; Hofmann, 2019; Ünal et al., 2018; Urbinati et al., 2017), ecosystems (Hofmann Trevisan et al., 2023; Kanda et al., 2021; Konietzko et al., 2020a, 2020b; Takacs et al., 2020), and industry standards (Bressanelli et al., 2020; Elia et al., 2020; Fischer & Pascucci, 2017; Parida et al., 2019). Notably, the transition to a CE has been slower than anticipated, even in the face of clear signals from policymakers, such as those in the European Union, and growing concerns over resource scarcity (European Commission, 2020; WBCD, 2020).

To elucidate the persistent inertia in the CE transition, we pose the following research question: *What underlying mechanisms impede the transition to a CE, and how do they shape and reinforce existing barriers?* Research on CE barriers has established the key challenges obstructing the transition (Geissdoerfer et al., 2023; Govindan & Hasanagic, 2018b; Grafström & Aasma, 2021; Takacs et al., 2022) but has not explored the deeper mechanisms through which these barriers emerge and persist. In addition, research has only partially been conducted from a systemic economic, social, and technical perspective, for example, by integrating the concept of social-technical regimes and taking a comprehensive multi-level lens (Geels, 2002, 2010). Understanding these mechanisms may aid in overcoming the current slow pace of adopting circular strategies. To address this gap, we systemically identify the most prominent barriers from the literature and analyze the underlying mechanisms influencing their impact.

This paper serves as the lead article in the special issue "Exploring the Circular Economy – Pathways to a Sustainable System within Planetary Boundaries" in the *Swiss Journal of Business*. It provides a foundation for the other papers of this special issue through an in-depth discussion of the CE transition. This paper makes three contributions. First, we present an overview of the barriers that hinder the transition toward circular socio-technical regimes across five relevant levels—product, business, ecosystem, industry, and society/regulation. This overview offers a comprehensive, literature-based mapping of relevant barriers. Second, we identify and discuss the underlying mechanisms that give rise to these barriers. We present eight mechanisms that help explain how these barriers function, thereby elucidating the systemic challenges involved. Third, building on this foundation, we derive and discuss practical interventions that help overcome the identified mechanisms and thereby advance CE transition.

2. Background: Understanding the Underlying Mechanisms of Circular Economy Barriers

A socio-economic regime (c.f., Geels, 2002, 2022; Geels & Schot, 2007) refers to the dominant configurations of system-relevant elements (e.g., technologies, institutions, practices, networks, cultural norms, and companies) that shape how societal functions (e.g., energy, transport, and food) are fulfilled. These configurations, characterized by *dynamic stability* (Geels, 2010), collectively shape the trajectory of possible change along established pathways, thereby influencing the ease or difficulty of transformation (Markard et al., 2012a). Actors embedded in these elements tend to align their behavior with dominant cognitive frames (Geels, 2002). They follow prevailing regulatory structures (Geels & Schot, 2007), adhere to established value creation logics (Geels, 2006), and maintain conventional engineering practices (Rip & Kemp, 1998). Prior investments in business models, ecosystems, infrastructure, and assets further entrench these trajectories, as mechanisms of value capture become institutionalized and difficult to displace (Markard & Truffer, 2006; Unruh, 2000a). Research adopting the multi-level perspective (MLP) (Geels, 2002) has established that these socio-technical regimes—particularly when in a stable state (e.g., the current linear economy)—exhibit inherent resistance to structural adaptation and system innovation owing to their deeply embedded configurations and reinforcing dynamics (Coenen et al., 2012).

Flow of Resources

Inspired by the concept of industrial metabolism introduced by Ayres (1997), we argue that the degree of circularity in a socio-technical regime depends on the operationalized logic of the flow of resources (Bocken et al., 2016) and the extent of the capacity for natural regeneration (Morseletto, 2020). These factors determine the socio-technical regime's overall compatibility with planetary boundaries (Desing et al., 2020). The emerging dichotomy allows for the positioning of socio-technical regimes along a nuanced yet fuzzy continuum between linear and circular (Morseletto, 2023). Within these regimes, embedded actors perform (coordinated) activities that shape value-creation pathways across resource extraction, processing, consumption, discarding, and recovery levels (Geels & Schot, 2007; Unruh, 2000a).

In this context, *linearity* is characterized by a "take–make–use–dispose" logic (Ellen MacArthur Foundation, 2013), which is open (i.e., generating waste, leftovers) and inherently generates negative environmental externalities (Esposito et al., 2018; Hummen & Desing, 2021). Among its practical consequences, linearity lacks provisions for product longevity, price internalization for negative external effects, effective resource utilization, and take-back mechanisms. Linearity fails to recognize the value of natural capital and residual value of products and resources, as well as lacks incentives for production and consumption reduction (Desing et al., 2021; Geissdoerfer et al., 2017; Morseletto, 2023; Tukker, 2015), resulting in environmental overshoot (Desing et al., 2020; Whiteman et al., 2013). Despite these drawbacks, linear systems have been optimized over the decades and thus perform with high efficiency (Morseletto, 2023; Pavel, 2018).

In contrast, *circularity* fundamentally redefines the flow of resources within socio-technical regimes by introducing novel approaches to value creation and value capture. It incorporates thinking of multiple lifecycles through different circular strategies (e.g., regenerate, reduce, reuse, repair, remanufacturing, and recycle) with the goal of minimizing environmental impact, resource devaluation, and waste (Bocken et al., 2016; Ünal et al., 2018; Urbinati et al., 2017). Circularity represents a paradigm shift. Ideally, all technical materials (technocycle) should be restored, and all biological materials (biocycle) should be regenerated (Ellen MacArthur Foundation, 2013). Hence, it aims to restore and regenerate natural capital (Morseletto, 2020) while promoting a holistic and society-wide perspective of well-being within planetary boundaries (Desing et al., 2020).

Barriers to the Circular Economy Transition

Various barriers hinder the transition from a purely linear to a fully circular socio-technical regime (Geissdoerfer et al., 2023; Kirchherr et al., 2018; Takacs et al., 2022). A CE transition—a sustainable transition—is a long-term, multidimensional, and fundamental transformation of socio-technical regimes (Coenen et al., 2012; Geels & Schot, 2007; Markard et al., 2012b). It is actively driven by a subset of actors across public and private sectors who seek to establish an alternative socio-technical regime with novel configurations that allow for production and consumption within environmental boundaries (Collste et al., 2021; Desing et al., 2020). The underlying mechanisms and factors that hinder this transition can be elucidated by combining the research on CE barriers (c.f., Kirchherr et al., 2018; Takacs et al., 2022) with the MLP and its conceptualization of

transition in socio-technical regimes (c.f., Geels, 2002; Geels & Schot, 2007; Rip & Kemp, 1998). Drawing on these two research streams, we classify the barriers into five levels:

- *product* (including *technology*) (Bakker et al., 2014; Bocken et al., 2016; Nag et al., 2022),
- *business* (Geissdoerfer et al., 2020; Hofmann, 2019),
- *ecosystem* (i.e., inter-organizational networks and partnerships) (Kanda et al., 2021; Konietzko et al., 2020b),
- *industry* (Awan et al., 2021; Fischer & Pascucci, 2017; Flynn & Hacking, 2019), and
- *society* (Michaud & Llerena, 2011; Pepper et al., 2009) and *regulation* (Agamuthu & Visvanathan, 2014; Desing et al., 2021; Zhu & Geng, 2013).

Although previous research has effectively identified key barriers (c.f., Geissdoerfer et al., 2023; Govindan and Hasanagic, 2018; Grafström and Aasma, 2021; Ritzén and Sandström, 2017), it has not provided sufficient theoretical and practical grounding to explain how these barriers operate and why, as a result, the transition to a CE remains so challenging. This lack of a systemic understanding of the fundamental underlying mechanisms represents a key shortcoming. Effectively addressing the barriers—to deploy solutions that actually tackle the root causes—requires a deep understanding of the underlying mode of action of these underlying, interlinked, and reciprocally interacting mechanisms across levels. Addressing individual barriers may only result in (small) short-term improvements or benefit isolated levels (e.g., product improvement only), without fostering systemic change throughout whole socio-economic regimes. To advance research on CE barriers and accelerate the CE transition, we propose a shift in focus toward the root causes of barriers and introduce a new conceptual framework that expands the existing literature by incorporating a systemic perspective.

Underlying Mechanisms

Our research identifies eight underlying mechanisms behind the barriers to a CE transition, identified in existing literature and managerial practice. After briefly introducing the theoretical foundations, we illustrate how the mechanisms and respective barriers work across levels (see Section 3), before discussing potential solutions to break them (see Section 4).

The first mechanism constitutes ***lock-in***, which is closely associated with path dependency. Geels (2006) highlighted that socio-technical regimes, given the nature of their configurations, cause lock-ins as they (explicitly and implicitly) attempt to stabilize the predominant value creation and capture logic—in our study, the linear flow of resources (Sopjani et al., 2020). Lock-ins increase the switching costs fueled by past expansions of actors involved (owing to network effects), their relations and structural embedding (David, 1985), and the vested interests of already made investments (Geels, 2006). Technologies and infrastructure in the prevailing socio-technical regime—created and designed to remain stable and functional over time (Berkhout, 2002)—lock up the actors in a dominant linear value creation and capture logic (Henrysson & Nuur, 2021; Turnheim et al., 2015).

The second mechanism constitutes ***institutional inertia*** and arises from prevailing institutions that shape behavior, expectations, and organizations through formal and informal rules and norms, thereby stabilizing the socio-technical regime; individuals align with

these frameworks over time (North, 1990). The "stickiness" of institutions arises from their design, which provides stability and predictability but simultaneously impedes transitions toward sustainable alternatives (Hannan & Freeman, 1984; Rosenschöld et al., 2014; Sydow et al., 2009). Furthermore, expected returns embedded in established value-capturing mechanisms keep the previously chosen path the dominant option, as it becomes more advantageous the longer it is followed (Pierson, 2000).

A further mechanism builds ***information asymmetry***, leading to market failures. When one actor holds better information than another, adverse selection and inefficient resource allocation can ensue (Akerlof, 1970; Löfgren et al., 2002). Principal–agent theory explains how asymmetric information can result in incentive misalignment (Ross, 1973) and conflicts of interest between the instructing principal and the executing agent. This leads to opportunistic behavior that does not support a sustainable design of resource flows (Lahti et al., 2018; Rizzati & Landoni, 2024).

Asymmetric incentives are also central to the ***prisoner's dilemma***, a game-theoretical construct that describes the situation in which actors in socio-technical regimes could achieve better outcomes through cooperation yet are often driven toward suboptimal (collective) results owing to (short-term) self-interests (Axelrod, 1980; Nash, 1950). This dilemma illustrates the tension between responsibility for collectively shared resources and ecological integrity, as well as the self-interests of corporate and national actors that neglect this responsibility (Robèrt & Broman, 2017). Trapped in this dilemma, firms are pressured into unsustainable behavior, as individual deviation is rewarded (e.g., by short-term profits). Meanwhile, pursuing the sustainable path often entails disadvantages (e.g., market losses or cost increases), even though it would be collectively better over time (Pacheco, Dean, et al., 2010).

The ***innovator's dilemma*** describes the tendency of actors to prioritize incremental (i.e., exploitation) over disruptive (i.e., exploration) innovation (Christensen, 1997; Frankenberger et al., 2020). Various factors lead to the fixation on incremental advancements, including entrepreneurial resource allocation, where resources are directed toward optimizing existing capabilities rather than exploring transformative opportunities (Corso & Pellegrini, 2007; Sharma, 1999). Short-term time preferences lead to prioritization of immediate returns over long-term innovation (Lumpkin & Brigham, 2011; O'Reilly & Tushman, 2008). This situation is evident in companies that have long focused on linear business models, optimizing them for efficiency. As such, circular solutions initially perform worse by direct comparison (Morseletto, 2023; Pavel, 2018).

A further mechanism pertains to the so-called ***environmental externalities*** (Ostrom, 1990), whereby environmental consequences (e.g., damage, pollution) of economic value creation processes (e.g., usage and disposal) are not internalized in market prices (Chava, 2014; Delucchi, 2000). This effect is reinforced by the fact that the economic value of so-called natural ecosystem services and natural functionality is not assigned a measurable value or price. Hence, the cost of exploitation of natural resources and the value of ecosystem services are excluded from economic calculations (Costanza et al., 1997). This lack of price internalization leads to market failures, misuse and overuse of resources (e.g., fossil fuels) and common goods (e.g., clean air), as well as free riding behaviors. As prices do not reflect the totality of costs generated (i.e., internalization leads to higher prices and reduced (over)consumption), systemically inefficient resource allocation is observed (Chander, 1997; Meade, 1973), as in today's linearly functioning socio-technical regimes.

Social norms constitute the explicit and implicit standards and rules that govern the behavior of actors. From a functionalist systems theory perspective, actors within a socio-technical regime operate in alignment with and in fulfillment of systemic needs and goals, which then shape their functions, tasks, and roles (Geels, 2010). These normative rules become relevant as actors do not operate in isolation but rather within social networks, effectively defining the "rules of the game" (Geels & Schot, 2007). Subsequently, social norms influence the individual and aggregated perceptions and emotions of producers and consumers (e.g., regarding product design and functionality) and thus actively shape market demand (Godinho Filho et al., 2024; Moreau et al., 2017). Thus, firms strongly align their value creation processes with prevailing social norms, as well as dominant consumer behaviors and demands, which are predominantly structured in a linear manner (Ahmadov et al., 2023).

At the heart of these norms lies the ***growth paradigm***. It describes the dominant narrative deeply embedded within the actors and institutions in the socio-technical regimes asserting that economic growth (i.e., mostly measured in society as increases in the gross domestic product [GDP] and in companies as revenue growth) is both desirable and necessary for the prosperity of societies and businesses (Jackson, 2016; Raworth, 2017). A core element of this narrative is its linkage to societal progress (Ayres, 1996). This assumption implicitly carries the belief that growth is both indefinitely possible and allows for a decoupling of economic expansion from environmental degradation. Notably, these assertions have been conceptually and empirically contested (Hickel & Kallis, 2020; Parrique et al., 2019). This paradigm manifests in the expectations of actors, shaping and guiding their activities, and is structurally embedded in the measurement systems and targets of the socio-technical regimes, defining what prosperity is and how it is achieved. It is closely linked to the imperative to expand monetary value creation processes to deliver more products and services, which further reinforces the linear flow of resources (Desing, Brunner, et al., 2020; Martínez-Alier et al., 2010; Schmelzer, 2015).

3. Findings: Linking Barriers to Underlying Mechanisms

We identified the most relevant barriers in the CE literature and assigned them to one of the five levels—product, business, ecosystems, industry, and society/regulation—based on their level of impact and respective relevance for practitioners (see Figure 1). We then conducted a categorization of the key barriers through a comprehensive morphological analysis (i.e., Frow et al., 2015; Lüdeke-Freund et al., 2018). Table 1 (in the appendix) provides an overview of the 27 most relevant barriers as well as the identification of the most dominant underlying mechanism for each barrier. Next, we conducted a series of five workshops over the course of one year (from late 2023 to late 2024) with more than 150 executives, to challenge the categorization and discuss the underlying mechanisms in the context of managerial practice, thereby moving beyond the static perspective on barriers typically found in CE research. The barrier overview (Figure 1) is based on an extensive literature review and insights from Takacs et al. (2022). On each level, a few underlying mechanisms, as previously explained, influence the functioning of the barriers.

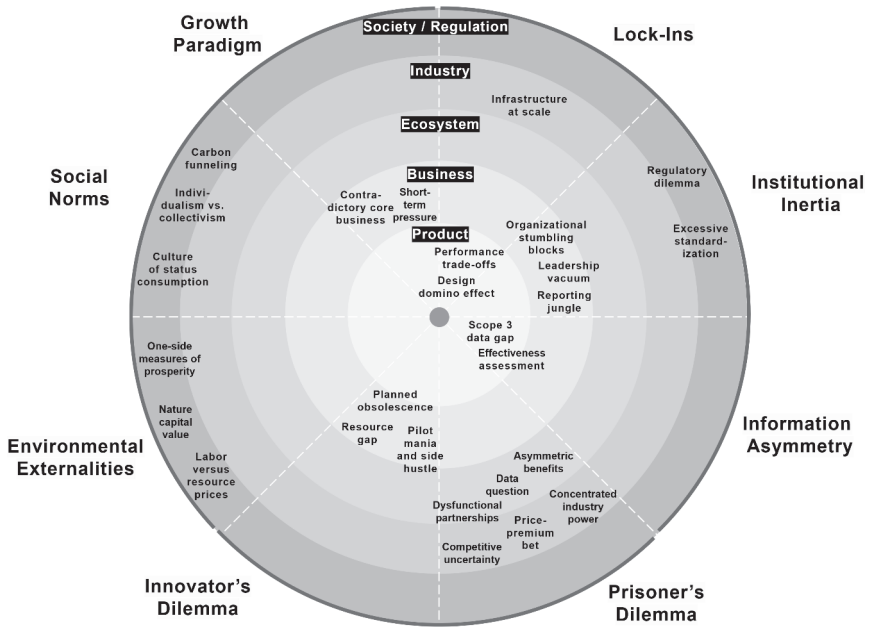


Figure 1 Identified barriers and their underlying mechanisms

Product Level

Two underlying mechanisms hinder the development of circular products and services. First, **lock-ins** create path dependencies on previous linear processes and design specifications. This leads to a *design domino effect* where fragmented design decisions across the value chain hinder product development teams from adjusting their conventional ways of designing products and implement design changes to support circular strategies (Cantú et al., 2021; Guldmann & Huulgaard, 2020; Hansen & Schmitt, 2021; Kumar et al., 2019). For example, the design of a car is typically planned multiple years before start of production and is optimized for production platforms that serve multiple vehicle generations. Customers' (product) performance expectations regarding quality, aesthetics, and designs intensify lock-ins. Customers develop expectations based on previous product offerings and may apply these to circular alternatives. Depending on the type of circular products, the functionalities, quality, and appearance may differ from those of linear options. These *performance trade-offs* may create consumer skepticism, ultimately resulting in limited demand (Cantú et al., 2021; Hina et al., 2022; Luchs et al., 2010, 2012). For instance, a remanufactured phone may offer the same performance and warranty as a brand-new device, yet minor imperfections can make it less appealing to consumers who equate appearance with value.

The second dominant underlying mechanism is **information asymmetry**, which exists between value chain actors and complicates decision-making in favor of existing linear design standards. Although producers have insights into general data, they often lack granular details from upstream players (i.e., *scope 3 data gap*), which complicates the implementation of circularity, as seen in the design of toxic-free product components (upstream) or operationalization of take-back processes (downstream) (Hansen & Schmitt,

2021; Jaeger & Upadhyay, 2020a; Jäger-Roschko & Petersen, 2022; Wijewickrama et al., 2021). Information asymmetries impede *effectiveness assessments* of circular strategies (e.g., limited lifecycle assessments, lack of standardizations). Consequently, decisions on the most environmentally friendly end-of-life design implications and circular strategies, such as repair, are often hindered by a lack of insights into a given product's material composition, origins, resource values, and after-usage handling. In such cases, stakeholders face uncertainty, from an energy efficiency perspective, about whether it is more beneficial to repair and thereby extend the product's lifespan or prefer a replacement. Such asymmetries drive the difficulty in appropriately evaluating and deciding suitable circular strategies and alternative material choices and may erode trust between consumers and sellers (Guldmann & Huulgaard, 2020; Hina et al., 2022; Jaeger & Upadhyay, 2020a; Kirchherr et al., 2018).

Business Level

Three underlying mechanisms drive the barriers that hinder the innovation of circular business models (Bocken et al., 2018; Geissdoerfer et al., 2020; Ünal et al., 2018). First, **institutional inertia** creates rigid structures, siloed thinking, and legacy processes that hinder cross-functional collaboration within companies and prohibit the introduction of novel business models, organizational designs, and processes that would support scaling circular strategies at the organizational level (i.e., *organizational stumbling blocks*) (Arranz et al., 2024; Hansen & Schmitt, 2021; Hofmann & Jaeger-Erben, 2020; Santa-Maria et al., 2021; Sarja et al., 2021). Institutional inertia also drives insufficient senior sponsorship for CE, a lack of psychological safety, and a limited openness toward sustainability, often owing to an unwillingness to leave the comfort zone of daily business and manifesting in a *leadership vacuum* (Govindan & Hasanagic, 2018b; Ritzén & Sandström, 2017; Rizos et al., 2015). The barrier *reporting jungle* further exacerbates this situation through inaction. In current business practice, numerous new regulations, laws, and reporting obligations are being introduced within the European Union (e.g., Corporate Sustainability Reporting Directive, EU Taxonomy regulation) to solve environmental problems through transparency and reporting practices. However, these new settings also impose additional administrative burdens and high costs, which reinforce institutional inertia. Consequently, companies are diverted from innovation-driven approaches toward bureaucratic compliance, pressured to adopt reactive sustainability strategies instead of taking time to proactively innovate circular business models (George et al., 2021; Hummel & Jobst, 2024; Rizos et al., 2015).

The second underlying mechanism reinforcing business-level barriers is the **innovator's dilemma**. It pertains to a situation where constantly adding new features or functionalities to products—to signal technological progress (i.e., *planned obsolescence*), even though performance is improved only slightly—becomes the new normal. Such additional features jeopardize circular design, which focuses on simplicity, modularity, and accessibility, and complicate end-of-life handling (Barros & Dimla, 2021; Ellen MacArthur Foundation & IDEO, 2020; Jain, 2019; Özkan & Karataş Yücel, 2020). Furthermore, past investments (e.g., in machinery or technology) and the ongoing operation of such investments tie up significant resources (e.g., human or financial resources), creating a *resource gap* for the build-up of new resources and skills for CE, especially in small- and medium-sized companies (Hart et al., 2019; Hina et al., 2022; Rizos et al., 2015; Takacs et al., 2022). The

innovator's dilemma also stimulates the tendency of companies to treat their CE strategies as a *side hustle* instead of aligning it with their core business. Pilot projects improving circular strategies often do not receive the same attention and resources as other existing products or business models, which leads to unsuccessful or slow pilot project outcomes (i.e., *pilot mania*) (Cantú et al., 2021; Guldmann & Huulgaard, 2020; Lauten-Weiss et al., 2024; Salmenperä et al., 2021).

Finally, the third underlying mechanism—the **growth paradigm**—prevents companies whose value propositions are fundamentally incompatible with ecological or circular principles (e.g., firms producing non-recyclable, fossil-based products) from preparing for their own phase-out or voluntarily renunciation of harmful economic practices for the greater good (i.e., *contradictory core business*). As a result, harmful products or suboptimal alternatives are maintained, or only incremental changes are pursued, rather than actively working toward strategic liquidation or market exit, driven in part by the interests of owners, employees, or customers. Also, *short-term pressure* (e.g., given through the requirements of delivering shareholder value) fosters a culture of short-termism among company leadership, where immediate revenue gains are prioritized at the expense of long-term sustainability and organizational resilience. This puts circular strategies at a disadvantage compared to existing linear business models, as their profitability might take longer to achieve (de Jesus & Mendonça, 2018; Hina et al., 2022; Takacs et al., 2022; Van Eijk, 2015a).

Ecosystem Level

At the ecosystem level, the **prisoner's dilemma** is the dominant underlying mechanism. It is derived from misalignments between value chain actors and from challenges faced by individual organizations in ecosystems, often owing to the limited involvement of stakeholders committed to the CE. Collaboration would be mutually beneficial, but is hindered by short-term interests and the uncertainty of involved actors. A lack of trust in the fair distribution and capture of value prevents joint action. Barriers such as complex collaborative set-ups, difficulties in building trust among actors, and a lack of transparency are significant challenges that slow down the formation of CEs (Cantú et al., 2021; Hina et al., 2022; Kanda et al., 2021; Konietzko et al., 2020b; Takacs et al., 2020).

Within this context, *asymmetric benefits* comprise a key barrier. Imbalances in value distribution within circular ecosystems, such as between an original equipment manufacturer (OEM) and a supplier, often create a disconnect between those who generate value and those who ultimately capture it. This misalignment leads to adverse incentives and mistrust, reducing motivation for collaboration despite the fundamental role of transparency and trust in enabling a CE (Berardi & de Brito, 2021; Brown et al., 2020; Evertsen & Knotten, 2024). Closely related to this challenge is the *data question*. The ability to share data across value chains and among actors delivering circular value propositions is necessary for successfully realizing CE initiatives. However, this often proves difficult owing to a lack of mutual benefits and security concerns. A lack of trust prevents open data sharing and access, as stakeholders fear that disclosing information could place them at a competitive disadvantage, again reflecting a prisoner's dilemma situation (Gupta et al., 2019; Jäger-Roschko & Petersen, 2022; Khan & Abonyi, 2022; Serna-Guerrero et al., 2022). A further barrier is represented by unproductive partnerships (i.e., *dysfunctional partnerships*), emerging from similar prisoner's dilemma conditions. In many cases, part-

nerships progress only to the extent of the lowest common denominator between actors, lacking a clear vision and structured plans for mutual benefit (Berardi & de Brito, 2021; Hina et al., 2022; Köhler et al., 2022; Santa-Maria et al., 2021).

Industry Level

Prevailing market structures, technology adoption, and value chain configurations present significant barriers to CE transition (Cantú et al., 2021; Geels, 2002; Hansen & Schmitt, 2021; Loorbach et al., 2017; Magnusson & Werner, 2023). Past investments in conventional, linear infrastructure (e.g., incineration plants) constitute a major industry-level barrier, again driven by **lock-ins** as the underlying mechanisms. Deviation from investments in linear infrastructure, established and optimized over decades (e.g., incineration plants or one-way shipping), is a significant challenge. As such, *infrastructure at scale* to support circular strategies (e.g., collection and recycling systems for plastics) remains lacking, exacerbated by a limited availability of partners (de Jesus & Mendonça, 2018; Markard et al., 2012b; Seto et al., 2016; Unruh, 2000b).

The **prisoner's dilemma** also drives barriers at the industry level. First, *competitive uncertainty* hinders the transition as actors are often reluctant to shift toward circular products or business models over concerns that doing so might place them at an immediate industry-wide competitive disadvantage. Many firms in highly competitive industries adopt a "wait and see" approach, delaying necessary transitions and reinforcing the status quo (Cantú et al., 2021; Jaeger & Upadhyay, 2020b; Paha, 2023; Quairel-Lanoizelée, 2011; Van De Ven & Jeurissen, 2005). Second, the prisoner's dilemma creates a *price-premium bet* barrier, in which circular alternatives are often more expensive than their linear, unsustainable counterparts, owing to unpriced externalities, such as the costs of chemical pollution for conventional fruits and vegetables. Assuming the consumers' limited willingness to pay, businesses face difficulties in justifying the price premiums of circular products. Companies that deviate and opt for the more expensive circular value creation are potentially penalized by a decline in demand. Indeed, they may have to perform within niches (Boyer et al., 2021; Hamzaoui Essoussi & Linton, 2010; Pretner et al., 2021). Third, *concentrated industry power* hinders the CE transition. Industry incumbents frequently dominate market agendas, often to the disadvantage of more sustainable businesses. This situation is also rooted in the prisoner's dilemma, where established firms, hesitant to deviate from their past successes, dictate the trajectory of market development (e.g., lobbying for a specific policy agenda). Their reluctance to explore circular alternatives makes it more challenging for emerging, sustainable substitutes to gain traction, ultimately slowing down the CE transition at an industry-wide level (Geels, 2002, 2022; Loorbach et al., 2017; Magnusson & Werner, 2023).

Society and Regulation Level

The barriers at the society and regulatory levels are driven by the mechanisms of social norms, institutional inertia, and environmental externalities. First, **social norms** play a crucial role in fostering a *culture of status consumption*, which conflicts with CE principles on the consumer side. Often, consumption is motivated by the desire to signal wealth, engage in social comparisons, or access desirable networks (Eastman et al., 1999; Goldsmith & Clark, 2012). Consequently, consumers tend to prioritize consumption vol-

ume—manifesting as overconsumption beyond essential needs—and continue to follow traditional ownership models, rather than adopting alternatives like product–service systems (Bocken & Konietzko, 2022; Camacho-Otero et al., 2018; Eastman et al., 1999; Goldsmith & Clark, 2012). Moreover, scholars have identified the *individualism versus collectivism* barrier. This barrier pertains to an ongoing societal and regulatory debate on whether the ecological challenges addressed by the CE should be tackled through the aggregation of individual behavioral and preference changes (i.e., bottom-up approaches such as reducing individual overconsumption) or through collective, top-down measures (e.g., carbon taxes or market interventions that increase the cost of consumption) (Cho et al., 2013; Ianole-Călin et al., 2020; Saracevic et al., 2022). Social norms also drive *carbon funneling*, describing the tendency to overly prioritize efforts and resources aimed at reducing carbon emissions (i.e., planetary boundary of climate change), neglecting other critical environmental issues (e.g., biodiversity loss, land system change) and creating an imbalance in how firms respond to sustainability challenges (Gallego-Schmid et al., 2020; Richardson et al., 2023b).

Institutional inertia serves as another mechanism underlying barriers across regulatory and administrative frameworks. Regulatory frameworks must balance economic activity with environmental protection while avoiding excessive bureaucracy (i.e., *regulatory dilemma*) (Kitching et al., 2015; Peng & Shen, 2024; Pickman, 1999). Similarly, standardization efforts (i.e., *excessive standardization*) must prevent administrative burdens while ensuring comparability of circularity data at the material, product, and process levels (Flynn & Hacking, 2019; Grillo et al., 2024).

Finally, scaling circular strategies is strongly reliant on profitable business models. However, achieving this requires a shift in market boundary conditions, which is strongly prevented through unpriced **environmental externalities**. An important barrier—driven by the mechanism of environmental externalities—that hinders the CE transition is the imbalance between low resource prices and high labor costs (i.e., *labor versus resource prices*). This cost structure discourages circular strategies, such as repair and refurbishment, which are labor-intensive but receive little economic incentive compared with resource extraction and virgin production. These circular strategies tend to be labor-intensive in implementation, as the given problems are poorly structured, difficult to process through automation, and thus hard to scale through technology. For example, repairing a pair of jeans involves significantly more complexity and manual effort compared with highly standardized waste incineration processes and (re)production of new products (de Jesus & Mendonça, 2018; Guldmann & Huulgaard, 2020; Kissling et al., 2013; Llorente-González & Vence, 2020; Stahel, 2013; Vence & López Pérez, 2021). Additionally, the failure to account for *nature capital value* in economic activities leads to severely underpriced market values, discouraging sustainable practices, such as circular strategies (Bateman & Mace, 2020; Baumol & Oates, 1988; Fenichel & Abbott, 2014; Rizos et al., 2016). The current socio-technical regime is significantly driven by linear, resource-extractive practices, as can be seen by the amount of subsidies (7 % of global GDP) supporting fossil fuels (IMF, 2025). Further intensifying both of these challenges is the current focus on *one-sided measures of prosperity*, particularly GDP, which prioritizes financial, economic output (driven by material throughput and resource extraction) over other social or environmental benefits, such as health or economic resilience. The situation is comparable to the dominance of

growth-oriented performance indicators in companies (Costanza et al., 2009; Jackson, 2009; Kallis, 2017; Stockhammer et al., 1997).

4. Discussion: Breaking Barriers

A wide range of potential interventions exists to effectively address the identified barriers. We present a selection of those we consider particularly relevant—cross-level and interdependent—and link them to the underlying mechanisms that shape these barriers.

The CE transition can be enabled by interventions that break the quasi-irreversibility and path dependency created by ***lock-ins*** within dominant linear regimes. This possibility is illustrated by other historically fundamental transitions, such as the one from the carriage to the automobile (Berkhout, 2002). Geels (2002) recommended opening a "window of opportunity" for innovation, therefore actively bringing CE innovation out of its niche. This release can gradually destabilize existing regime configurations (in business, industry, society), potentially triggering further reinforcing changes, known as "circular causality" (Geels, 2006). On the one hand, regulatory bodies can perform "shielding" interventions—known from strategic niche management (Kemp et al., 1998)—that protect the upcoming innovation within its niche to prevent it from being crushed before scaling and usher it into the socio-technical regime (Turnheim et al., 2015). To illustrate, new material innovations (e.g., seaweed-based packaging) are often driven by start-ups or research institutes rather than established organizations (e.g., plastics packaging companies). Many circular business model innovations, such as circular as-a-service models, require development in a protected organizational space to avoid potential early conflicts with the incumbent solution (e.g., BlueMovement is an entrepreneurial spin-off of Bosch-Siemens Hausgeräte). On the other hand, firms and regulators must enable a gradual reconfiguration—simultaneously across multiple levels, ideally—to limit resistance within existing regimes (Geels, 2002). According to Geels (2006), two particularly useful interventions can be applied to the CE context. First, add-on interventions (e.g., adding equipment-as-a-service alongside traditional machine sales) can target new customer segments. Second, retrofitting and component substitution within existing infrastructure, as demonstrated by firms like Lorenz Water Meters and Renault's The Refactory, can generate cost advantages.

In its scope and magnitude, the transition from combustion engines in the car industry toward lower-carbon mobility technologies (e.g., battery electric vehicles, BEVs) serves as a good example of the break from predominant, locked-in regimes. Technology adoption typically follows an S-curve, scaling exponentially once a tipping point is reached. Enabling solutions to reach such tipping points—often signaled by cost parity, user attractiveness, and accessibility—is therefore critical (Systemiq & University of Exeter, 2023). In this case, at the product, business, and ecosystem levels, companies can work toward making BEVs cheaper than combustion engines (e.g., through cost optimization, ecosystems for process innovation, economies of scale). Several Chinese original equipment manufacturers have achieved major progress in this regard. At the ecosystem level, companies can make BEVs more fun to drive (i.e., increasing relative attractiveness) and establish an accessible network of charging stations (i.e., possible through an add-on approach, without disrupting existing fossil-based petrol station infrastructure), such as that implemented by Tesla. At the industry level, gradual infrastructure adaptation can help break lock-ins, as exemplified by Norway, which established free parking opportunities and road toll

discounts to make EVs cost-competitive and more attractive in usage. Norway has also implemented society- and regulatory-level adjustments to vehicle taxation by modifying VAT and import duties for EVs.

Institutional inertia is characterized by a stickiness of established formal and informal rules and norms in business, society, and at the regulatory level, hindering CE transition. A common intervention is institutional entrepreneurship, which aims to help circular solutions move from niche into the socio-technical regime (Dorado, 2005; Hardy & Maguire, 2008; Pacheco, York, et al., 2010). According to Rosenschöld et al. (2014), who examined institutional entrepreneurship in the context of climate change, companies and their representatives must engage in power brokerage among different actors willing to drive regime change (i.e., through coalition building) and craft incentives for lowering transaction costs (i.e., making communication and negotiation more efficient). For example, the Business Coalition for a Global Plastics Treaty, convened by the Ellen MacArthur Foundation and WWF, brought together businesses and financial institutions to support the challenging global treaty negotiation process and unite businesses through a coalition of the willing. Institutional inertia in business and within government institutions can also be overcome through actively (re)shaping the public framing (Dorado, 2005). Political and societal interventions (i.e., more signals toward CE) can make it easier to mobilize resources across and within companies. For example, Zurich's public vote on a CE initiative, which was driven by different parties and companies and approved by the public, now significantly drives the actions of local authorities—both financially and ideologically. Another example is the Circular Economy Action Plan launched by the European Commission in 2015 and renewed in 2020.

Information asymmetries underlying various barriers potentially lead to market failures (i.e., insufficient allocation of resources) and hinder circular solutions owing to adverse selection and moral hazards (Goering, 1997; Rizzati & Landoni, 2024). These asymmetries can be mitigated through various interventions based on signaling, screening, contractual incentives, and the establishment of repeated interactions (Löfgren et al., 2002; Ross, 1973; Spence, 1973; Stiglitz, 1975). All these measures aim to improve market allocation in the sense of a CE—immediate and over time—by fostering information transparency and aligning the knowledge base of involved actors. Promising efforts regarding these interventions have been applied. First, to send credible signals, companies are increasingly relying on recognized certificates and standards. Emerging circular standards include DIN, ISO norms (e.g., 59004), and the Cradle-to-Cradle certificate (McDonough & Braungart, 2002). These initiatives primarily operate at the product and business levels. Meanwhile, early developments at the ecosystem and industry levels are also taking shape. For instance, consortia of companies are developing industry-wide digital product passports, as seen in the case of the battery passport (mandated by the EU Battery regulation as of 2027), to ensure transparent information and sustainable material flows. This type of intervention is implemented by Catena-X, the first European open data ecosystem designed for the automative industry. Such collaborative approaches play an important role in creating the trusted infrastructure to share information. Indeed, platforms play an increasingly important role in strengthening companies' screening capabilities. For example, Excess Material Exchange aims to facilitate the reuse of materials across companies and industries. The platform Materiom also inspires and connects circular material innovators.

To break the ***prisoner's dilemma*** and thereby address the associated barriers, the authorities require solutions that either discourage companies from persisting with linear practices (e.g., owing to short-term cost advantages or reputational concerns) or create incentives for collaboratively adhering to higher circular strategies and standards. That is, interventions that make unilateral deviation less attractive must be formulated. The prisoner's dilemma arises when competitive incentives lead to a collectively suboptimal outcome. Circular-oriented companies face disadvantages for implementing more costly yet sustainable alternatives (e.g., monomaterial, recyclable design), as these costs are not internalized by competitors who opt out of such practices for reasons of short-term self-interest (Ostrom, 1990; Pacheco, Dean, et al., 2010). Avoiding this requires institutional entrepreneurship, aimed at changing existing, linear-dominated institutions—such as the rules of the market—so that minimum standards are established, and collaboration becomes worthwhile. This, however, depends on targeted lobbying efforts explicitly oriented toward enabling the CE transition (Pacheco, Dean, et al., 2010; Pacheco, York, et al., 2010). The packaging industry serves as a good example for interventions to overcome this dilemma, requiring policy makers to introduce clear rules, such as the Packaging and Packaging Waste directive (PPWRD), to set minimum standards (e.g., recycled content quotas) that create a level playing field for innovation. Another intervention is driven by the creation of secure and interoperable data and information flows that break misaligned incentives (see SINE Foundation). In practice, this requires privacy-preserving, cross-industry standards for data exchange and analysis that account for specific values (e.g., security, reciprocity, openness) and actively fosters collaboration, such as the Partnership for Carbon Transparency (PACT) initiative by the WBCSD, which aims to develop a methodology for calculating and exchanging product-level Scope 3 data across value chains, together with leading stakeholders from industrial practice (WBCSD, 2025).

The ***innovator's dilemma***, which underlies various barriers, can be addressed if companies develop a tolerance for ambiguity between their existing linear business model and a potential new circular one—the former is typically aligned with an exploitation path, whereas the latter is understood as an exploratory innovation path (Frankenberger et al., 2020; Morseletto, 2023). Such tolerance enables them to learn to perform across both trajectories (Corso & Pellegrini, 2007). Christensen (1997) emphasized the importance of creating room and ring-fence innovation, such as by enabling new business units or entrepreneurial ventures to drive innovation, or by integrating long-term value creation metrics (e.g., Hilti's Circelligence method or the Environmental Profit & Loss accounting by Kering) to actively manage dual strategies (sustain vs. disrupt). To establish the exploration path in the context of the CE, the chemical company BASF designed a circular intrapreneurship program that allowed project leaders to apply for circular initiatives with minimal bureaucracy. These projects were funded equally by corporate and the divisions and guided through a multi-step project funnel from initial idea to market launch.

Other interventions to bridge the dilemma are partnerships and ecosystem innovation—coalitions or alliances drive circular solutions. For example, integrated value chain partnerships, such as Project STOP against ocean plastics, the Circular Electronics Partnership, and SENS for electronic recycling in Switzerland, are types of interventions that establish novel configurations in the socio-technical regime. Similarly, partnering with entrepreneurial innovators or venture builders (e.g., Antler or Carbon-13), or engaging in corporate venture capital investing, can enable access to innovation that is still in the

niche. Moreover, an increasing number of circular innovation networks are aiming to bring companies together and enable ecosystem innovation partnerships. For example, the Ellen MacArthur Foundation has played a key role as a field builder for CEs in the past 15 years, facilitating a solution-focused international network. Similarly, Circular Republic, a Munich-based regional network, is following a programmatic approach to facilitate circular innovation (e.g., to close the loop on EV batteries) by uniting OEMs, suppliers, recyclers, and start-ups to develop scalable solutions for EV battery reuse and recycling.

To address the underlying mechanism of ***environmental externalities***, governments must push interventions that help internalize the full cost of all currently unpriced effects and environmental costs, both negatively (e.g., cost of pollution) and positively (e.g., value of ecosystem services) (Chava, 2014; Delucchi, 2000). Circular strategies may have a structural disadvantage if their benefit or the true cost of the linear alternative is mispriced. Practical examples are market-based instruments, such as CO_2 pricing, either through carbon markets or emission trading schemes. These are impactful regulatory interventions, as shown by the EU Emissions Trading Scheme, which applies to the electricity, aviation, and industrial manufacturing sectors. This scheme requires polluters to pay for CO_2 emissions, setting a cap that is reduced annually according to the EU's climate targets. Another example for regulatory measures that aim to support CE transition are Extended Producer Responsibility schemes, which are becoming increasingly applied (e.g., for packaging, textiles, tires) by countries to make producers responsible for products across the entire lifecycle, while creating incentives for sustainable product design choices (e.g., reduced fee for products with higher recycled content). Similarly, subsidies on clean energy for the sustainability transition are essential to counteract the high subsidies for fossil fuels. Novel approaches call for interventions that support a proper natural capital accounting, to "put nature on the balance sheet" (e.g., the case of the LandBanking Group), and establish natural capital as an asset class. In this way, ecosystem services are actually valued and can become an investable asset.

Social norms and the ***growth paradigm*** serve as fundamental frameworks that guide behavior within organizations, shape society, and influence regulations. While the former refers to broader socio-cultural expectations, the latter specifically concerns the anticipation of continuous growth within economic value creation. Social norms typically manifest in concrete ways. For example, the continuous renewal of trends fosters fast consumption patterns, as seen in ultra-fast fashion, simultaneously driven by corporate growth ambitions, which are pursued through strategies such as (influencer) marketing, planned obsolescence, and the expansion of production volumes. The deeply ingrained desire for ownership fuels new purchasing decisions, even for products that are typically underutilized, such as cars. Moreover, even when products are shared, individualistic—as opposed to collectivist—behavior can pose challenges for circular business models, as illustrated by the mindset of "don't be gentle, it's a rental." As for the growth paradigm, it is specifically attributed by Geels (2002) to the so-called landscape within the MLP framework. It represents an overarching structure that is highly resistant to change and can only be influenced through the fundamental transformation of socio-technical regime configurations. Together, social norms and the growth paradigm shape the "rules of the game" (Geels & Schot, 2007) through implicit views, preferences, and expectations—rules that must be reoriented in the light of a CE.

Interventions to address these mechanisms include social activism (e.g., environmental movements, demonstrations) as well as educational awareness campaigns (e.g., documentaries, influencers) (Akemu et al., 2016; Ho et al., 2022). Policymakers have a critical role to support the structural shift against accelerated consumption. Scaling reuse (e.g., adapted VAT for second-hand products in Sweden) and longer product life (e.g., repair bonus in Austria) may lead to achieving the same benefits for society with less production. At the societal level, the International Resource Panel (2024) suggested that greater focus must be placed on *provisioning systems* (i.e., nutrition, mobility, built environment) to identify less resource-intensive ways of meeting human needs while advancing shared sustainability objectives.

To address the growth paradigm, governments and businesses need to think about alternative measures of prosperity at the business and society levels. At the company level, alternative key performance indicators that account not only for sales volumes but also circular strategies can help redirect managerial attention away from pure volume growth toward more sustainable value creation and capture. At the societal level, alternative metrics can be used to assess well-being, such as the Genuine Progress Indicator (GPI). Unlike GDP, the GPI incorporates economic, social, and environmental dimensions, offering a more comprehensive reflection of a country's overall progress. Other examples of relevant global movements are the Economy of the Common Good or the "Enkelfähig" community (i.e., pushing for generating value for generations). More fundamentally, the *sufficiency* movement promotes reduced consumption through moderation and simplicity, enabling CEs by ensuring that resource loops are not only closed but also slowed and scaled down.

"Moving away from our current inefficient, linear logic, which creates waste, risks, and pollution, and toward a circular, resource-efficient world economy that operates within the finite and absolute budgets provided by the planetary boundaries" requires "systematic deep innovation and transformation," as emphasized by leading climate scientist Johan Rockström (2024). For transitioning to socio-technical regimes in favor of a CE and compatible with planetary boundaries, we must break several of the key barriers illustrated in this article. Numerous practical interventions can tackle the underlying mechanisms of the barriers and overcome siloed interventions and incremental improvements. A cross-level, collective approach to building ecosystems, pioneering leadership, and supportive regulatory conditions may help speed and scale up the much-needed CE transition.

Table 1. Most relevant circular economy (CE) barriers and their most dominant underlying mechanisms

CE Barrier	Underlying mechanisms							
	Lock-ins	Institutional inertia	Information asymmetry	Prisoner's dilemma	Innovator's dilemma	Environmental externalities	Social norms	Growth paradigm
Product								
Design domino effect: Previous design decisions (across the value chain) create a linear path dependency, hindering the implementation of the design changes needed to support circular strategies (e.g., modularity) (Cantú et al., 2021; Guldmann & Huulgaard, 2020; Hansen & Schmitt, 2021; Kumar et al., 2019).	X							
Performance trade-offs: Circularity-driven choices (e.g., material, design, feature) compromise the primary product performance (e.g., regarding functionality or aesthetics), leading to consumer dissonance manifesting in limited consumer interest or demand (Cantú et al., 2021; Hina et al., 2022; Luchs et al., 2010, 2012).	X							
Scope 3 data gap: A lack of transparency about upstream and downstream product data (e.g., material composition) complicates the innovation of novel products, their designs, and tack-backs (Cantú et al., 2021; Hansen & Schmitt, 2021; Jaeger & Upadhyay, 2020a; Jäger-Roschko & Petersen, 2022; Wijewickrama et al., 2021).			X					
Effectiveness assessment: Challenging evaluations of the effectiveness of potential circular strategies (e.g., unclear reuse cycles) and material composition (e.g., recycling content), given limited lifecycle assessment insights, a lack of standardizations, and baseline measurements, can erode trust between consumers and sellers (Guldmann & Huulgaard, 2020; Hina et al., 2022; Jaeger & Upadhyay, 2020a; Kirchherr et al., 2018).			X					

CE Barrier	Underlying mechanisms							
	Lock-ins	Institutional inertia	Information asymmetry	Prisoner's dilemma	Innovator's dilemma	Environmental externalities	Social norms	Growth paradigm
Business								
Organizational stumbling blocks: Existing (rigid) structures, siloed thinking, and legacy processes hinder CE investment and cross-functional collaboration. CE remains isolated (e.g., in projects) rather than integrated across divisions (Arranz et al., 2024; Hansen & Schmitt, 2021; Hofmann & Jaeger-Erben, 2020; Santa-Maria et al., 2021; Sarja et al., 2021).		X						
Leadership vacuum: Weak leadership support (e.g., lack of senior sponsorship), psychological safety (e.g., tolerance for mistakes), openness toward sustainability, and operational decision-making hinder the development of circular strategies (Govindan & Hasanagic, 2018b; Ritzén & Sandström, 2017; Rizos et al., 2016).		X						
Reporting jungle: Organizations are occupied with measuring, aggregating, and processing data, leading to increased administrative costs attributable to compliance-driven reporting requirements. Thus, they have less time to formulate a cohesive sustainability strategy. Consequently, they foster a reactive approach to a CE (e.g., focus on communicable goals instead of actual internalization), instead of a proactive and innovation-driven one (George et al., 2021; Hummel & Jobst, 2024; Rizos et al., 2016).		X						
Planned obsolescence: This pertains to the tendency to incorporate unnecessary functionalities and features (c.f., feature creep) in products and services, as companies aim to signal (technological) progress to their stakeholders (e.g., customers). This drives planned obsolescence, including the prioritization of sales stimuli over eco-friendly products and business model innovation (Barros & Dimla, 2021; Ellen MacArthur Foundation & IDEO, 2020; Jain, 2019; Özkan & Karataş Yücel, 2020).					X			

CE Barrier	Underlying mechanisms							
	Lock-ins	Institutional inertia	Information asymmetry	Prisoner's dilemma	Innovator's dilemma	Environmental externalities	Social norms	Growth paradigm
Resource gap: Lack of funding, knowledge, time, and labor slows CE implementation. Daily demands limit capacity for further development. Progress requires skilled human resources (Hart et al., 2019; Hina et al., 2022; Rizos et al., 2015; Takacs et al., 2022).					X			
Pilot mania and side hustle: Circular practices are peripheral to and misaligned with a company's core mission and strategy, focusing on incremental innovation that leads to weak sustainability changes. Without strategic focus or immediate monetization, efforts stall at the pilot phase. This results in fragmented efforts, limited commitment, and insufficient resources (Cantú et al., 2021; Guldmann & Huulgaard, 2020; Lauten-Weiss et al., 2024; Salmenperä et al., 2021).					X			
Contradictory core business: Companies' core value propositions are incompatible with environmental sustainability (e.g., oil processing, fossil-based products). While business liquidation may align with ecological goals, it conflicts with economic survival (e.g., driven through the will to survive of owners, employees, or customers), leading companies to avoid environmentally superior options (i.e., different, fewer, or no products at all) and rather prioritize harmful products, overlooking the ecological necessity of (parts of) their existence.								X
Short-term pressure: Short-term focus arises in response to pressures from shareholders (e.g., capital markets, owners) and financial institutions. Quarterly earnings, annual targets, and sales incentives lead to a prioritization of immediate sales over long-term strategy, sustainability, and resilience (de Jesus & Mendonça, 2018; Hina et al., 2022; Takacs et al., 2022; Van Eijk, 2015b).								X

CE Barrier	Underlying mechanisms							
	Lock-ins	Institutional inertia	Information asymmetry	Prisoner's dilemma	Innovator's dilemma	Environmental externalities	Social norms	Growth paradigm
Ecosystem								
Asymmetric benefits: Imbalanced value distribution in CEs create a disconnect between value creation and capture. Asynchronous benefits, mistrust, and adverse incentives reduce motivation to collaborate (Berardi & Peregrino de Brito, 2021; Brown et al., 2020; Evertsen & Knotten, 2024).				X				
Data question: This challenge highlights issues with data availability, security, and openness in CEs. Limited access, lack of mutual benefits, and security concerns hinder collaboration and data-driven decision-making (Gupta et al., 2019; Jäger-Roschko & Petersen, 2022; Khan & Abonyi, 2022; Serna-Guerrero et al., 2022).				X				
Dysfunctional partnerships: Partnerships lack momentum and clear guidance, delaying CE implementation. Progress is often stalled by the lowest common standard among participants (Berardi & de Brito, 2021; Hina et al., 2022; Köhler et al., 2022; Santa-Maria et al., 2021).				X				
Industry								
Infrastructure at scale: The infrastructure for circular strategies is insufficiently established in industries, with limited partners (e.g., for reverse logistics). Issues with material recovery (e.g., non-existence of secondary material markets) hinder recycled material availability and demand fulfillment. Past investments lead to dependence on existing technologies and hinder the adoption of circular alternatives, reducing the willingness to change. Prospective path dependencies arise from future anticipations, limiting flexibility and innovation (de Jesus & Mendonça, 2018; Hansen & Schmitt, 2021; Markard et al., 2012a; Unruh, 2000a).	X							
Competitive uncertainty: Fears of disadvantages in highly competitive industries lead to a "wait-and-see" approach. Companies hesitate to change over concerns about first-mover risks. Low margins do not allow any scope for deviations from present strategies (Cantú et al., 2021; Jaeger & Upadhyay, 2020b; Paha, 2023; Quairel-Lanoizelée, 2011; Van De Ven & Jeurissen, 2005).				X				

CE Barrier	Underlying mechanisms							
	Lock-ins	Institutional inertia	Information asymmetry	Prisoner's dilemma	Innovator's dilemma	Environmental externalities	Social norms	Growth paradigm
Price-premium bet: This pertains to the practice of expecting that circular solutions will be financed directly by customers willing to pay a premium for sustainability. If this willingness to pay does not materialize (e.g., recycled products are seen as not clean), the solution fails to achieve market penetration. This reliance on a premium segment ultimately prevents broader adoption (Boyer et al., 2021; Hamzaoui Essoussi & Linton, 2010; Pretner et al., 2021).				X				
Concentrated industry power: Incumbents dominate industry agenda, often disadvantaging sustainable companies. This power concentration discourages deviation from established success, slowing progress toward CE practices (Geels, 2002; Loorbach et al., 2017; Magnusson & Werner, 2023).				X				
Society/Regulation								
Culture of status consumption: Social status drives consumption by influencing individuals' desire to signal wealth, engage in comparison, and turn consumption into an end in itself. In a CE, consumers reuse products, shift away from a disposable mindset, and foster sustainability awareness. However, some consumers perceive circular products as of a lower quality or prefer traditional purchasing methods over as-a-service models (Bocken & Konietzko, 2022; Camacho-Otero et al., 2018; Eastman et al., 1999; Goldsmith & Clark, 2012).							X	
Individualism versus collectivism: The tension between individualism and collectivism shapes societal views on responsibility in the socioeconomic system. Individualism emphasizes autonomy and personal accountability, whereas collectivism prioritizes shared responsibility and cooperation (Cho et al., 2013; Ianole-Călin et al., 2020; Saracevic et al., 2022).							X	

CE Barrier	Underlying mechanisms							
	Lock-ins	Institutional inertia	Information asymmetry	Prisoner's dilemma	Innovator's dilemma	Environmental externalities	Social norms	Growth paradigm
Carbon funneling: This refers to the tendency to overly prioritize efforts and resources toward mitigating carbon emissions and addressing climate change, while neglecting other planetary boundaries that have been surpassed or are at risk of being exceeded. This narrow focus on carbon can lead to an imbalance in addressing broader environmental issues, such as biodiversity loss and land degradation (Gallego-Schmid et al., 2020; Richardson et al., 2023b).							X	
Regulatory dilemma: Regulations must balance economic activity and planetary boundaries. Overregulation stifles innovation; weak regulations cause environmental harm, social injustice, and market failure (Kitching et al., 2015; Peng & Shen, 2024; Pickman, 1999).		X						
Excessive standardization: Standards can set a uniform understanding of CEs across material, product, and process levels, ensure quality standards, and allow for data exchange. However, standardization also creates a heavy administrative burden, bureaucracy, and unanticipated behavioral rebound effects, like changes in consumer perceptions (Flynn & Hacking, 2019; Grillo et al., 2024).		X						
Labor versus resource prices: Low resource costs incentivize production-focused (e.g., pressure for virgin materials) methods over circular strategies. This favors incineration and recycling over labor-intensive practices like repair or refurbishment. High labor taxation amplifies this. However, the execution of work by humans is generally more ecological than the use of machines and raw materials (de Jesus & Mendonça, 2018; Guldmann & Huulgaard, 2020; Kissling et al., 2013; Llorente-González & Vence, 2020; Stahel, 2013; Vence & López Pérez, 2021).						X		

CE Barrier	Underlying mechanisms							
	Lock-ins	Institutional inertia	Information asymmetry	Prisoner's dilemma	Innovator's dilemma	Environmental externalities	Social norms	Growth paradigm
Nature capital value: The true environmental costs of economic activities are not incorporated in market prices. Negative externalities (e.g., pollution) are not factored into the cost of goods and services, leading to underpricing and a misallocation of resources. Ecosystem services (e.g., pollination) are undervalued. This discourages the adoption of sustainable practices (Bateman & Mace, 2020; Baumol & Oates, 1988; Fenichel & Abbott, 2014; Rizos et al., 2016).						X		
One-sided measures of prosperity: Established metrics prioritize economic output over broader well-being, limiting incentives for circular strategies. GDP, for instance, overlooks societal and environmental benefits, reinforcing a focus on monetary transactions and economic growth (Costanza et al., 2009; Jackson, 2009; Kallis, 2017; Stockhammer et al., 1997).						X		

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Rethink: Planetary Perspectives on Circularity

Harald Desing

Abstract: Circularity has advanced to a key strategy for transforming our society: closing the loop is expected to enable economic profits independent of resource consumption and its associated environmental impacts (Blomsma & Brennan, 2017; Bocken et al., 2021; Circle economy, 2023; Ellen MacArthur Foundation, 2019; European Commission, 2020). Thinking in circles and in systems is paramount for transforming our society to stay within planetary boundaries (Desing, Brunner, et al., 2020), yet specific circular strategies must target specific problems. Circularity is not a panacea (Blum et al., 2020; Geissdoerfer et al., 2017), thus it is important to distill when and where circularity can contribute to planetary wellbeing (Wiedenhofer et al., 2025). "Rethink" emerges as the most influential strategy: from the way we use energy, over which activities deserve priority, all the way to the role circularity itself can play.

Keywords: circular economy | planetary boundaries | basic needs | energy transition | climate change

Rethink: planetare Perspektiven auf die Kreislaufwirtschaft

Zusammenfassung: Kreislaufwirtschaft ist zu einer der wichtigsten Strategien für die Transformation unserer Gesellschaft aufgestiegen: Kreisläufe zu schliessen soll ökonomische Profite unabhängig vom Ressourcenverbrauch und dem damit einhergehenden Umweltauswirkungen ermöglichen. Das Denken in Kreisläufen und Systemen ist zweifelsohne essenziell, um eine Gesellschaft innerhalb planetarer Grenzen aufzubauen. Aber: Kreislaufstrategien müssen auf spezifische Probleme zugeschnitten sein. Kreislaufwirtschaft ist nicht ein Allheilmittel, daher ist es wichtig herauszukristallisieren, wann und wo Kreislaufwirtschaft zum planetaren Wohlergehen beitragen kann. Dabei stellt sich „Rethink" – umdenken – als wichtigste Strategie heraus: von der Art und Weise wie wir Energie verwenden, über die Priorität wirtschaftlicher Aktivitäten, zur Rolle die die Kreislaufwirtschaft selbst in der Transformation spielt.

Stichwörter: Kreislaufwirtschaft, planetare Grenzen, Grundbedürfnisse, Energiewende, Klimawandel

For a society to become absolutely sustainable, two conditions need to be fulfilled (Desing, Brunner, et al., 2020; Heide et al., 2023): (i) it has to provide basic needs for everyone (Millward-Hopkins et al., 2020; Rao & Min, 2018; Schlesier et al., 2024; United Nations, 2015), and (ii) all human activities combined have to happen within planetary boundaries (Richardson et al., 2023; Rockström et al., 2009, 2023). Only then will it be possible to ensure long-term planetary stability (Armstrong McKay et al., 2022; Wunderling et al., 2022) and a decent life for all (United Nations, 2015). Returning to within planetary boundaries needs to happen in the coming decades, because living in overshoot since

nearly 40 years pushes the Earth system to the brink of tipping (Ditlevsen & Ditlevsen, 2023; Lenton et al., 2023; van Westen et al., 2024). To reach a doughnut economy, i.e., the operating space between fulfilling basic needs and planetary boundaries (Raworth, 2013), requires a fast and far-reaching transformation of society, as basic needs are still not fulfilled for everyone (Kikstra et al., 2021; O'Neill et al., 2018) and 6 out of 9 planetary boundaries are exceeded (Richardson et al., 2023). CO_2 emissions need to reduce by at least 98 %, the pressure on biodiversity by 90 %, phosphorus and nitrogen emissions by about 75 %, and land occupation by 50 % (Desing, Braun, et al., 2020). Primary material production—excluding biomass—is responsible for about 20 % of total CO_2 emissions and 14 % of biodiversity loss (Desing, Braun, et al., 2020; UNEP, 2024). Despite policy focus and international efforts, no absolute decoupling between resource use and economic activity could be observed (European Environmental Bureau, 2019; UNEP, 2024). Even if circularity could make primary production completely obsolete, this would reduce impacts by 20 % at best. Hence, the focus on material circularity is insufficient to achieve planetary stability alone. Similar to circularity, population control can have only a minor contribution towards achieving absolute sustainability (Schmalz, 2025; Springmann et al., 2018). In the absence of large-scale catastrophes—such as wars, pandemics, and famines—global population will likely reach a maximum of around 10 billion in 2085 before it will start to decline (UN, 2022). Even if global population could somehow humanly be reduced significantly in the next few decades—i.e., when actions are most important (United Nations Environment Programme, 2022)—, this would only reduce environmental impacts proportionally (Springmann et al., 2018).

Fulfilling basic needs for 10 billion people with today's predominantly fossil-based and linear provisioning system would allow to cut environmental impacts by roughly half. However, this would still transgress planetary boundaries (Schlesier et al., 2024). Prioritizing the fulfillment of basic needs allows to increase living standards for more than half of the current population (Kikstra et al., 2021, 2025; Millward-Hopkins, 2022), while the remaining would have to *reduce* consumption. Sufficiency is important (Creutzig et al., 2024; European Environmental Bureau, 2021; Pauliuk, 2024), yet by itself insufficient to achieve a planet-compatible society. What is needed is a transformation of the provisioning systems catering basic needs. And here, fossil energy is the largest driver of impacts (Desing & Widmer, 2021; IPCC, 2022; Schlesier et al., 2024). Completely defossilizing energy supply—i.e., replacing coal, oil, and gas with solar and other renewables (Desing et al., 2019)—allows a giant leap towards absolute sustainability, reducing CO_2 emissions by more than 95 % and half biodiversity impacts again (Schlesier et al., 2024). The remaining impacts beyond planetary boundaries are dominated by the industrial production of animal-based products and land use change in agricultural systems (Gerten et al., 2020; Schlesier et al., 2024; Shepon et al., 2018; Willett et al., 2019). Fortunately, meat and dairy are not essential for our bodies, allowing to design healthy and predominantly vegan diets (Chen et al., 2019; Willett et al., 2019). Some animal products from extensive forms of agriculture may still be possible, however large scale, industrial meat and dairy production is environmentally untenable (Springmann et al., 2018, 2023). Also, improved agricultural practices, which do not deplete soils, can be sustained on the same land for millennia, eliminating the need for additional land transformation. When supplying basic needs with renewable energy, without industrial meat and dairy, and without additional

natural land conversion, living within planetary boundaries becomes possible (Schlesier et al., 2024).

Material circularity was not yet necessary to construct scenarios where society could sustain itself within planetary boundaries. This is because impacts from primary material production for providing basic needs are of minor importance compared to the changes described before. Even when reaching the doughnut, primary material production still accounts only for about 20 % of CO_2 emissions, global warming potential, and biodiversity loss (Schlesier et al., 2024). Circularity can thus increase the safe and just operating space beyond basic needs.

More important, however, is the role of circularity in the transformation process. The biggest contribution to reach planetary boundaries is defossilizing the energy system (Desing et al., 2022; Desing & Widmer, 2021). Building renewable energy infrastructure needs a lot of materials (Carrara et al., 2023; IEA, 2023), the primary production of which causes environmental impacts (Tost et al., 2020), impedes vulnerable communities (Lebre et al., 2020), and opening new mining and processing facilities takes time (Desing et al., 2024). Given the urgency of the climate crisis, we need to accelerate the transition (Desing & Widmer, 2021) and one way to facilitate this is by applying circular strategies. Scraping and *recycling* fossil infrastructure—such as cars, heat boilers, power plants, pipelines—immediately when they become obsolete, can significantly increase the availability of secondary raw materials for the transition, which reduces the need for primary materials and—consequently—environmental impacts (Schlesier et al., in review). Using secondary materials in the transition requires a *redesign* of renewable energy components to make use of materials contained in fossil infrastructure. For example, aluminum in mounting systems in solar PV is flagged as a potential bottleneck (Lennon et al., 2022) but can be replaced by steel recycled form fossil infrastructure (Schlesier et al., in review). This focus on recycling can be counter-intuitive in the light of the often promoted "waste hierarchy", suggesting reuse and repair as higher value strategies than recycling (European Commission, 2020; Potting et al., 2017). When optimizing for minimal impacts (Baum, 2018; Haupt et al., 2018; Hummen & Desing, 2021), the waste hierarchy proves to be unfit as a general rule, requiring to select appropriate circular strategies on a case-by-case basis instead. For example, gas boilers in domestic heating systems should be replaced with heat pumps immediately, irrespective of their working condition (Hummen & Desing, 2021). This is because extending the use of fossil devices is counterproductive for achieving the transition. In contrast, *repurposing* functional parts of fossil infrastructure—e.g., e-retrofitting diesel buses and trucks (Desing, 2024) or pipelines for district heating pipes (Creutzig et al., submitted; Wiedmann & Desing, 2024)—can help to accelerate and thus reduce cumulative impacts.

Another way to accelerate the energy transition is to recycle idle or hibernating material stocks of materials essential to the energy transition. One such example is silver, required as current collector in state-of-the-art crystalline silicon PV modules (Hallam et al., 2022; Victoria et al., 2021). Silver replacements are intensively researched (Grübel et al., 2021; Heath et al., 2020; Zhang et al., 2021), yet their scaling on the market is still uncertain and will take some time. Until then, we could resort to the silver we have already mined, about 70 % of which is hibernating as silverware and financial holdings (Sverdrup et al., 2014; The Silver Institute and Metal Focus, 2023). Recycling these stocks alone would be more than enough to power basic needs for everyone with current solar PV technology

(Desing et al., 2024, 2025) on the surface of the already built environment (Desing et al., 2019).

Many materials deemed critical in the context of the energy transition are needed for energy storage, such as lithium, cobalt, or platinum group metals (Carrara et al., 2023). Insignificant stocks of those materials are present in society today (Wang et al., 2018), making recycling to build desired energy storage unfeasible. *Rethinking* the way we use energy in society today, however, can reduce the demand for energy storage significantly (Creutzig et al., 2018, 2024; Desing & Widmer, 2022). Aligning societal energy demand with the intermittent availability of renewable energy avoids material supply bottlenecks, reduces costs, accelerates the transition, and lowers its cumulative impacts (Barnhart & Benson, 2013; Desing & Widmer, 2022). Following the course of the sun in a sunflower society (Desing & Widmer, 2022) will require to rethink societal operations: making work schedules more flexible, prioritizing essential energy uses, developing grid connected modes of transport, or seasonal stockpiling products to store embodied energy.

Returning to a safe climate mandates the removal and safe storage of at least 1500Gt of CO_2 as soon as possible (Armstrong McKay et al., 2022; Desing, 2022; Wunderling et al., 2022). As the biosphere's potential and capacity to bind CO_2 is slow and limited (Fuss et al., 2018; Griscom et al., 2017), speeding up carbon removals will need a new type of industry: *cleaning up* the atmosphere. Simply putting CO_2 underground is an end-of-pipe solution and represents a cost to society. Converting CO_2 into carbon-dense, valuable, solid materials and storing them underground after material use allows to generate value for society (Desing, 2022). Mining the atmosphere (Lura et al., 2025), however, needs large amounts of green energy, requiring the scaling of renewable energy capacities far beyond of what is needed to power basic needs (Desing et al., 2022). And it needs to aim at maximizing the linear flow of CO_2 out of the atmosphere to safe final sinks until 350ppm atmospheric CO_2 concentration is reached. All supporting materials—be it hydrogen, water, steel, silicon—must circulate to best facilitate the linear flow of carbon (Desing & Blum, 2023). Furthermore, the idea of cleaning up needs to extend to toxic and persistent chemicals (Persson et al., 2022), as well as restoration of ecosystems (IPBES, 2019).

All of this can only happen, if we fundamentally rethink the way we organize our society: From business operations (Bocken et al., 2016) to economic paradigms (Bärnthaler et al., 2021; Desing et al., 2025), from the way we live (Vita, Hertwich, et al., 2019; Vita, Lundström, et al., 2019; Waldinger & Schulz, 2023) to how we participate in political decision making (Gerwin, 2022), and from interacting with each other (Graeber & Wengrow, 2021) to our relationship with the natural world (Ivanova et al., 2024). When used for purpose, circularity offers us tools to build the future we want.

Declaration of Interest

The author declares no known competing interests which could have appeared to influence the work reported in this paper.

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What can we learn about the Circular Economy from Cities?

Mugur Schuppler and Julian Kirchherr

Summary: This article explores the role of cities in advancing the circular economy (CE), drawing on insights from experts in five mid-sized European cities. While cities contribute significantly to global pollution, they also have the resources and influence to drive impactful CE initiatives. Key lessons include the importance of strong political and societal support, piloting circular practices internally, and integrating circular principles into urban planning. Collaboration with local businesses and research institutes, as well as adapting successful strategies from other cities, can further facilitate effective implementation. These insights offer actionable guidance for cities, policymakers, and other stakeholders seeking to refine and strengthen their CE efforts.

Keywords: circular economy, circular city, urban circularity, circular transition, sustainable development, circular learnings

Was können wir von Städten über die Kreislaufwirtschaft lernen?

Zusammenfassung: Dieser Artikel untersucht die Rolle von Städten bei der Förderung der Kreislaufwirtschaft (CE) und stützt sich dabei auf Erkenntnisse von Expertinnen und Experten aus fünf mittelgroßen europäischen Städten. Während Städte erheblich zur globalen Umweltverschmutzung beitragen, verfügen sie gleichzeitig über die Ressourcen und den Einfluss, um wirkungsvolle CE-Initiativen voranzutreiben. Zu den wichtigsten Erkenntnissen zählen die Bedeutung starker politischer und gesellschaftlicher Unterstützung, das interne Pilotieren zirkulärer Praktiken sowie die Integration kreislaufwirtschaftlicher Prinzipien in die Stadtplanung. Die Zusammenarbeit mit lokalen Unternehmen und Forschungseinrichtungen sowie die Anpassung erfolgreicher Strategien aus anderen Städten kann die Umsetzung zusätzlich erleichtern. Diese Erkenntnisse bieten praxisnahe Learnings für Städte, politische Entscheidungsträger und weitere Akteure, die ihre CE-Maßnahmen weiterentwickeln und stärken möchten.

Stichwörter: Kreislaufwirtschaft, Kreislaufstadt, urbane Zirkularität, zirkuläre Transformation, nachhaltige Entwicklung, zirkuläre Erkenntnisse

Cities and the circular economy

With more people moving to cities every year, urban areas have become significant contributors to global pollution. Cities are responsible for roughly 70 % of global greenhouse gas emissions, account for nearly two-thirds of global energy consumption, and generate

approximately half of the world's solid waste – projections indicate that by 2050, the global volume of municipal solid waste could double (OECD, 2025). At the same time, cities bring together a unique blend of resources, capital, talent, and data within compact geographic boundaries (Ellen MacArthur Foundation, 2019). This makes them powerful drivers of the transition to a circular economy (CE) (Kisser & Wirth, 2021; Lakatos et al., 2021). While the concept of the CE has gained increasing attention in recent years, its practical application at the macro or city level remains underexplored in academic literature.

In practice, however, an increasing number of cities are embarking on CE measures, supported by the development of dedicated circular strategies. For instance, the European Circular Cities Declaration (2020) has been signed by 86 cities across 22 countries; 142 cities and regions are participating in the Circular Cities and Regions Initiative (European Commission, 2022); 97 cities representing 22 % of the global economy participate in the C40 network with the aim to reduce carbon emissions (www.c40.org). Additionally, academic research has started to explore CE practices in a growing, yet still limited, number of cities (e.g., Petit-Boix & Leipold, 2018; Wang et al., 2018).

According to (Paiho et al., 2020), a circular city (CC) should give priority to measures like conserving resources, enhancing efficiency, promoting shared use, shifting to service-based models, and embracing digital alternatives. These foundational strategies should be pursued first. Only after their potential has been maximized should cities turn to techniques for closing, slowing, or narrowing material and energy flows. Any remaining demand should ideally be met through renewable resources sourced locally (Paiho et al., 2020). The typical CC has been found to focus on environmental, systemic, and cross-sectoral objectives, with implementation spanning sectors such as the built environment, energy, mobility, waste, water, industrial production, agri-food, and citizens and communities (Gravagnuolo et al., 2019). In addition to environmental gains, economic and social benefits may also emerge from the implementation of circularity in cities – for example, the CE could generate up to 2.5 million new jobs in the EU in sectors such as recycling, repair, and reuse (OECD, 2025).

We think that the CC of the future can and should encompass not only efficient material and energy flows but also the regeneration of natural systems and enhanced climate resilience. This can include the integration of green-blue spaces, such as parks, wetlands, and urban forests, which provide critical ecosystem services and improve urban biodiversity. Tree canopies, for instance, can reduce urban heat island effects, improve air quality, and enhance the overall well-being of residents (Ellen MacArthur Foundation, 2024). Additionally, CCs can prioritize the restoration of natural water cycles through sustainable urban drainage systems and the creation of permeable surfaces that reduce flooding risks. By incorporating these elements, cities can build resilience against climate change impacts, such as extreme weather events and rising temperatures (Ellen MacArthur Foundation, 2024).

It is important to note that the Global South is currently massively underrepresented in CC academic literature. We acknowledge this gap and recognize that, systemically, significant progress in resource-efficient development must occur in the next 50 years to achieve sustainable advancements in these regions. Furthermore, we do not believe that learnings from the Global North (e.g., Europe, North America) are necessarily directly replicable to Global South realities. Economic growth is vital for the Global South,

making it essential to identify circular strategies that support rather than undermine this growth. For example, tailored circular business models that align with the economic and social contexts of the Global South could be developed to make the concept of a CE more attractive and feasible in these regions.

To better understand the factors currently driving circularity in European urban contexts – a region where we have seen a relatively large number of CCs emerging in recent years – we conducted interviews with experts from selected European cities actively implementing circular strategies, all of which have been developed within the past five years. The five main identified learnings are presented in the following paragraphs.

Learnings from circular cities

Generate political and societal support: We found that having strong political and societal support is essential for making CE strategies work. For instance, in Leuven (City of Leuven, 2020), a city of ~100,000 in Belgium, the inclusion of the Green political party in the city coalition in 2019 provided a political basis to push for more ambitious CE measures. Additionally, grassroots movements and local NGOs played a significant role in advocating for circular practices – Leuven saw a grassroots push from local NGOs working on repairability and sustainability projects, which were already connected with the city's universities. Engaging with the community and building broad-based support for these projects was essential to ensure their progress. This involved organizing public workshops, bringing educational campaigns to life, and involving citizens in decision-making processes. A city that advocates for policies promoting circularity, facilitates public consultations, and fosters a culture of sustainability within organizations and communities can thus help drive the implementation of CE practices.

Pilot circular practices internally: Another key learning that emerged is the value of piloting circular solutions internally. In Gothenburg (City of Gothenburg, 2021), a city of ~600,000 in western Sweden, municipal departments were engaged in a process to test circular practices within their own operations, starting with furniture as a pilot product category. Six departments explored their own routines, organizational structures, knowledge levels, and potential roles needed to implement circular practices. This approach allowed each department to consider how circular practices could be integrated into their workflows, set local targets linked to broader city-wide objectives, and identify where support was needed. Piloting circular solutions internally helped uncover practical challenges and opportunities, enabling the city to refine processes before scaling up to additional product categories. This approach can further help build momentum for broader circular organizational change, set a positive example by positioning the city as a circular role model, and thereby encourage citizens to adopt circular practices themselves.

Leverage urban planning: We further found that integrating circular principles into urban planning could have strong potential to facilitate the implementation of CE in cities. In Espoo (City of Espoo, 2021), a city of ~300,000 residents in southern Finland, the municipality has embedded CE thinking into planning practices, designating dedicated CE development areas, notably Kera and Kiviruukki. There, the city is piloting initiatives such as biogas production, food production aligned with CE principles, increased use of recycled growing materials, and the reduction of food waste in municipal operations. By creating dedicated areas for CE development within urban planning, cities can therefore

accelerate the adoption of circular practices, demonstrate to stakeholders what is achievable, and provide testbeds for experimenting with innovative circular solutions.

Collaborate with businesses and research: Collaboration with local businesses and research institutes emerged as another key learning. In Prague (Prague Innovation Institute, 2021), the capital of the Czech Republic with a population of ~1.4 million, the city has established various diverse working groups, involving representatives from public authorities, private sector developers, architecture and design studios, farmers, social innovators, and businesses in agriculture and food. For instance, in the water sector, Prague has closely cooperated with private companies and universities on projects related to recycling water. In the waste segment, the city has collaborated with public NGOs and initiatives focused on reuse activities. Such partnerships can drive innovation and ensure that circular measures have a measurable impact. Fostering strong collaborations with academic institutions and local enterprises can lead to the development of innovative solutions and technologies that support CE goals. Such collaborations can also help bridge the gap between research and practical implementation, ensuring that theoretical advancements translate into real-world benefits.

Learn from other cities: Lastly, studying and adapting successful CE strategies from other cities can provide valuable insights and practical examples that can be tailored to local contexts. In Murcia (Municipality of Murcia, 2021), a city of ~460,000 in south-eastern Spain, the local government reviewed 60-70 strategies from around the world, including Amsterdam and Paris, and adapted the main learnings to fit their local context – this resulted for instance in the introduction of stakeholder "agoras", and the determination of their six strategic circular priority areas. This approach can therefore help cities avoid having to reinvent the wheel and speed up the implementation of effective circular practices. Being open to learning from others, participating in knowledge exchange networks, and adapting best practices to local challenges and opportunities can therefore help facilitate CE implementation in cities.

Conclusion

In conclusion, cities are crucial in driving the transition to a circular economy due to their unique concentration of resources and influence. Our discussions with experts from five mid-sized European cities highlight several key factors for success: strong political and societal support, piloting of circular practices, integration of circular principles in urban planning, collaboration with local businesses and research institutes, and learning from successful strategies in other cities. These insights offer practical lessons for cities, policymakers, and stakeholders looking to enhance their circular economy efforts. By adopting these best practices, cities can accelerate the implementation of CE measures, stimulate innovation within its own operations, embed circularity into urban planning, more effectively translate theoretical insights into practical applications, and tap into the wealth of existing CE knowledge.

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Overcoming System Boundaries: Closing Material Cycles in the Chemical Industry

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Abstract: BASF pioneers circular economy initiatives in the chemical industry, aiming to replace fossil-based materials with bio-based and recycled alternatives. Encouraging a positive "can do" mentality through its Circular Economy Co-funding program, the company fosters innovation and collaboration across diverse sectors. By embracing digital solutions and supporting upcoming industry ecosystems, BASF seeks to overcome barriers and create sustainable business models, committed to transforming their operations and contributing to a more sustainable future.

Keywords: Circular Economy, Sustainable Business Models, Business Model Innovation, Digital Innovation, Circular Ecosystems

Überwinden von Systemgrenzen – Schließen von Materialkreisläufen in der chemischen Industrie

Zusammenfassung: BASF ist Vorreiter bei Kreislaufinitiativen in der Chemieindustrie und strebt an, fossile Rohstoffe durch biobasierte und recycelte Alternativen zu ersetzen. Das Unternehmen fördert eine positive „Can-do"-Mentalität durch sein Circular Economy Co-Funding-Programm, das Innovation und Zusammenarbeit über verschiedene Branchen hinweg unterstützt. Durch den Einsatz digitaler Lösungen und die Förderung aufkommender Industrie-Ökosysteme will BASF bestehende Hürden überwinden und nachhaltige Geschäftsmodelle schaffen – mit dem klaren Ziel, die eigenen Geschäftsprozesse zu transformieren und zu einer nachhaltigeren Zukunft beizutragen.

Stichwörter: Kreislaufwirtschaft, Nachhaltige Geschäftsmodelle, Geschäftsmodellinnovation, Digitale Innovation, Zirkuläre Ökosysteme

BASF, headquartered in Germany, is one of the largest chemical corporations in the world. The company serves customers in almost all industries, for example automotive, construction, consumer goods, personal care as well as agriculture. In 2024, BASF processed approximately 30 million metric tons of raw materials. Simply put, a few base chemicals derived from crude oil are used to produce a large variety of products. To exchange these fossil-based raw materials with bio-based and recycled based materials remains a challenge for the whole industry. It also shows the need for greater integration of circular economy principles.

The think-tank Systemiq outlines a vision for the chemical industry emphasizing growth opportunities through the replacement of fossil-based products in their report "Planet Positive Chemicals". These opportunities lie in sourcing alternative materials currently viewed

as scrap, as well as in better organizing ecosystems to reduce costs. Finally, rethinking the design of products and services with circularity firmly embedded at their core will provide long-term competitive advantages. Nevertheless, this transformation represents one of the industry's most significant challenges. Why is this change so difficult?

To make circular economy a sustainable business case, several hurdles must be overcome. In this article we want to focus on challenges at the company level as well as system-related challenges and the role of digitalization.

Circular Business Models in the Chemical Industry

When looking at company-level challenges, we must differentiate between business models close to the company's core activities and those that are further away and require a new circular ecosystem set-up.

The circular business model that is closest to the current model outlined above involves exchanging fossil-based raw materials with e.g. bio-naphtha or biogas at the beginning of the chemical production process while continuing to use the existing infrastructure, i.e. the steam cracker. Here, focus is on sourcing costs of those alternative raw materials and the possibility to pass on these additional costs to the entire value chain. This raw material shift is the major challenge today and will continue to be so in the next decade.

Many closing-the-loop business models involve new assets as well as a whole new ecosystem of partners to work with. One example is BASF's Loopamid® project in which a solution was developed to recycle mixed textile waste with a high nylon content, transforming it into a raw material suitable for creating entirely new sustainable clothing. This represents a significant technological advancement in the textile industry. Additionally, in collaboration with Inditex, BASF developed a fully circular jacket made exclusively from a single material and designed specifically for circularity. Apart from the technical development, new partnership models were set-up and new assets needed to be deployed.

To achieve such new business models is difficult and this undertaking has been described by academia as the "innovator's dilemma," first articulated by Clayton M. Christensen. It illustrates how established and successful companies struggle to adopt disruptive technologies, which may initially be less efficient by design. In the chemical industry, existing value chains have been thoroughly optimized over several decades, particularly in the processing of chemicals within large-scale production facilities. Therefore, to set-up business models where these assets are only partially used, presents additional challenges.

Internal Co-funding Program for Circular Economy

To generally advance circular business models and help them overcome these and other hurdles, we have set-up the internal Circular Economy Co-funding program.

The program encourages employees to test and deploy circular business model concepts. This initiative not only assists in overcoming challenges but also fosters a shift in mindset towards adopting circular business models. To date, we have incubated 65 projects across all global regions and diverse markets. These projects received coaching and support from our Circular Economy Strategy Group and internal consulting specialists.

Our learnings from this program extend beyond technical aspects, encompassing challenges related to waste sourcing (both post-consumer and post-industrial), logistics (especially cross-border), and marketing strategies (including pricing and claims) as well as

digitalization topics. Other projects include efforts to enable recycling with e.g. additives for mechanical recycling, develop digital market platforms, orchestrate circular systems, and focus on service-oriented solutions as well as replacing fossil-based raw materials with bio-based feedstock. These global learnings are regularly shared through targeted community exchange. This exchange enriches our understanding of how circularity can be effectively implemented in diverse contexts.

The authors believe that setting up new ecosystems and developing digital solutions are the key to overcoming barriers in circular models. Therefore, the following paragraph focuses on these two topics.

The need for ecosystem thinking

The first point is the functioning circular ecosystem that allows scaling. One example is end-of-life vehicle recycling in Germany. Most vehicle dismantlers in Germany lack the capacity to scale up material recycling and component reuse. With over 1,000 car dismantling companies in Germany; the market remains highly fragmented. Many of these are small businesses, only capable of scrapping a low number of cars per year, with recycling efforts largely restricted to metals. Many dismantling companies lack the know-how and financial strength to establish digital interfaces to increase the degree of automation and to network digitally with material or component recyclers. An average car contains hundreds of plastic parts made of different materials, in total 150 – 200 kg. In the end, the chemical industry needs thousands of tons of used, at best well sorted plastics, which ideally are not significantly more expensive than fossil products.

BASF is actively engaged in CATENA-X, an initiative with over 100 partners which builds a data ecosystem for the automotive industry and develops standards which are the foundation to achieve scalability. Standards are being developed to address key areas such as common data-exchange formats, product passports and the calculation of product carbon footprints. These standards are a precondition to e.g. accurately calculate recycling quotas. Close collaboration in an ecosystem regarding standards triggers new market opportunities and leads to new investments needed.

Additionally, greater value can be recovered from car parts at the end of their life cycle. However, various factors need to be clarified to determine whether parts are suitable for it, e.g. how good the condition of the part in question is, how expensive is the dismantling, how high are the costs for cleaning or remanufacturing, how expensive are the costs for shipping and determining an achievable sales price. Addressing this will involve establishing an IT infrastructure that connects dismantlers, utilizing algorithms to optimize parts usage at the end of life, i.e. via a new ecosystem.

Circular requires digital solutions

The second challenge arises from the lack of digital information available in many industries on the use phase of products and materials. This means that during the production of a product, e.g. an outdoor jacket, the information on product composition of raw materials and sometimes also its recyclability is available. But once the product passes the cashier, that information is not automatically processable or even gets lost during the use phase. Thus, there is low information transparency e.g. regarding the material composition, location, ownership or the value of components at the end of the life cycle. The

lack of information is a main reason why end-of-life materials are not treated as valuable feedstock. The digital product passports as outlined in the ESPR legislation addresses this problem. A digital product passport contains information on products and materials that are digitally stored and passed on throughout the value chain until the end of the life cycle, like a label, which is found in many textiles, but containing technical information that is relevant for collection, sorting, shredding and the recycling process.

The importance of developing applicable cross industry and country standards cannot be understated. Material streams have to be collected across industries to achieve economies of scale in bundling recycling assets in hubs as we can already observe e.g. in China. This transparency and the possibility to use economies of scale would attract investments into the circular economy. As material manufacturers, we are increasingly involved in data standardization efforts to enable bundling of material streams at end-of-life. This is a prerequisite for larger-scale recycling investments into digital infrastructure for collection and automized sorting as well as pretreatment processes. These processes are required to transform end-of-life materials into more homogenous feedstocks which are easier to recycle. At the moment, fossil resources are still less expensive compared to bio-based or, in many cases, recyclate-based resources.

To make this switch feasible, the whole value chain needs to bear the (initially) higher investment costs of renewable or recycled-based raw materials. Here, legislation encouraging the demand for circular products can play a role in facilitating the needed investments. We believe that focused capital expenditures into new ecosystems and digital solutions will eventually lower the cost structures and thus enable viable circular business models for many players. A good basis for creating these new eco-systems are close cooperation models that are pre-competitive. They can be supported by institutes such as Fraunhofer or international bodies such as the World Economy Forum.

In conclusion, BASF is very committed to addressing the barriers of circular business models and transforming the current landscape of the chemical industry. By leveraging digital technologies, optimizing material flows and fostering industry partnerships, BASF aims to catalyse meaningful change and seize the opportunities presented by the circular economy.

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From Purpose to Circularity: Unpacking the Strategic and Systemic Role of Corporate Purpose

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Abstract: Organizations face increasing pressures to address climate change, disruptive technologies, resource scarcity, and shifting stakeholder expectations. These factors require them to reassess their strategies, societal roles, and approaches to innovation. At the same time, transitions toward circular economy (CE) models demand systemic changes in how value is created and sustained. In these conditions, high-growth companies and alliances demonstrate how placing purpose at their core enables organizational transformation and value-driven collaborations with stakeholders that can drive circular systemic change. By synthesizing insights from strategic management, system, organizational change, and circular economy literature, this conceptual paper positions purpose as a normative, strategic, and systemic construct and proposes a future research agenda to examine its mechanisms, risks, and transformative potential – with particular attention to its role in accelerating circular economy transitions on the organizational level.

Keywords: Circular Economy Transition, Purpose, Organizational Change

Purpose als Treiber der Kreislaufwirtschaft-Transition: Strategische and systematische Perspektiven

Zusammenfassung: Organisationen sehen sich wachsenden Herausforderungen gegenüber, etwa dem Klimawandel, disruptiven Technologien, Ressourcenknappheit und sich wandelnden Erwartungen ihrer Stakeholder. Diese Entwicklungen erfordern eine grundlegende Neubewertung von Strategien, gesellschaftlicher Rolle und Innovationsverständniss. Gleichzeitig verlangt die Transition zu Kreislaufwirtschafts-Modellen systemische Veränderungen in der Art und Weise, wie Wert geschaffen und erhalten wird. In diesem Kontext zeigen wachstumsstarke Unternehmen und Allianzen, wie eine konsequente Ausrichtung auf «Purpose» tiefgreifende organisatorische Transformationen sowie wertebasierte Kooperationen mit Stakeholdern ermöglichen kann, und dadurch den systemischen Wandel zur Kreislaufwirtschaft vorantreibt. Dieses konzeptionelle Paper verknüpft Perspektiven aus der Strategieforschung, Systemtheorie, Organisations-

wandel- und Kreislaufwirtschaft -Literatur und positioniert „Purpose“ als normatives, strategisches und systemisches Konzept. Aufbauend darauf wird eine zukünftige Forschungsagenda vorgeschlagen, die die zugrunde liegenden Wirkungsmechanismen, Risiken und transformative Potenziale von Purpose analysiert – mit besonderem Fokus auf dessen Rolle bei der Beschleunigung zirkulärer Transformationen auf Organisationsebene.

Stichwörter: Kreislaufwirtschaft-Transition, Purpose, Organisationsveränderung

1. Introduction

Organizations today face multiple pressures from climate change, resource scarcity, technological disruption, and social inequality. In response, they are increasingly called upon to redefine how they create and sustain value for a broader set of stakeholders. Traditional models of shareholder primacy have shown limitations in addressing these interconnected, systemic challenges (Harrison et al., 2020; Paine & Freeman, 2024). As a result, the academic and practitioner discourse is turning toward implementing organizational purpose to align strategic ambitions with societal needs, serving as a bridge between financial performance and social impact (Henderson, 2021a; Mayer, 2021).

In recent years, the concept of corporate purpose has received growing attention (Binns et al., 2022; Pregmark & Beer, 2025; Steller & Björck, 2025; Volberda et al., 2022). Purpose is seen as a multi-faceted normative concept guiding the overall corporate activities and behaviors: As a fundamental reason for the being of an organization and an overarching commitment to the firm's stakeholders it combines financial performance with broader aims such as social contributions, or groundbreaking innovation (Gartenberg & Serafeim, 2022; Henderson, 2021a; Morrison & Mota, 2023). Two research perspectives dominate the discussion: one focuses on framing, formalizing, and enacting purpose as an organization’s core reason for being, while the other examines purpose as a counterpoint to traditional profit-maximization models (Besharov & Mitzinneck, 2023; George et al., 2023; Ocasio et al., 2023). Less prominent but not less urgent is a third perspective: the enquiry into Purpose as a core element of fundamental or systemic change (O’Reilly & Tushman, 2013; Schmitt et al., 2018; Besharov & Mitzinneck, 2023; G. R. Bushe, 2021; Henderson, 2021a), defined as a significant shift in behavior and outcomes after a transformation within a system (Hollander et al., 2017).

At the same time, transitions to more sustainable economic models – particularly the circular economy (CE) – require organizations to fundamentally rethink their structures, processes, and stakeholder relationships. The CE aims to replace the traditional linear “take-make-dispose” model with regenerative systems to increase resilience and longevity in harmony with the environment (Geissdoerfer et al., 2018). While realizing the potential benefits of CE is considered promising, its implementation is often limited to isolated initiatives with questionable economic viability, inadequate measurement, and rising greenwashing claims (Bocken et al., 2014; Kirchherr et al., 2018). Scholars and practitioners increasingly recognize that realizing the promise of circularity requires more than technological and material innovation – it demands systemic change supported by new mindsets, business, and governance models.

High-growth companies and coalitions have demonstrated the potential of purpose-centered strategies in reshaping industries and redefining value propositions (Knowles et al., 2022; Malnight et al., 2019), and serving multiple stakeholders’ interests (Battilana et al.,

2022). For example, Logitech, a pioneer in consumer electronics, has embedded purpose at the core of its identity, strategy, and operations, combining human-centricity and sustainability. The company has emerged as an industry leader in circularity – committing early to carbon labeling, product transparency, and closed-loop product and solution design – demonstrating how purpose can guide long-term innovation and stakeholder trust (Logitech Impact Report, 2024). An example of a purpose-driven, cross-sectoral initiative is the Alliance to Zero, a consortium of life science companies, including manufacturers and suppliers. Focused on achieving net-zero and circular practices in the pharmaceutical value chain, the alliance is advancing shared innovation projects, pre-competitive collaboration, and global implementation projects -displaying how a collectively defined purpose can orchestrate systemic change (*Alliance to Zero*, 2025). However, the role of purpose in driving organizational renewal and industry-wide change – transforming value chains, fostering cross-sectoral partnerships, and catalyzing social shifts – remains underexplored (Henderson, 2021b; Tushman et al., 2024).

By addressing these gaps, we aim to conceptualize corporate purpose not only from a normative and strategic, but also from a systemic perspective. Drawing from disciplines such as strategic management, system theory, organizational change, and circular economy, we examine how purpose can trigger and facilitate the reconfiguration of organizational structures, stakeholder relationships, and value creation logics necessary for CE adoption. We argue that purpose, when deeply embedded, can provide direction, motivation, and legitimacy for transformative efforts towards circularity that go beyond incremental corporate social responsibility (CSR).

The article is structured around three analytical themes. First, we clarify the definition of corporate purpose, thereby "de-cluttering" the term and delineating what it is and is not, aiming to reduce conceptual ambiguity. Second, we explore the characteristics and mechanisms of purpose-driven organizations, focusing on how purpose enables them to transform in response to CE imperatives. Finally, we outline a future research agenda that positions purpose as a normative foundation, strategic compass, and systemic enabler of circular economy transitions at the organizational and ecosystem levels.

2. Defining Purpose: What It Is and What It Is Not?

Organizational purpose has been studied since the beginning of the 20th century and is rooted in organizational psychology, though it gained broader interest in the late 1980s (Gartenberg & Serafeim, 2022; Hurth et al., 2018; Selznick, 1984). As a guiding principle and organizational ideal, purpose is intuitively comprehensive and often remains abstract and ambiguous, carrying varied meanings for different stakeholders (Jasinenko & Steuber, 2023; Steller & Moellering, 2024). To illuminate the multifaceted nature of purpose, this article examines its content, function, and potential benefits, and defines its boundaries in relation to other concepts.

Integrative Umbrella for Multiple Goals and Functions

Purpose defines the normative constitution of an organization (Bleicher, 1991) and can be operationalized in three main content categories to guide the organizational conduct. A functional purpose content is ambition-driven and competitive, and drives innovation, enhances customer-centricity, and boosts productivity (Dhanesh, 2020; Fontán et al., 2019;

Kershaw & Schuster, 2021). Social purpose content targets contributing to the common good, improving lives, and bringing people together. A pro-"social purpose" describes a strong linkage between organizational purpose and the pursuit of societal goals while creating profits (Hsieh et al., 2018). Grewal et al. (2017) highlight that a well-defined higher purpose can strengthen stakeholder relations, fostering greater engagement and emotional bonds rooted in a shared identity. Thus, an inspirational purpose content strives to motivate and excite (Jasinenko & Steuber, 2023).

Gulati (2022) points out the integrative role of purpose that can address multiple perspectives at the same time. He defines purpose as a unifying statement of the commercial and social problems a business intends to profitably solve for its stakeholders (Gulati, 2022). Uniting diverse and often conflicting goals under one framing or "umbrella" requires a multifaceted definition of purpose that can therefore remain general and calls for further operationalization.

For example, Logitech's purpose, "Extend human potential in work and play" is an example of the integrative role of purpose. The organization positions itself as a bridge between people and the digital world, aiming to create meaningful experiences that enhance how users interact with technology in both professional and personal contexts (*Logitech*, 2025a). It consolidates multiple dimensions that guide Logitech's overall conduct: the functional promise of high-performance, reliability, and ergonomics that enhance productivity, gaming, and digital interaction, the social commitment to human-centricity ("Design with People" approach), diversity, inclusion, and community engagement; and finally, inspiring by empowering creativity, enabling fulfilling lives, and driving positive change for people and planet (*Logitech*, 2025b). These multiple ambitions are implemented in strategic initiatives, innovation guidelines, and cultural code throughout the global operations.

A variety of different interpretations regarding the function and impact of an organization's purpose has been developed. First, the economic perspective provided by Mayer (2021) suggests that organizational purpose is necessary to create problem-solving organizations, and as a consequence, dual-purpose or hybrid organizations, which balance both financial and environmental or social objectives (Battilana et al., 2019). A growing consensus among economic scholars reflects that purpose has a positive impact on a company's performance and financials (Cardona & Rey, 2022; Gartenberg et al., 2019).

Second, another stream of thought focuses only on creating a positive environmental and social impact (Marques, 2019; Narbel & Muff, 2017; Thakor & Quinn, 2013; van Ingen et al., 2021; von Ahsen & Gauch, 2022). Purpose-driven companies can positively contribute to Sustainable Development by aligning their vision, mission, and values to promote sustainability (Baumgartner, 2014). According to Fleischer (2021), embedding corporate purpose throughout the value chain is a critical factor to achieve societal impacts.

Third, growing research evidence shows the potential benefits of a purpose orientation without being linked to social or environmental outcomes: higher productivity and growth rates (O'Brien et al., 2019), authentic value creation for stakeholders by improving their satisfaction and optimism (O'Brien et al., 2019; Rodríguez Víla et al., 2017; von Ahsen & Gauch, 2022), or an opportunity to unlock new sources of innovation (Henderson, 2021b). The design and delivery of remarkable brands, products, and services with a higher customer orientation can also serve as an organizational purpose (von Ahsen & Gauch, 2022).

Purpose is not Corporate Social Responsibility

The notion that businesses have responsibilities toward society and the environment has long shaped debates in both academic and practitioner communities (Wang et al., 2016). Over time, numerous constructs have emerged (Brosch, 2023; Carroll, 1979), and corporate social responsibility (CSR) has been established as one of the dominant frameworks to capture these responsibilities (Brosch, 2023; Crilly et al., 2015). It is a broad umbrella term encompassing ethical practices, stakeholder engagement, and sustainability initiatives. Given the apparent overlap between the elements of corporate purpose and CSR, it is understandable that the boundaries between these concepts may sometimes become unclear.

Corporate Purpose and CSR are both holistic concepts that guide businesses in their business operations and interactions with stakeholders. They share several metrics: First, both emphasize the long-term value creation for stakeholders and society (Senge, 2008). Second, both concepts promote the involvement of and engagement across multiple stakeholder groups (Lacy & Rutqvist, 2015). Third, organizations focused on purpose and CSR often measure success with non-financial outcomes, such as loyalty, trust, and engagement, rather than short-term financial gains (Porter & Kramer, 2011).

Equating purpose with CSR risks oversimplifying the concept and failing to recognize its deeper strategic implications. While CSR often addresses *what* companies do to mitigate negative externalities, corporate purpose defines *why* a company exists in the first place—and how it integrates societal value into its core strategic logic. Purpose lies at the strategic core, guiding decision-making and aligning all organizational activities towards a common goal (Bocken et al., 2014). In contrast, CSR is often viewed as peripheral to the business model, demonstrated by specific practices that organizations implement to fulfill ethical obligations to society (Brosch, 2023; Geissdoerfer et al., 2018). For example, CSR initiatives such as corporate philanthropy may operate independently of an organization's core strategic focus (Carroll, 2016). CSR success is frequently demonstrated by compliance with regulations, adherence to ethical standards, or the completion of specific initiatives (Meadows, 2008).

Corporate purpose encompasses a transformative vision and a clear sense that can drive innovation and collaboration within and beyond the organization (J. C. Collins & Porras, 1991; Porter & Kramer, 2011). A well-defined purpose can provide direction and coherence for CSR initiatives, aligning them with the overarching goals of the organization (Gartenberg & Serafeim, 2022). Purpose success is often measured by the organization's ability to fulfill its purpose and create shared value for all stakeholders. This broader perspective necessitates innovative metrics that capture qualitative outcomes (Hollander et al., 2017).

The distinction between corporate purpose and CSR becomes especially salient when looking at circular economy (CE) adoption. Many firms still approach CE through the lens of CSR – launching pilot programs, reporting recycled content, or sponsoring awareness campaigns. But these efforts often remain symbolic and disconnected from the business model (Bocken et al., 2014; Kirchherr et al., 2018). CE is seldom anchored in the company's mission and vision (Kirchherr et al., 2018; Pheifer, 2017), and scholars argue for the importance of integrating CE into strategic and business development agendas (Diaz et al., 2022; Kuhlmann et al., 2023; Takacs et al., 2022).

Research shows that one of the greatest barriers to CE implementation is the lack of strategic integration and leadership commitment (Moktadir et al., 2020). The role of leadership is to frame and position CE as a source of competitive advantages and new value creation (Simpson et al., 2004; Stewart & Gapp, 2014). Takacs et al. (2022) found that economically dominated thinking causes managers to weigh business risks associated with CE against the environmental risk of doing nothing, as well as causing a lack of guidance on how to manage trade-offs between short-term profits and long-term investments into CE. The notion that managers lack guidance and are unwilling to engage in trade-offs supports the point made by Brosch (2023) that sustainability initiatives, such as CE, can be seen by organizations as an add-on decoupled from core business strategy. In contrast, corporate purpose is the very element shaping and influencing core business operations, strategy, and mission (George et al., 2023). Consequently, striving for sustainability or being responsible should not be equated with being purpose-driven.

When circularity is treated as a CSR activity, it competes with rather than shapes core business priorities. In contrast, a purpose-led approach positions CE as a strategic imperative—framing it as essential to the organization's identity and long-term value creation (Brosch, 2023; George et al., 2023). A clear illustration of the difference between CSR and purpose can be seen in the transformation of Clariant, a specialty chemicals company (Clariant Annual Report, 2021, 2024). Clariant's approach to sustainability is the embodiment of its corporate purpose: "*Greater chemistry – between people and planet.*" Since the introduction of the purpose statement and purpose-led strategy 2021, the company has established purpose as the organizing principle of every core function—from R&D to supply chains and customer engagement. Product portfolios are restructured to meet sustainability goals, with emission reductions validated by the Science Based Targets initiative (*Clariant*, 2021). Additionally, Purpose is reflected in board-level oversight and employee incentives, ensuring accountability. Finally, Clariant collaborates across industries to reshape value chains and accelerate circular innovation as a founding member of the Global Impact Coalition (*Global Impact Coalition*, 2025; Estrada et al., 2025). The example of Clariant's shows how a circular strategy can be directly aligned with its purpose-driven strategy and operating model. It demonstrates the transformative potential of purpose: to reorient not only what a business does, but why and how it operates (Steller, Björck & Volberda, 2025).

Purpose is not a Mission or a Vision, but guides them

Corporate purpose directs the mission and vision (J. C. Collins & Porras, 1996; Margolis & Hansen, 2002; Shee & Abratt, 1989). However, often purpose, mission, and vision are used interchangeably (Ingenhoff & Fuhrer, 2010). The reason for such confusion may be that many companies express their purposes through mission statements (Ingenhoff & Fuhrer, 2010). The purpose and vision are long-term oriented, while the mission is short- to mid-term oriented (J. C. Collins & Porras, 1991, 1996). Compared to the purpose, which will be ever pursued, the vision and mission aim to be accomplished (J. C. Collins & Porras, 1996). Although these terms share similarities, they also have distinct differences. While corporate purpose describes the "why" (J. C. Collins & Porras, 1991), the vision depicts *what* state the company desires to be in the future and provides a direction that a firm aims for (where?). The mission articulates *how* to achieve that state (Fitzsimmons et al., 2022) and is typically framed for internal stakeholders, with an

emphasis on unifying employees to work toward a common goal (Hsu, 2017; Ingenhoff & Fuhrer, 2010).

Consequently, adopting a strong purpose could provide the foundations for embedding CE in the broader mission, vision, and strategic goals and align the multiple organizational changes needed for CE with the competitive strategy of the company, a critical enabler of CE according to authors (Diaz et al., 2022; Kuhlmann et al., 2023).

Purpose is both Goal- and Duty-Based

In their meta-analysis, George et al. (2023) articulate a comprehensive and multidimensional definition of purpose, goal- and duty-based, that relates to the aforementioned concepts while simultaneously delineating its boundaries. A goal-based corporate purpose is underpinned by three core elements: mission, vision, and strategic intent. The mission defines and conveys the first pillar of the organization's purpose by establishing its identity, values, and the approach to achieving its objectives. The vision represents the organization's long-term aspiration and serves as the second cornerstone of its overarching purpose. The third pillar, strategic intent, emphasizes a unified organizational focus by setting clear objectives and a strategic orientation that empowers the organization to achieve competitive advantage and surpass its rivals (George et al., 2023; Steller & Björck, 2024).

More recent research explores a duty-based perspective on corporate purpose that builds on three additional pillars: values, social service, and stewardship. The fourth pillar, *values*, establishes that purpose must be grounded in intrinsic beliefs and core principles to ensure credibility, while the fifth pillar, *social service*, highlights the incorporation of common good objectives into corporate strategies (George et al., 2023). Finally, the sixth pillar, *stewardship*, underscores the responsibility to minimize their ecological footprint and adopt sustainable business models (George et al., 2023). To fulfill this duty, companies integrate environmental metrics into their operations and ensure consistent monitoring and measurement of their environmental performance (George et al., 2021). The previously discussed multifaceted and integrative nature of purpose requires that the goal-based and duty-based perspectives do not represent a dichotomy, but rather as a continuum that organizations must critically define and deliberate upon. For example, in Coca-Cola, leading soft drinks manufacturer, the Purpose "refresh the world and make a difference" includes, at the same time goal-based dimension – the company aims to provide physical refreshment and inspire positive experiences – and a duty-based dimension – a contribution to the well-being of individuals and communities (*Coca-Cola Company*, 2025).

Taking a multidimensional approach to purpose, as suggested by George et al. (2023) can provide a framework for discussing the role of CE in the company (assuming the purpose aligns with CE). Is the alignment with CE duty-based or goal-based? Is CE seen as a moral obligation or a strategic driver of growth? For example, a furniture company may choose to reduce waste, recycle, and repurpose used furniture, even when it is not financially viable, because it aligns with core values of stewardship and social service set out by the company's purpose. Such an approach would exemplify a duty-oriented approach to CE. The same furniture company could also choose to develop modular product lines designed for easy disassembly, reconfiguration, reuse, and resale as a strategic means to attract customers and growth, achieving both business and CE goals, which would exemplify a goal-oriented approach to CE. The chosen paths entail different strategic choices and trade-offs.

Breaking purpose down into the elements suggested by George et al. (2023) can help facilitate discussion and decision-making on the strategic goals, priorities, and trade-offs needed to operationalize the purpose, and by extension CE. As such, a strong purpose can help organizations understand and gain clarity the implications of the chosen approach to CE, such as needed structural changes (Arekrans et al., 2023), goal formulation, metrics and follow-up (Roos Lindgreen et al., 2022) and business model innovation (Santa-Maria et al., 2022) while drawing on the many benefits of a strong purpose, such as allowing financial and pro-social goals to co-exist as equals (Beer et al., 2011; Björck et al., 2023; Hollensbe et al., 2014; Rey et al., 2019) while providing clarity and guidance for organizational members (Gartenberg & Serafeim, 2022).

3. What is a purpose-driven organization?

Drawing on Gartenberg (2022) and O'Brien et al. (2019), a purpose-driven for-profit organization can be defined as an organization that strives to find a common motivational purpose pursued by all its stakeholders, with this corporate purpose reinforced throughout all its activities and business conduct. Two main characteristics of the purpose-driven organization become evident: active engagement of the organization's stakeholders and the necessity of implementation through business activities and behavior.

First, purpose-driven organizations rely on building and sustaining relational capital – they are able to engage and motivate all their stakeholders to achieve a common goal (Henderson, 2021b). To make purpose explicit, an ongoing dialogue with stakeholders is necessary that at the same time gives the organization direction and unity (Hurth et al., 2018; Morrison & Mota, 2023; Rey et al., 2019; Steller & Björck, 2024). Organizations need to be able to instill a sense of purpose to provide meaning for employees and attract new talent. This can be achieved by shaping and defining purpose, and providing a guiding framework for decisions to foster consistent behavior (Gartenberg & Serafeim, 2022; Mirvis et al., 2010; Saleem & Iglesias, 2016). To create real impact, however, purpose must be connected to employees through actions, knowledge, and internalization (Lleó et al., 2020).

Another example that thrives under a purpose-driven paradigm are *open innovation initiatives*. By leveraging external ideas and technologies, organizations can accelerate internal innovation processes (Chesbrough, 2003). Open innovation encourages close collaboration and co-creation of value through stakeholder relations and engagement. Firms that integrate purpose with open innovation models can effectively mobilize external knowledge and resources to address complex problems (Chesbrough & Di Minin, 2014), such as those inherent in circular economy initiatives. Johnson & Johnson, a pharmaceutical and medical technology company, has successfully connected its purpose, the Credo established already 1947, with its substantial open innovation activities and is recognized as a global leader in open innovation in healthcare (Johnson & Johnson, 2025). Since the early 2010s, J&J's open innovation journey accelerated with the launch of JLabs and resulted in over 600 companies being incubated there (Saionz, 2023). Currently, over 50 % of the pipeline of the company stems from external innovation (imec, 2023). Consequently, corporate purpose can be seen as a management concept that serves as a way to manage an organization, its stakeholders, and inter-organizational initiatives, providing the glue that holds everything together (J. C. Collins & Porras, 1996).

As a consequence, purpose-driven organizations create strategic opportunities by *collaborating with stakeholders* and creating *purpose-driven ecosystems* (Holden, 1997; van Ingen et al., 2021). One study of an environmentally purpose-driven SME found that the organization was able to increase its resilience and customer loyalty by embedding itself strongly in the local community through collaborating with local suppliers and institutions (H. Collins & Saliba, 2020). Another example is Alliance to Zero, demonstrating how a purpose-driven coalition can engage and motivate multiple players through strategies such as: shared purpose and urgency – launching net-zero pharmaceutical products in regulated markets by 2030; inclusive and cross-functional membership by connecting traditionally siloed actors from every stage of the pharma supply chain, joint strategic roadmaps and implementation inter-company working groups, and delivering tangible value and accountability for all participants (Alliance to Zero, 2025).

Second, an organization needs to fully commit its practices and management to creating a structured and organized way of fulfilling its purpose. The fundamental idea is that the purpose is defined and then implemented into projects and programs that then translate the purpose into actions (Almandoz et al., 2018). In other words, a purpose-driven transformation creates *a process* through which the alignment of all organizational dimensions is pursued (Lleó et al., 2020). For example, managers and leaders play a crucial role in ensuring that employees understand their responsibilities, the methods for executing them, and, most importantly, the underlying purpose behind their work—effectively translating organizational purpose into concrete actions, tasks, and skills (Rey et al., 2019). One way to create a connection to this 'why factor' is to clarify how employees' tasks and projects serve to achieve the purpose of the organization (Almandoz et al., 2018; Shuck & Rose, 2013). Bailey and Madden (2016) argue that the meaningfulness of work arises from an ecosystem that encourages understanding of the organization's purpose and involves meaningful functions and tasks through interesting and respectful interactions.

4. Purpose-driven System Transformation

Organizational transformation is commonly defined as a fundamental change process that aligns the purpose, systems, and structures with one another (Moser, 2016). Transformation processes demand a systematic, integrative, and constructive approach that will likely require rigorous planning (Al-Haddad & Kotnour, 2015). Moreover, it is often seen as a type of change that is large in scale (Allaoui et al., 2018) and when it changes norms, values, and management form, a particularly prolonged process (Ghoshal & Bartlett, 1988). Organizational transformation can also be interpreted as an identity transition through the adaptation of the underlying organizational values architecture, and re-evaluation of moral ideals with the goal to create a new value architecture and common understanding (Glissman & Sanz, 2009; Rerup et al., 2022; Silver, 2018). When initializing such transitions, organizations focus on developing the organizational culture (Al-Haddad & Kotnour, 2015).

Within broader interdisciplinary frameworks, purpose is a critical element in various systems as a motivator and framework for guiding decision-making and actions. For instance, the exploration of purpose in system design often revolves around aligning individual or organizational goals with functional outcomes, ensuring a sense of direction that transcends mere task execution (AshaRani et al., 2022; Rosenman & Gero, 1999). Embedding purpose involves iterative steps to conceptualize purpose, align it with measur-

able impact, and embed it within collaborative frameworks with stakeholders. Purpose helps designers understand the goals of their creations and facilitates communication and alignment in collaborative environments (Rosenman & Gero, 1999). As a result, a purpose-driven system design demonstrates enhanced resilience, meaningful engagement, and sustained innovation, particularly when contextualized within collaborative or technological systems (Elgendy et al., 2017). Studies in similar domains affirm the necessity of defining purpose in multifaceted ways, including well-being, operational and performance goals, and social integration, which collectively enhance outcomes.

Corporate purpose plays a critical role in helping organizations evolve in the context of complexity and uncertainty. Binns, Tushman, and O'Reilly (2022) show that purpose fosters disruptive innovation by encouraging strategic ambition, risk-taking, and emotional engagement, which aligns employees and innovation with long-term strategy. The authors argue that creating an emotionally engaging purpose can motivate employees and align innovation with corporate strategy, providing an alternative to fear-based change approaches. They also highlight three enablers of renewal: empowering leadership, ambidextrous operational models, and alignment with evolving market opportunities. Complementing this, Bushe (2023) proposes a change model that privileges purpose over vision, enabling flexible, stakeholder-driven adaptation. This model emphasizes iterative learning, self-organization, and a purpose-framed response to challenges (Bushe, 2021; Pregmark et al., 2023). Through steps such as reframing challenges, facilitating generative dialogue, and scaling successful innovations, organizations can become more agile and effective in driving transformational change .

Mayer (2021) argues that a transformation toward purpose requires reform of organizations' ownership, regulation, company law, corporate governance, and performance evaluation. Henderson (2021a) sees a transformation towards purpose as a system transformation. As such it can be characterized as a type of social change aimed at the alteration of the entire social structure of institutions. Similarly, CE implementation poses considerable challenges for incumbent firms, including the need for cross-sector coordination, value chain redesign, and new governance structures (Parida et al., 2019). CE often requires challenging dominant norms and experimenting with new business models—an endeavor that aligns with the mentioned generative and exploratory function of purpose (Binns et al., 2022; Bushe, 2021). By embedding CE ambitions into their core purpose, organizations can frame circularity as a central element of their strategic identity. This framing legitimizes long-term investments in closed-loop supply chains, circular design, and reverse logistics systems. In this context, corporate purpose can serve as a powerful catalyst for aligning CE objectives with strategic, cultural, and operational renewal.

Purpose-led organizations are particularly well-positioned to lead CE transformations due to their ability to articulate a long-term vision that transcends narrow financial objectives and emphasizes collective value creation. Companies such as Johnson & Johnson, Clariant, Logitech, and coalitions such as Alliance to Zero, mentioned in this article, provide convincing examples. Parida et al. (2019) highlight how large manufacturing companies can orchestrate CE ecosystems by leveraging purpose to foster cross-sectoral partnerships and align actors around shared sustainability objectives. Similarly, Modgil et al. (2022) demonstrate how big-data-enabled decision-making within purpose-led firms can facilitate CE adoption by enabling large-scale coordination and transparency.

While the strategic integration of corporate purpose and circular economy (CE) principles holds transformative potential, it is not without significant risks. These risks stem from implementation challenges, strategic misalignment, cultural resistance, and external legitimacy dynamics. Understanding these risks is critical to avoid idealizing purpose or overestimating the organizational readiness for circular transformation. One of the most frequently cited risks is purpose-washing—the adoption of purpose language without meaningful integration into decision-making, governance, or incentives (Brosch, 2023) When purpose is communicated as a high-level aspiration but not reflected in strategic choices, resource allocation, or leadership behavior, it undermines internal credibility and external legitimacy (Gulati & Wohlgezogen, 2023).

Similarly, circularity-washing is emerging as a reputational hazard. Several authors highlight the systemic barriers to CE; and the need for clearer policy and regulation (Kirchherr et al., 2018; Takacs et al., 2022). Companies may promote circular product features (e.g., recyclability or biodegradable materials) while neglecting systemic changes to supply chains, business models, or end-of-life logistics. These symbolic efforts not only dilute the meaning of CE but also erode trust among stakeholders and regulators (Kirchherr et al., 2018).

The integration of broad societal goals—such as sustainability, inclusivity, or resilience—into core strategy can blur organizational priorities and complicate decision-making. Purpose-driven organizations often face tensions between commercial objectives and moral or environmental imperatives (Battilana et al., 2022). Without clear frameworks for managing trade-offs, leaders may struggle to maintain focus or make difficult choices. This risk is particularly pronounced in CE transitions, which often require long-term investments, higher short-term costs, or cannibalization of existing business models (Takacs et al., 2022). Firms may revert to incrementalism, abandon circular initiatives under financial pressure, or engage in double-speak to appease conflicting stakeholder expectations.

Implementing a purpose-driven, circular strategy often requires a deep shift in organizational culture, values, and mindsets. Employees may resist such changes if they perceive them as top-down impositions, disconnected from day-to-day work, or inconsistent with how success is rewarded (Almandoz et al., 2018; Ghoshal & Bartlett, 1988). Middle managers, in particular, may struggle to translate purpose into operational decisions without appropriate tools or support (Björck et al., 2024). Moreover, circularity often demands cross-functional collaboration, experimentation, and learning practices that may conflict with legacy structures or short-term performance metrics. If purpose is not translated into actionable routines, it may remain abstract or even breed cynicism.

5. Towards a Future Research Agenda linking Corporate Purpose and Systemic Change towards Circularity

In this paper, we discussed the multiple facets of purpose and aimed to advance its understanding by linking it to organizational transformation and systemic change. We refined the conceptual boundaries of corporate purpose, delineated what it is - and what it is not - thereby interpreting the construct from a process-oriented perspective and its application within the context of systemic change and CE implementation.

We identify three dimensions that are relevant for the role of purpose as a driver of a system change towards circularity: normative, strategic, and systemic. First, organizational

purpose is a normative construct that serves as a guiding principle and core reason for existence (Campbell & Yeung, 1991; Hurth et al., 2018). Grounded in stewardship, social service, and values (George et al., 2023), purpose serves as the ethical foundation for goals and conduct distinct from CSR or compliance-oriented ethics. Second, corporate purpose is a strategic construct that aligns value creation with societal needs, enabling the organization to create shared value (Porter & Kramer, 2011). It informs vision, mission, and strategic intent, acting as a directional guide for resource allocation, competitive advantage, and trade-offs. (Gulati, 2022) calls it "unifying strategic anchor". Third, emerging research highlights purpose's role as a systemic change agent and its potential to catalyze first organizational and then industry-wide transformation. It serves as an organizing principle that enables organizations to participate in or lead broader system changes in response to complex challenges such as circularity: by shaping how firms interact with other actors, redefining value chains, and orchestrating ecosystem-level transformation (Baumgartner, 2014; Henderson, 2021b).

By exploring the characteristics of purpose-driven organizations and the mechanisms through which such organizations effect systemic change towards achieving their purpose, we have identified three dimensions relevant for the process understanding of purpose: First, purpose is a unifying and motivational framework. Purpose-driven organizations are defined by their ability to cultivate a shared motivational purpose that aligns stakeholders and informs organizational conduct (Gartenberg, 2021; O'brien et al., 2019). By fostering relational capital, purpose acts as a guiding framework that motivates stakeholders, attracts talent, and aligns actions with long-term goals in and beyond the single organization (Henderson, 2021b).

Second, integrating purpose within operational and cultural systems is critical to translating purpose into actionable outcomes. When operationalized and made explicit, purpose can serve as a strategic framework for guiding actions and measuring implementation progress and impact (Steller & Björck, 2024). This alignment requires iterative steps, including framing, translation into measurable objectives, and embedding purpose into strategic processes (Almandoz et al., 2018; Björck et al., 2023; Rey et al., 2019).

Third, a purpose-driven transformation entails a fundamental reconfiguration of operating model, governance, and incentivization to create alignment with stated purpose (Birkinshaw et al., 2014; Ghoshal & Bartlett, 1988, 1994; Moser, 2016). This transformation reflects an identity shift achieved through a re-evaluation of organizational norms and goals (Rerup et al., 2022), but also its role in enhancing resilience across dynamic environments (Binns et al., 2022).

By combining these six dimensions we synthesize a research agenda that highlights directions for future inquiry in this domain. Table 1 summarizes the research directions, conceptual tensions, and provides exemplary research questions.

Table 1: Future Research Agenda (Own illustration)

	Exemplary Conceptual Tensions and Research Questions
Research Direction 1: Clarifying the Conceptual Boundaries and Strategic Role of Purpose	*Tension: What distinguishes purpose from adjacent concepts, and how does it shape organizational identity and strategic intent in circular transitions?* ▪ How can corporate purpose be conceptually differentiated from CSR and sustainability, particularly in the context of circular economy (CE) transitions? ▪ In what ways do the six pillars of corporate purpose (George et. al., 2023) interact to enable long-term, purpose-driven transformation? ▪ To what extent does conceptual ambiguity hinder strategic alignment and implementation of CE initiatives? ▪ How can purpose be framed and operationalized to serve as a strategic foundation for circular innovation in incumbent firms?
Research Direction 2: Investigating Purpose as a Mechanism for Stakeholder Alignment and Collective Action	*Tension: How does purpose foster internal and external collaboration across diverse and conflicting interests?* ▪ What motivational dynamics and identity mechanisms align employees and external stakeholders around circular goals? ▪ How do organizations co-create and sustain purpose narratives in interorganizational and coopetitive CE ecosystems? ▪ What role does purpose play in fostering trust and commitment in complex stakeholder networks, especially where value creation is diffuse?
Research Direction 3: Embedding Purpose into Organizational Systems and Practices	*Tension: How is purpose operationalized into daily practices and operational routines?* ▪ What iterative processes support the alignment of structures, culture, and systems with purpose-driven CE goals? ▪ How do leadership styles and governance models enable or hinder purpose integration? ▪ Which management tools, KPIs, and incentive systems effectively embed purpose into circular business models (e.g., closed-loop systems, product-service systems)? ▪ What organizational conditions facilitate or block the translation of purpose into operational CE outcomes?
Research Direction 4: Purpose as a Catalyst for Systemic Innovation and Ecosystem Orchestration	*Tension: Can purpose drive not only organizational change but also lead multi-actor system transformation?* ▪ How does purpose enable firms to lead ecosystem orchestration for circularity, including standard-setting and coordination? ▪ In what ways does purpose foster ambidexterity between exploitation and exploration in CE contexts? ▪ How do purpose-driven firms create pre-competitive collaboration platforms, such as the Alliance to Zero, to accelerate industry-wide change?

	Exemplary Conceptual Tensions and Research Questions
Research Direction 5: Navigating the Risks, Tensions, and Limits of Purpose-Driven Circularity	*Tension: What are the risks and vulnerabilities of embedding purpose in circular transitions?* ▪ What are the risks of purpose-washing and circularity-washing, and how can they be identified and mitigated? ▪ Under what conditions does purpose lead to overextension, strategic ambiguity, or internal resistance? ▪ How do organizations manage tensions between purpose-led ambitions and short-term commercial pressures in CE implementation?
Research Direction 6: Assessing Purpose Maturity and Systemic Impact	*Tension: How do we evaluate the effectiveness and depth of purpose-driven transformation in circular transitions?* ▪ Which metrics capture the long-term, systemic impact of corporate purpose on organizational renewal and circular value creation? ▪ What maturity models and indicators can assess the progression from stated to embedded purpose in CE transitions? ▪ How can firms and ecosystems measure the alignment between purpose, performance, and sustainability outcomes?
Research Direction 7: Advancing Methodological Approaches to Study Purpose in Systemic Change	*Tension: How can we better observe, trace, and theorize purpose-driven change over time and across systems?* ▪ What longitudinal and processual methods best capture how purpose shapes CE transformation trajectories? ▪ How can network analysis and system mapping be applied to trace purpose-driven influence in innovation ecosystems? ▪ What comparative designs can illuminate variation in purpose implementation across industries or regions?

The first research direction is to refine the conceptual clarity of corporate purpose by distinguishing it from related constructs such as CSR, mission, and vision—especially in the context of circular economy (CE). This includes advancing the process-oriented perspective of corporate purpose as a normative framework, strategic instrument, and systemic change agent. Future studies should investigate how purpose differs in its intent, scope, and integration, particularly when framed as a normative foundation, strategic compass, and systemic enabler of change. Researchers should explore how purpose interacts with constructs like values, stewardship, and social service, and how it guides long-term value creation in contexts of structural transformation. A unified framework encompassing purpose's multiple facets could improve theory building and empirical testing (George et al., 2023).

The second research direction focuses on how purpose functions as a relational and motivational mechanism. In circular settings—often marked by interdependence and coordination failure—purpose may offer a shared language that builds trust, reduces opportunism, and enables collective action. CE offers a fruitful context to investigate the mechanisms through which shared purpose is emerging and being co-created in collaborative and coopetitive settings in intra- and cross-industry environments, how it evolves as stakeholder complexity grows, and how it influences behavioral shifts among employees, suppliers, consumers, and regulators (Bocken et al., 2014). Particular attention is needed to understand how purpose helps resolve goal conflicts and support stakeholder alignment in ecosystems where power asymmetries and competing incentives persist.

The third research direction is to examine how organizations embed purpose into internal systems, enabling it to guide behavior at all levels. In CE transitions, this includes

aligning purpose with decision-making logic, performance metrics, and incentive structures (Björck et al., 2023; Rey et al., 2019). Future research should explore how purpose is enacted through strategy formulation, resource allocation, product innovation, and HR practices—while accounting for the roles of emotional, political, and cognitive work (Steller & Björck, 2025). Investigating cross-functional and cross-boundary coordination mechanisms is particularly relevant for CE, where systemic integration often requires breaking down organizational silos and involving actors from outside the firm.

Purpose has the potential to serve as an orchestration mechanism for multi-actor CE ecosystems. The fourth future research direction should investigate how purpose-driven firms initiate or coordinate cross-sector collaborations (Baumgartner, 2014; Gulati, 2022), engage in pre-competitive innovation, and influence industry standards and policy environments. Studies could examine how purpose-driven firms use purpose to align diverse actors around shared circular goals. This includes examining how businesses can facilitate collaboration with governments, communities, and consumers to co-create value and drive sustainable practices (Lacy & Rutqvist, 2015). Relatedly, researchers should explore the conditions under which purpose supports ambidexterity—balancing core business pressures with exploration of new, circular value creation models. The challenging balance between conscious control and momentum, temporality horizons, and multiple goals and interests within the processes calls for future research (Henderson, 2021a).

A critical and often neglected research direction concerns the risks and limits of purpose-driven transformation. These include purpose-washing, strategic ambiguity, initiative fatigue, and the risk of decoupling purpose from core decision-making (Knowles et al., 2022). Future research should explore when and why purpose backfires—such as when short-term commercial pressures override long-term intentions, or when stakeholder skepticism undermines legitimacy. Scholars should examine how organizations navigate tensions between economic rationality and environmental ethics, and how trade-offs are managed in circular innovation processes. Investigating the structural, cultural, and cognitive barriers to purpose realization will help distinguish authentic transformation from symbolic adoption.

The sixth research direction explores the impact and maturity measurement of Purpose-driven Systemic Renewal respectively Circular Transformation. To establish the legitimacy and effectiveness of corporate purpose in systemic change, research should develop methodologies for measuring its impact on organizational performance, stakeholder satisfaction, and other societal outcomes. This includes exploring frameworks for impact measurement, feedback mechanisms, and iterative adjustments that ensure consistency between articulated purpose and realized outcomes (Björck et al., 2023; Henderson, 2021b). Furthermore, defining and implementing suitable quantitative and qualitative KPIs measuring the maturity of the purpose-driven system renewal should also be part of future investigations (Björck et al., 2023).

The final seventh research direction encompasses methodological considerations for future research. To advance empirical inquiry into purpose-driven systemic change, future research should consider adopting methodological approaches suited to complexity, such as longitudinal case studies, process tracing, and ecosystem mapping. These can help uncover how purpose evolves over time, how it diffuses across networks, and how it interacts with institutional and material structures. Comparative designs across industries or national systems would help uncover contingency in how purpose is implemented or

resisted. In addition, network analysis, design thinking, and participatory methods may also illuminate how purpose-driven firms function as orchestrators in CE ecosystems. Methodological innovation is key to unpacking the recursive dynamics between purpose, structure, and systemic outcomes.

6. Conclusion

This conceptual research aimed to explore the role of corporate purpose in systemic change, particularly in the context of transitions toward a circular economy (CE). Through a process-oriented lens, we positioned purpose not only as a normative and strategic concept but also as a lever for systemic renewal. By distinguishing purpose from related constructs such as CSR, we highlighted its unique capacity to unify stakeholders, guide organizational identity, and catalyze transformation.

Purpose-driven organizations are characterized by their ability to integrate purpose into strategic, cultural, and operational domains. This integration enables them to navigate complexity, build relational capital, and drive innovation across internal and external boundaries. When embedded in decision-making processes, purpose becomes a generative force that aligns diverse actors and enables organizations to pursue ambitious transformations, such as those required for CE. In the context of circular transitions, purpose serves as both a compass and an engine for change. It fosters collaboration, legitimizes long-term investments, and supports new governance models. Purpose-oriented firms are increasingly acting as orchestrators in circular ecosystems, shaping not only markets but also institutional policy.

The future research agenda we propose outlines seven key directions—ranging from conceptual clarification and stakeholder motivation to operational embedding and systemic innovation. Each direction is enriched with CE-specific questions to encourage targeted inquiry. In addition, we emphasize the need for methodological pluralism to capture the complex, evolving dynamics of purpose-led change.

In alignment with Durand & Huynh (2024), corporate purpose is more than a rhetorical statement—it is a strategic and systemic tool for addressing complex shifts within and beyond organizational borders. By advancing theory and offering pathways for empirical exploration, this paper contributes to a growing understanding of how purpose can enable organizations to drive meaningful, measurable, and enduring change in the age of circularity.

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Circular Economy and Human Rights: Ethical Considerations

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Abstract: Circular Economy embraces opportunities and risks from an ethical perspective informed by human rights. From an ethical standpoint, the aim is to enjoy the human rights-upsides and avoid the human rights-downsides. At the same time, a conceptual compatibility characterizes the relationship between human rights and circular economy. Based on these considerations, circular economy and human rights are discussed as a tandem for a sustainable and flourishing future of humanity and the planet.

Keywords: Circular Economy, Human Rights, Ethics, Principle of Vulnerability, Intergenerational Justice

Kreislaufwirtschaft und Menschenrechte – Ethische Überlegungen

Zusammenfassung: Die Kreislaufwirtschaft berücksichtigt Chancen und Risiken aus einer ethischen Perspektive, die sich an den Menschenrechten orientiert. Aus ethischer Sicht besteht das Ziel darin, die Vorteile der Menschenrechte zu nutzen und die Nachteile zu vermeiden. Gleichzeitig zeichnet sich die Beziehung zwischen Menschenrechten und Kreislaufwirtschaft durch eine konzeptionelle Kompatibilität aus. Auf der Grundlage dieser Überlegungen werden Kreislaufwirtschaft und Menschenrechte als Tandem für eine nachhaltige und blühende Zukunft der Menschheit und des Planeten diskutiert.

Stichwörter: Kreislaufwirtschaft, Menschenrechte, Ethik, Prinzip der Verletzlichkeit, Generationengerechtigkeit

1. Human Rights Opportunities and Risks of Circular Economy

The United Nations Development Programme (UNDP) defines "Circular Economy" in the following way:

> *Our current economic system can be considered a 'linear economy,' built on a model of extracting raw materials from nature, turning them into products, and then discarding them as waste. Currently, only 7.2 percent of used materials are cycled back into our economies after use. This has a significant burden on the environment and contributes to the climate, biodiversity, and pollution crises. Circular economy, on the other hand, aims to minimize waste and promote a sustainable use of natural resources, through smarter product design, longer use, recycling and more, as well as regenerate nature. Besides helping tackle the problem of pollution, circular economy can play a critical role in solving other complex challenges such as climate change and biodiversity loss. (United Nations Development Programme UNDP, 2023)*

Circular Economy is all about this change from organizing economic value-creation without "happy end", namely resulting in waste, to an economic circle of production, reuse, recycling, and regeneration (Stockholm Environment Institute, 2019; Abbate et al., 2023a) contributing to a sustainable future (Gil-Pérez & Vilches, 2023).[1]

Human rights protect elements of human existence that are necessary for the physical survival of humans (e.g., food through the human right to food) and for a life as a human – with human dignity – (e.g., education through the human right to education) (Kirchschlaeger, 2013).

If one looks at circular economy from the perspective of an ethics of human rights, circular economy, by contributing to a sustainable future, enables the sustainable fulfillment of human needs and rights (The Clube of Rome & Systemic, 2020; UN Environment Programme, 2024). At the same time, circular economy overcomes some of the human rights issues the linear economy encompasses by recognizing and addressing "environmental degradation and climate change as interconnected human rights crises" (UN News, 2021). Stealing for example the basis for a human existence by ruining the environment, by destroying the climate, or by polluting the water or air, linear economy possesses a negative human rights record which can be left behind by circular economy. Protecting the environment, the climate, and clean water and air means at the same time to respect, to protect, and to realize human dignity and the human right to life as well as the right to a clean, healthy, and sustainable environment.

This positive impact by circular economy is necessarily needed from an ethics of human rights-standpoint because the risks of inaction, particularly regarding the "Global South," encompass violations of human rights. The severe consequences of inaction – such as extreme weather events – are unfortunately already evident.

At the same time, it could be possible that circular economy achieves these ethically positive ends by violating human rights at the same time.

> *Human rights risks and impacts are present in the transition to renewable energy from the mining of the critical minerals needed for the transition, to the manufacturing of solar panels and the deployment of solar and wind projects […] Because regenerative agriculture may result in smaller crop yields than conventional agriculture, farmers may resort to child and forced labor as they seek to increase crop yields and profits. Hazardous working conditions due to longer working hours and less industrialized processes may also result from shifts away from conventional farming. Loss of livelihood for smallholder farmers who may be left behind in favor of large commercial farms with higher crop yields is also a potential adverse impact. Because of the continued use of pesticides, the risks to health and to the right to a clean, healthy and sustainable environment typically associated with large agribusiness will persist even in this new context. Regenerative agriculture activities have also been linked to threats against environmental human rights defenders. There is a risk of forced and child labor in the scaling up of the circular economy, as more waste workers are needed to process recycled goods. There is also a risk of adverse impacts on workers' health from hazardous working conditions in recycling centres.[…] Closing loops to scale up the circular economy may also cause workers to lose their livelihoods as supply chains are shifted or reduced. (Areias, 2024, p. 336)*

1 Of course, these are selected examples – driven by the R-strategies – rather than a comprehensive list.

The implementation and practice of circular economy could result in such ethically negative realities.

> *Nature-based solutions can lead to violations of customary land and carbon rights of local peoples, including Indigenous Peoples and traditional communities. Violence by security forces, sexual harassment and gender-based violence at project sites […] and threats to environmental human rights defenders are additional risks associated with nature-based solutions. (Areias, 2024, pp. 336–337)*

For example, renewable energies require raw materials, rising concerns about the impact of its extraction for people (Vasil, 2020; Kuegerl & Tost, 2022; Zanoletti et al., 2024).

Moreover, in the textile and fashion industry – known for their substantial contributions to environmental pollution and climate destruction and, correspondingly, for their significant change-potential towards a circular economy – (Abbate et al., 2023b)

> *there are initiatives that employ regenerative agriculture to produce organic cotton and other natural fibers, using natural colorings and dye, thus ensuring higher quality and safer garments for the health of consumers and the environment. By producing higher quality garments, clothing can also last longer, be repaired, thrifted, and recycled. (United Nations Development Programme UNDP, 2023)*

Theoretically, this could also be done by economically exploiting humans with excessive working hours per day or by paying them too low wages.

Finally, the social value of agri-food industrial parks serving circular economy can be discussed (Atanasovska et al., 2022). While changing value-creation in a sustainable way (including contributing to the respect, protection, implementation, and realization of human rights), circular economy itself needs to respect, protect, implement, and realize human rights of all humans. "The circular economy will not be socially just by default." (Lembacher et al., 2022, p. 13). From an ethical perspective, in order to master its own social challenges (Mies & Gold, 2021; Sevigné-Itoiz et al., 2021; Upadhyay et al., 2021; Musariri & Moyer, 2022; Suarez-Visbal et al., 2022; Millward-Hopkins, 2024; Mulvaney, 2024; Sareen & Martin, 2024), circular economy needs to accept the guidance by human rights as ethical points of reference. At this point, the concept of "Just Transition" provides ethical guidance embracing the economic opportunities as well as the social aspects of such a transformation. "A Just Transition means greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind." (Chrysler et.al., 2024)

2. Compatibility of Human Rights and Circular Economy

Both, circular economy – because it serves the ethically necessary protection of the environment and the climate (Kirchschlaeger, 2012, 2023) –, and human rights – e.g., based on the principle of vulnerability (Kirchschlaeger, 2013, 2016) –, can be justified ethically. Therefore, there is a responsibility to realize circular economy as well as human rights. At the same time, both are conceptually compatible with each other. Whilst circular economy encompasses sustainability (Sehnem et al., 2019) and protects the environment, the climate, and clean water and air, it joins forces with human dignity and the human right to life as well as with the human right to a clean, healthy, and sustainable environment. The other way around, linear economy applied in, e.g., "plastics production, use, and disposal

pose significant threats to human rights." (Center for International Environmental Law CIEL, 2023, p. 11) Therefore, human rights (Orellana, 2021) like the right to information should inform the understanding of circular economy from an ethical perspective (CIEL, 2023):

> *People everywhere must be fully and actively informed about plastics' risks, hazards, and harms [….] This should include, among other things, freely and easily available information on air and water emissions from plastics production; labeling disclosures for plastic products and packaging; and transparency regarding the impacts of local plastic burning, thermal processing, or disposal (CIEL, 2023, p. 11).*

Furthermore, the right to full and meaningful participation needs to be integrated in the concept of circular economy as well:

> *A fully informed public should be actively involved in key decisions at every stage of the circular economy for plastics. This includes: the amount and purpose of plastics resin production; construction of waste management facilities of any kind; and the inclusion of additives in recycled plastics that might be toxic to workers, local communities, or consumers. In particular, Indigenous Peoples have the right to free, prior, and informed consent, as they shall be protected from, among other scenarios, the storage or disposal of hazardous material on their lands (CIEL, 2023, p. 11).*

Beyond that, access to accountability and remedy should also be part of a circular economy:

> *The plastics industry and recyclers should be accountable for the harms wrought by their products and processes along their life cycles.[…] People have a right to remedy for any harm caused, and this remedy should include a global mechanism for liability and compensation […] Circularity for any material or resource must be deeply rooted in protection and respect for the lives and livelihoods of all people across the global supply chain and use system. Policy approaches for a circular economy that fail to include principles grounded in justice to prevent future harm will fall short of addressing the crisis. (CIEL, 2023, p. 11)*

This means concretely that circular economy cannot avoid the "monument of human rights" (Joas, 2012, p. 280). In an economic value creation – also in the case of circular economy – and its impact on the environment and the climate, human rights are at stake (Rocasolano & Berlanga, 2022). "The implementation of circularity for all materials in the economy[…] must ensure that human rights are upheld for all people, with specific care for those made most vulnerable to harm." (CIEL, 2023, p. 1) This requires though specific and focused efforts to achieve the respect, protection, implementation, and realization of human rights while advancing circular economy.

> *Conducting human rights due diligence on nature-based solutions can be challenging as there can be a 'green haze' surrounding these projects due to their positive impacts on the environment. This can lead to a reluctance from stakeholders within companies to engage on the human rights issues associated with these projects, particularly when activities to achieve the company's net zero strategy have been prioritized. Often these projects are managed by third-party suppliers, and, in the case of carbon offsets, they are purchased from suppliers who may be one or two tiers removed from the projects*

themselves, adding complexity to human rights due diligence. Such projects may also represent a completely new business activity for companies. Understanding biodiversity-related human rights impacts can be highly complex and context specific. The multiple actors often involved in nature-based solutions, the lack of experience of some companies in these activities and the complex interconnection between biodiversity and human rights can all create additional challenges in identifying and addressing the adverse human rights impacts associated with nature-based solutions. (Areias, 2024, p. 337)

3. Circular Economy and Human Rights – The Way Forward Creating a Future of Humanity and the Planet?

If one goes beyond the present and thinks about the future, "intergenerational justice" builds an adequate principle to balance needs and interests not only of the present humans but also of past and future generations in a fair way.

A society is intergenerationally just when each generation does its fair share to enable members of succeeding generations, both inside and outside its borders, to satisfy their needs, to avoid serious harm and to have the opportunity to enjoy things of value. (Thompson, 2010, p. 6)

The concept of "intergenerational justice" does not address the satisfaction of every need of all humans which already results of the aspired balance between past, present, and future generations. "Intergenerational justice" is obviously not about excessive needs and luxury goods but protecting a minimal standard based on human rights for enabling survival and living with human dignity for every human living now and in the future (Kirchschlaeger, 2013). So, the combination of intergenerational justice with human rights creates a first part of a tandem for the future of humanity and the planet. The second part can be circular economy because it represents a concept of economy fostering the protection of the environment and the climate. The tandem of circular economy and human rights can only depart into the future if circular economy includes ethics of human rights. "Building the human rights lens early in the planning or development of climate action activities can help companies break down siloes and act more quickly to identify and address human rights risks." (Areias, 2024, p. 338) Concretely, this could mean

to include partnerships or other collaborations with Indigenous Peoples and traditional communities due to their unique knowledge and roles as stewards or custodians of land. Such collaborations may, for example, cover the management of forests for nature-based solutions or the rehabilitation of soil in regenerative agriculture. These collaborations themselves must be based on respect for human rights, including land rights and cultural traditions. (Areias, 2024, p. 338)

Beyond that,

engaging with suppliers to support the transformations necessary for climate mitigation can also help to identify and mitigate adverse human rights impacts. Reskilling and retraining the workforce may also be necessary.[…]In implementing nature-based solutions, companies may need to engage with partners carrying out these projects,

to ensure they are able to respect human rights throughout project implementation. (Areias, 2024, p. 338)

As a tandem, circular economy and human rights could be transformative for the world (Vallaeys, 2020). As a tandem, circular economy and human rights would ensure that the environment, the climate, as well as all humans enjoy circular economy as ethically positive change. As a tandem, circular economy and human rights could lead humanity, the environment, and the climate in a flourishing sustainable future.

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A Critique of the Circular Economy from the Perspective of Sufficiency: Decoupling and Inequality

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Summary: Current growth-oriented efforts to build economies are not on a sustainable and inclusive path: the well-being of the entire population of the planet remains unattainable while planetary boundaries are exceeded. Thus, instead of focusing on economic growth, a more holistic approach to building economies needs to be taken. Here, the concept of sufficiency as an organizing principle that recognizes enoughness and excess is challenging the growth paradigm. This article begins by discussing the circular economy as part of the green growth approach but outside the post-growth agenda. Next, two key criticisms of the circular economy raised by the sufficiency-focused degrowth approach are reviewed: the limits to decoupling and inequality. This article ends with an outlook on how the sufficiency-focused approach has been embedded into policy proposals and organizational activities, and how the circular economy could foster sufficiency-focused economies.

Keywords: sufficiency, circular economy, post-growth agenda

Eine Kritik an der Kreislaufwirtschaft aus der Suffizienzperspektive: Entkopplung und Ungleichheit

Zusammenfassung: Derzeitige wachstumsorientierte Bemühungen zum Aufbau von Volkswirtschaften befinden sich weder auf einem nachhaltigen noch inklusiven Pfad: Das Wohlergehen der gesamten Weltbevölkerung bleibt unerreichbar, während planetare Grenzen überschritten werden. Daher braucht es, anstelle eines Fokus auf Wirtschaftswachstum, einen ganzheitlicheren Ansatz für den Aufbau von Volkswirtschaften. In diesem Zusammenhang stellt das Konzept der Suffizienz als Ordnungsprinzip, welches ein „Genug" sowie Übermass anerkennt, das Wachstumsparadigma infrage. Dieser Artikel beginnt mit einer Diskussion über die Kreislaufwirtschaft als Teil des Green-Growth-Ansatzes, jedoch außerhalb der Postwachstumsagenda. Anschließend werden zwei zentrale Kritikpunkte an der Kreislaufwirtschaft beleuchtet, welche aus der suffizienzorientierten Degrowth-Bewegung hervorgehen: die Grenzen der Entkopplung und die Ungleichheit. Der Artikel schließt mit einem Ausblick darauf, wie der suffizienzorientierte Ansatz in politische Vorschläge und organisatorische Aktivitäten eingebettet wurde und wie die Kreislaufwirtschaft suffizienzorientierte Wirtschaftssysteme fördern könnte.

Stichwörter: Suffizienz, Kreislaufwirtschaft, Postwachstumsagenda

1. Introduction

Currently, not all of humanity's social goals are being achieved and the well-being of the entire population of the planet remains unattainable (Raworth, 2017). At the same time, planetary boundaries are being exceeded (Richardson et al., 2023). Thus, socio-economic systems are not on a sustainable and inclusive path. Instead, the systems are more focused on achieving economic growth – and wealth for the privileged – while a large part of the world's population is still unable to meet their basic needs (Parrique, 2019). In sum, "GDP growth (monetary value creation) somewhere occurs at the expense of exploitation elsewhere in the global economy" (Parrique, 2019, p. 374).

Since the concept of economic growth is ambiguous, we define it here as the inflation-adjusted increase in GDP resulting from an increase in production and consumption (Cassiers & Maréchal, 2018; see also Stoknes & Rockström, 2018; Vadén et al., 2020b). According to some literature, such economic growth is, among other things, a necessity and a primary goal of policymaking (Ekins, 2000; Vadén et al., 2020b), as it is believed that economic growth can be used to reduce social inequalities, such as poverty, and combat climate change (Vadén et al., 2019) through, for instance, technological innovations (Ekins, 2000; Lehmann et al., 2022). However, excessive focus on economic growth causes problems, as it forgets that our economies are embedded in holistic Earth systems: by some measures, for example, inequality increases while community cohesion decreases, environmental impacts accumulate, and climate change progresses as a result (Wright et al., 2018; Laurent, 2024; Costanza, 2025). As for policymaking, it has even been argued that maintaining and improving economic growth provides the boundary conditions for solutions proposed to combat environmental crises rather than trying to avoid the negative ecological and social impacts of economic growth (Banerjee, 2012). This is the case even though "globally, climate change has led to a population-weighted GDP loss of 6.3 % in 2022" (Rising, 2023, p. 4). Thus, to prevent the transgression of planetary boundaries and realign economic activities with the Earth's ecological limits, it is necessary to move beyond a narrow focus on economic growth and adopt a more holistic approach.

In this article, the concept of sufficiency challenges the focus on economic growth and is seen as an organizing principle that recognizes enoughness and excess, and, thus, leads to more sustainable and inclusive economies (Jungell-Michelsson & Heikkurinen, 2022; Heikkurinen, 2024) guided by the principles of justice, safety, and diversity (see, e.g., Raworth, 2017; Scheidel & Schaffartzik, 2019). This article proceeds as follows: First, it discusses the circular economy as part of the green growth approach but outside the post-growth agenda. Then, two key criticisms of the circular economy raised by the sufficiency-focused degrowth approach are reviewed: the limits to decoupling and inequality.

2. The circular economy as part of the green growth approach

Some different ways of approaching growth are evident in the post-growth agenda and its periphery. Here, the word "approach" has been chosen to refer to a combination of scholarly literature, political stances, and social activism. At one end of the spectrum is the *green growth* approach, whose proponents argue that through efficiency and absolute decoupling, it is possible to achieve a sustainable and inclusive path while maintaining continuous economic growth (Stoknes & Rockström, 2018; Lehmann et al., 2022). On the

opposite end is the *degrowth* approach, meaning "an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions" (Schneider et al., 2010, p. 511). Degrowth literature states that to achieve sustainability and inclusivity, the goal of economic growth should be abandoned (Lehmann et al., 2022). Furthermore, degrowth proponents argue that economies might even need to shrink in rich countries of the Global North (Hickel, 2021) and bring further attention to inequality by asking who benefits from the current growth-focused system.

In all, green growth and degrowth approaches represent the extremes of the efficiency-sufficiency spectrum. The green growth approach relies on efficiency, that is, reducing resource consumption in relative terms, or in other words, doing more with less (Princen, 2003; Young & Tilley, 2006). Conversely, to align economic activity within ecological and social limits, degrowth calls for sufficiency – meaning producing and consuming less in absolute terms (Jungell-Michelsson & Heikkurinen, 2022; Laurent, 2024). According to some researchers, the link between degrowth and sufficiency is so obvious that, for example, degrowth is dependent on embracing sufficiency (Nesterova, 2020; Jungell-Michelsson & Heikkurinen, 2022). Between the efficiency desires of green growth and the sufficiency idea of degrowth lies the *growth agnostic* approach, which argues that economic growth should not be an issue that needs to be considered at all, that is, economic growth is indifferent (van den Bergh, 2011; van den Bergh & Kallis, 2012; Lehmann et al., 2022). Haapanen and Tapio (2016) view degrowth and growth agnostic approaches as a continuum: achieving the growth agnostic approach initially requires an intentional degrowth approach.

Despite the fact that scholarly circular economy literature examines the sufficiency aspects of the circular economy, such as refusing and reducing consumption and the use of natural resources, these aspects often receive less attention in mainstream discussions (Kirchherr et al., 2017; Murray et al., 2017; Bocken et al., 2022). Instead, the circular economy is rooted in the assumption of (resource) efficiency rather than sufficiency (Schneider et al., 2010; see, e.g., Finnish Government, 2021; European Commission, 2023) and the goal of economic growth (Bocken et al., 2022; Leinonen & Lappalainen, 2023). Thus, the majority of the scholarly circular economy discourses and mainstream discussions currently align with the technology-, efficiency-, and growth-oriented green growth approach (Lehmann et al., 2022; Kongshøj, 2023). Moreover, although some scholars consider the green growth approach to be part of the post-growth agenda – albeit on its margins (Laurent, 2024) – here, post-growth is defined as "an era in which the societal project is refined beyond the pursuit of economic growth" (Cassiers & Maréchal, 2018, p. 2) and thus, only growth agnostic and degrowth approaches can be grouped under the growth-critical and sufficiency-focused post-growth agenda (Lehmann et al., 2022), leaving the green growth approach out of the agenda.

3. Criticism of the circular economy from the perspective of sufficiency

"Achieving sustainability within planetary boundaries requires radical changes to production and consumption beyond technology- and efficiency-oriented solutions" (Kongshøj, 2023, p. 1). Therefore, a comprehensive approach to sufficiency is needed to complement and challenge current green growth – thus, circular economy – efforts to build (sustainable) economies (Bocken et al., 2022).

Since green growth and degrowth are extremes of the efficiency-sufficiency spectrum, and the connection between degrowth and sufficiency is obvious, next, the circular economy is examined through the critical lenses of degrowth. In the socio-economic sphere, two criticisms are central: the limits to decoupling and inequality.

3.1. The limits to decoupling

The first suspicion from the degrowth approach towards the circular economy is based on the notion of decoupling. Essentially, decoupling refers to the idea that it is possible to separate "environmental bads" from the "economic goods" with the help of, for example, new technologies, innovations, industrial development, and market-based solutions (Wright et al., 2018). Decoupling can be global or local, and relative ("GDP grows faster than domestic material consumption" (Hickel & Kallis, 2020, p. 471)) or absolute (GDP grows or remains the same while environmental load, resource use, and/or emissions decrease (Stoknes & Rockström, 2018; Vadén et al., 2019)). It can happen over a short or long period, and for one environmental indicator (e.g., carbon emissions) or multiple (e.g., all planetary boundaries) (Parrique et al., 2019). Thus, when decoupling is discussed within degrowth and green growth approaches, it is important to clarify what kind of decoupling is needed. Degrowth scholars argue that to halt environmental crises, decoupling needs to be global, absolute, occur over a long period, and happen for all environmental indicators. This can be characterized as "sufficient enough decoupling". (Vadén et al., 2020a.) The green growth approach is on the same page but vaguer when setting the target level for decoupling. For instance, the Circular Economy Action Plan, which is one of the main building blocks of the European Green Deal – the new growth strategy for Europe – states:

> *Indicators on resource use, including consumption and material footprints to account for material consumption and environmental impacts associated to our production and consumption patterns will also be further developed and will be linked to monitoring and assessing the progress towards decoupling economic growth from resource use and its impacts in the EU and beyond (European Commission, 2020, p. 19).*

However, sufficient enough decoupling is notably difficult or impossible to achieve (Hickel & Kallis, 2020). Indeed, decoupling environmental load, resource use, and/or emissions from economic growth has proven to be unrealistic (Hagens, 2020; Hickel & Kallis, 2020), and the empirical evidence for a decoupling that takes into account all ecological boundary conditions is lacking (Parrique et al., 2019; Vadén et al., 2020b). While some (absolute) decoupling between CO_2 emissions and economic growth (Stoknes & Rockström, 2018) and resource use and GDP has been observed or theoretically estimated within some rich countries, no credible empirical model of sufficiently broad and long-term decoupling that works in all policy settings exists (Hickel & Kallis, 2020). Furthermore, global resource use is projected to grow 60 percent from 2020 levels by 2060, which means an increase in material resource extraction from 100 to 160 billion tons. For instance, energy transition is driving a high increase in metal demand, while the build-up of infrastructure drives the growth of non-metallic mineral extraction. (International Resource Panel, 2024.) In sum, there is a lack of empirical support for the decoupling on which the green growth approach relies (Hickel & Kallis, 2020).

3.2. Inequality

The second main criticism of the degrowth approach to the circular economy's focus on growth is based on inequality. Although the degrowth approach also highlights other forms of inequality that the circular economy does not sufficiently address, like gender issues (see, e.g., Pla-Julián & Guevara, 2019; Dengler & Lang, 2022; Houtbeckers, 2022) and inter- and intra-generational equity (Murray et al., 2017), here inequality refers to economic inequality, which, according to Buch-Hansen and Koch (2019, p. 264), has serious consequences: "extreme and growing economic inequality threaten[s] human civilization as we know it".

Economic inequality can be examined at the global and national levels. First, the current growth-oriented efforts to build economies have benefited the rich countries of the global North, often at the expense of the countries of the global South (Hickel, 2021). Second, income disparities within countries have increased, and wealth has accumulated in the hands of an increasingly smaller number of people, who seek to isolate their own interests from the collective well-being (Piketty, 2014; Heikkurinen et al., 2019). At the same time, as noted earlier, a part of humanity is unable to satisfy their basic needs (Parrique, 2019). In response to inequality challenges at these two levels, sufficiency-focused degrowth argues for redistribution between and within countries: "There is a level of human well-being compatible with the Biosphere's viability, but it entails that some have too little while others have too much" (Laurent, 2024, p. 13).

Overall, the circular economy aims to provide conflict-free win-win solutions mainly related to economic and environmental sustainability. At the same time, it overlooks the social problems of the current growth-oriented efforts to build economies and fails to consider who benefits from economic growth and who does not. (Corvellec et al., 2022.)

To conclude, a wide range of policy proposals that include the sufficiency-focused approach already exist: work time reduction, universal basic income, universal basic services, and a maximum income cap, to name a few (Kallis et al., 2025). Moreover, studies have proposed how a sufficiency-focused approach can be included in organizational activities by adding democratic governance (Khmara & Kronenberg, 2018), being local and community-based (Hankammer et al., 2021), and considering non-human life (Nesterova, 2020). Some sufficiency-focused proposals (e.g., making products that last (Khmara & Kronenberg, 2018)) fit the growth-oriented green growth approach and the circular economy in it. As an illustration, sufficiency-focused policy proposals have recently been examined specifically from the perspective of advancing the circular economy (see, e.g., Leinonen & Lappalainen, 2023). However, some sufficiency-focused proposals (e.g., deviation from profit maximization (Nesterova, 2020)) challenge the circular economy.

In all, while a wide range of proposals exists, less focus has been placed on transformative enough proposals that would enable sustainable and inclusive sufficiency-focused economies to come to fruition (Kallis et al., 2025). To foster the change, the hegemony of economic growth needs to be further questioned. The circular economy can start the questioning and the flourishing of sufficiency-focused economies by letting the already existing sufficiency aspects of the circular economy concept bloom (Bocken et al., 2022) and by challenging decoupling and inequality.

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Blinded by Circularity: Ignoring Critical Limitations in the Quest for Sustainability – the Case of Operations and Supply Chain Management

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Abstract: This study critically examines the circular economy (CE) concept through two systematic literature reviews, conducted across general management and economics (28 articles) and operations and supply chain management (45 articles). The research addresses two key questions: how CE criticisms can be systematically categorised and how profoundly these criticisms are reflected in OSCM discussions. The analysis reveals six major criticism categories: conceptualisation, efficiency, implementation, regulation, product/process, and economic value. A critical finding shows that while OSCM literature acknowledges CE criticisms, only 20 % of publications move beyond superficial mentions to propose actionable solutions. The study challenges the prevailing utopian assumptions surrounding CE, revealing a disconnect between acknowledging limitations and addressing them in a meaningful way. The authors argue for interdisciplinary collaboration and deeper embedding of CE criticisms into research frameworks to develop realistic and implementable solutions rather than maintaining idealistic visions of circularity.

Keywords: Circular economy, criticism, sustainability, literature review, operations and supply chain management

Blind vor lauter Zirkularität: Das Ignorieren kritischer Limitationen auf dem Weg zur Nachhaltigkeit – der Fall des Operations und Supply Chain Managements

Zusammenfassung: Diese Studie untersucht kritisch das Konzept der Kreislaufwirtschaft (CE) durch zwei systematische Literaturübersichten in der allgemeinen Management- und Wirtschaftsliteratur (28 Artikel) sowie im Operations- und Supply Chain Management (45 Artikel). Dabei fokussiert sie auf zwei zentrale Fragen: wie CE-Kritikpunkte systematisch kategorisiert werden können und wie tiefgreifend diese Kritik in OSCM-Diskussionen reflektiert wird. Die Analyse identifiziert sechs Hauptkritikkategorien: Konzeptualisierung, Effizienz, Implementierung, Regulierung, Produkt/Prozess und wirtschaftlicher Wert. Die Ergebnisse zeigen, dass die OSCM-Literatur zwar CE-Kritik anerkennt, jedoch nur 20 % der Publikationen über oberflächliche Erwähnungen hinausgehen und konkrete, umsetzbare Lösungsansätze vorschlagen. Die Studie hinterfragt die vorherrschenden utopischen Annahmen zur Kreislaufwirtschaft und deckt eine problematische Diskrepanz zwischen der

Nennung von Limitationen und deren zielgerichteter wissenschaftlicher Behandlung auf. Die Autoren plädieren für verstärkte interdisziplinäre Zusammenarbeit und eine tiefere Einbettung der CE-Kritik in zukünftige Forschungsrahmen zur Entwicklung realistischer Lösungsansätze.

Stichwörter: Kreislaufwirtschaft, Systematische Literaturrecherche, Operations and Supply Chain Management, Kritik

1. Introduction

In a world struggling with environmental degradation, planetary boundaries, and social crises, the circular economy (CE) concept is widely promoted as a "silver bullet" for overcoming this grand challenge of our time (Rodriguez-Anton *et al.*, 2019; Desing *et al.*, 2020; Dzhengiz *et al.*, 2023). However, its enthusiastic and widespread acceptance as a universal solution towards sustainability risks reinforcing a comforting yet superficial illusion, promising change while masking deeper structural problems.

In its idealised form, a CE system harmonises socio-economic development with planetary boundaries by significantly reducing material system inputs and waste system outputs (Korhonen, 2004; Korhonen *et al.*, 2004). This justifies why companies, national governments, and supranational organizations like the EU push the development of corporate strategies and political agendas to realise CE policies (Korhonen *et al.*, 2018b; Alvarez-Risco *et al.*, 2022a). However, despite these efforts and the expanding body of literature postulating CE as a blueprint for ecological transformation (Centobelli *et al.*, 2020; Dzhengiz *et al.*, 2023), also critical voices have recently grown louder (Korhonen *et al.*, 2018a; Korhonen *et al.*, 2018b; Corvellec *et al.*, 2022).

Challenging its positioning as a solution to many (or even all) sustainability challenges, scholars criticising CE have emphasised that recent approaches to conceptualisation, operationalisation, and implementation fail to account for the economic system's true complexities (Murray *et al.*, 2017; Corvellec *et al.*, 2022). As Blomsma & Brennan (2017) have pointed out, CE currently resembles an umbrella concept, creating utopian enthusiasm while falling short of practical operationalisation. Vague theoretical foundations, difficulties in the implementation, and unintended systemic consequences are just a few potential problems raising doubts about whether CE can deliver its promised outcomes (Desing *et al.*, 2020; Corvellec *et al.*, 2022). Thus, the current CE literature often misses insights about (1) scholarly awareness of CE criticism and (2) implications for possible agendas to address them—thus, they may represent an idealistic utopia that is fundamentally unattainable.

This paper critically confronts these issues in the context of operations and supply chain management (OSCM) as an important field within business and management studies. We do so by conducting two distinct systematic literature reviews with subsequent categorisation approaches. To get a first impression of the scope and severity of CE criticism, we start by reviewing the general management and economics (GME) literature, one of the primary publishing streams on CE. From there, we synthesise a first comprehensive set of criticisms. After completing this first phase of our study, we conduct an independent review of the OSCM literature (providing an example of a functional management discipline) to identify a second, discipline-specific set of criticisms. Based on anecdotal insights and the fact that—to the best of our knowledge—there is currently no systematic work

on CE criticism in the context of OSCM, we assume the field to be unaware of the existence of these criticisms. Finally, we integrate both perspectives into a holistic criticism framework.

The goal of this study is to critically challenge the prevailing utopian assumptions surrounding the CE by raising awareness of its necessities and limitations within real-world business contexts. Further, we elaborate on the degree of consideration of these criticisms in the OSCM context. Thus, our research questions are as follows:

RQ1: What are the criticisms of CE, and how can they be systematically categorised?
RQ2: How profound are these criticisms reflected in OSCM discussions and implications?

Based on a selection of 73 papers, we aim to support scholars and practitioners moving to a deeper and actionable understanding of the true transformative potential inherent to the CE concept. Our analysis seeks to serve as a critical entry point, challenging scholars to rethink predominant mental models and established narratives, and confronting unresolved tensions in future interdisciplinary research. Compiling the GME and OSCM-specific criticisms offers an up-to-date overview to all scholars and practitioners interested in contributing to conceptualising and implementing a CE system. Further, our criticism framework marks a starting point for future work that delves deeper into the development of more attainable CE policy solutions.

We position this paper as a timely problematising statement in a period of a continuously growing body of CE literature. Based on our results, reviewing previous initiatives and research approaches to guide future CE implementation is instructive. Note that we acknowledge the limitations and imperfections of our work, which is not intended to serve as a contribution to CE conceptualisation or policy development, but rather as a provocative and critical examination of the shortcomings within current research agendas. We aim to raise scholars' and practitioners' awareness of the flaws of current approaches to achieve a more holistic understanding, with the aim of realising the full potential of CE systems. Thus, the contribution of this study is threefold:

1. The paper presents a problematising statement about the negligence of CE criticism in current research agendas in management and business. We advance prior systematic categorisations (Jesus & Mendonça, 2018; Korhonen *et al.*, 2018a) by responding to the evolving research landscape surrounding CE over the past years (Norouzi *et al.*, 2021).
2. Our analysis strongly recognises critical CE aspects, while at the same time, few approaches to overcoming these are supported with empirical or conceptual evidence.
3. The categorisation enables scholars and practitioners to raise awareness of the CE's limitations and to integrate these into the transition process towards circularity.

The subsequent sections are organised as follows: Section 2 presents a short review of existing literature. Section 3 outlines the methodology for data search and the results of our descriptive analysis. Section 4 presents the results of our analysis and the integration of our two frameworks. Further, theoretical and practical contributions are discussed. Finally, Section 5 addresses study limitations and highlights research avenues.

2. Related literature

Between 2016 and 2020, the total number of CE-related publications doubled (Norouzi *et al.*, 2021), with the top five publishing journals being the *Journal of Cleaner Production* (1,064 articles), *Sustainability* (926), *Resources, Conservation and Recycling* (445), *Waste Management* (223), and *Science of the Total Environment* (207) (Alvarez-Risco *et al.*, 2022b).[1] Many of these publications present CE as a restorative and regenerative system that balances socio-economic development with planetary boundaries. However, critical voices have emphasised several key limitations of the CE approach (Korhonen *et al.*, 2018b; Corvellec *et al.*, 2022). While several studies have critiqued singular specific CE aspects (e.g., Zink & Geyer, 2017; Babbitt *et al.*, 2018), relatively few have explored CE criticisms more systematically (e.g., Korhonen *et al.*, 2018b; Jesus & Mendonça, 2018).

One of the main concerns inherent in current CE approaches is their flawed conceptual definitions (Korhonen *et al.*, 2018b; Desing *et al.*, 2020). Predominantly shaped by practitioners, consultancies, and policymakers with the goal of emphasising expertise in the topic, these definitions prioritise economic benefits while overlooking the social dimensions of CE (Kirchherr *et al.*, 2017). Similarly, this practitioner-oriented approach lacks interdisciplinary collaboration in its scientific and conceptual development (Millar *et al.*, 2019). Other scholars have criticised the CE for issues related to supply limitations and price volatility (Babbitt *et al.*, 2018), inferior material quality (Zink & Geyer, 2017), and contamination (Baxter *et al.*, 2017). Further concerns include rebound effects, where, paradoxically, demand for materials increases rather than decreases (Greer *et al.*, 2021; Corvellec *et al.*, 2022).

Exploring CE criticism systematically, Jesus & Mendonça (2018) identify four major barriers to developing circular business models: (1) technical, (2) economic, (3) institutional and regulatory, and (4) social and cultural barriers. The development of viable business models is further complicated by unrealistic assumptions in CE research, which tend to overlook already implemented best practices in firm policies (Bansal *et al.*, 2024). Further, Korhonen *et al.* (2018a) identified six fundamental CE challenges related to:

(1) Thermodynamic principles; each material loop experiences dissipation and entropy, leading to material losses that inevitably necessitate the addition of new raw materials and energy (see also Cullen, 2017; Giampietro & Funtowicz, 2020),
(2) System boundaries; including the risk of surpassing physical and environmental constraints (see also Rockström *et al.*, 2009; Desing *et al.*, 2020),
(3) Limits to economic growth (see also Jesus & Mendonça, 2018),
(4) Path dependencies,
(5) Governance of inter-organisational and inter-sectoral circular material flows (see also Jesus & Mendonça, 2018),
(6) Physical energy flows.

Despite a substantial body of work addressing these criticisms within the GME literature, there remains a notable lack of critical exploration of the CE in OSCM. To date, no

1 As our article aims to take a critical stance, we acknowledge (but will not further discuss) recent criticism of supposedly unethical publication practices of at least two of these journals (Journal of Cleaner Production and Sustainability). We thank one of our reviewers for pointing this out. However, given the topical fit of these journals (and the fact that they have, of course, published good papers nevertheless), we retain them in our analysis.

review has focused specifically on criticisms of circularity or the extent to which these are considered in OSCM research on CE. This raises concerns that the overwhelmingly optimistic assumptions surrounding the concept may become normalised, limiting opportunities for critical reflection (Lazarevic & Valve, 2017).

3. Research method and descriptive results

The present study systematically categorised criticisms of CE into an integrated framework. A sequential two-step systematic literature review approach was employed, as illustrated by Figure 1. The two phases of our study were distinguished according to their respective purpose. In **Phase 1**, a systematic literature review was conducted in the field of GME as the primary literature stream publishing CE studies. Motivated by our initial assumption of OSCM literature (as a functional management discipline) not knowing about criticism aspects of CE, the purpose of this phase was to gain an initial understanding of the scope and severity of criticism discussed in the literature. Relevant literature for this phase was gathered in October and November 2023.

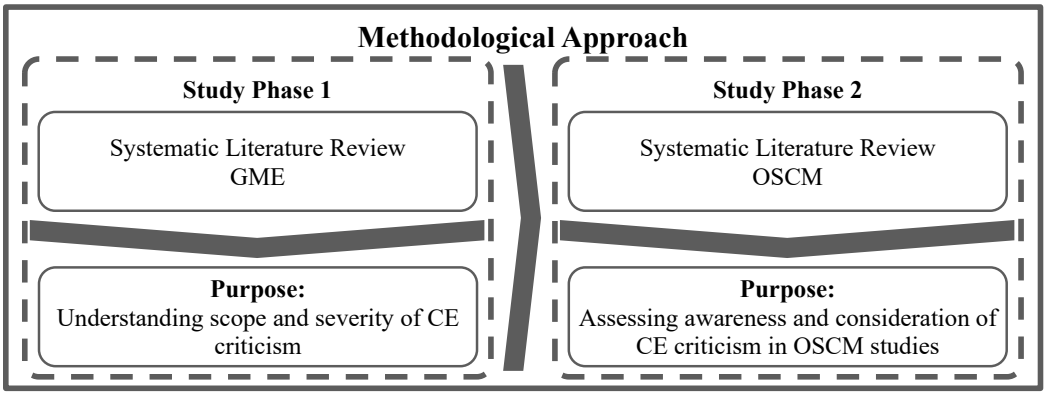

Figure 1: Sequential literature review approach

Phase 2 of our study involved an independent second systematic literature review in the field of OSCM. The objective was to assess the awareness of CE criticism in OSCM and, more importantly, the degree of their consideration in the discussions and implications in this field. Relevant literature for this phase was gathered in March and April 2024.

Combining the two perspectives of these separate, yet interlinked literature streams enabled the development of a holistic categorisation framework of CE criticisms. Both phases of our study adhered to established methodological guidelines for conducting systematic literature reviews. Although various types of literature reviews contribute significantly to research, systematic reviews are typically considered more objective than, for instance, narrative reviews. Such rigour is achieved through a transparent methodology that includes all relevant materials, enabling replication of the study by following the same steps (Thomé *et al.*, 2016). Our approach, aligned with the methodologies of Thomé *et al.* (2016), Seuring & Gold (2012), and Tranfield *et al.* (2003), involved four key stages after formulating the research question: (1) identifying and selecting sources, (2) extracting data, (3) analysing and synthesising data, and (4) presenting the results. Referring to stage

(1), the following scientific databases were selected for both phases of our study: EBSCO Academic Search Premier, EBSCO Business Source Premier, Scopus, and Web of Science. These databases were used in other literature reviews, for example by Beske-Janssen *et al.* (2015), and included all important scientific journals in the field of GME and OSCM.

For our qualitative content analysis, guidelines established by Mayring (2022) were used to ensure transparency and to achieve intersubjectivity. In both phases, data were independently reviewed line-by-line and relevant text passages were coded in-vivo (Manning, 2017). To reduce subjectivity inherent in data interpretation and to establish a certain degree of reliability, the approach followed the guidelines from Milne & Adler (1999). Thus, in both phases, coding and categorisation were performed independently by two scholars (one of which was one of the authors). The second scholar was an independent third person, different in each study phase. After each level of code aggregation, deviations between coding results were identified and discussed until consensus was reached. On the software side, analysis and synthesis were supported by MAXQDA, which facilitated coding, organisation of codes, and categorisation.

3.1 Study phase 1: Literature review in GME

Following the database selection, the keywords suitable for searching these databases were defined. For the GME review, search terms that aligned with our purpose of developing an initial understanding of the scope and severity of CE criticisms were selected. Thus, our GME search string was drafted using two keywords combined with an AND operator: "*Circular economy*" AND "*critic**". The search string was designed to be explicitly focused on CE criticisms, thus, limited to the articles' title and keywords. Restricting the search to titles and keywords ensured that selected studies directly engaged with CE criticism as a core topic, initially eliminating studies discussing CE more generally.

Our selection comprised journal and review articles, and conference proceedings in English, beginning in 1966, associated with the first notion of circularity (Boulding, 1966). A total of 669 publications were found in a first search. After screening publication titles and abstracts (1st check), articles were excluded from the analysis for the following reasons: (1) CE criticism discussed as secondary consideration only, (2) duplicate, and (3) restricted article access. Thus, 126 titles were identified as suitable for further analysis. In an initial screening of the full texts (2nd check), further articles were excluded from the sample (for instance Camacho-Otero *et al.*, 2018; Demestichas & Daskalakis, 2020). In these cases, the search term "*critic**" referred to other concepts rather than to CE. After this screening, 27 articles were found suitable for the review, enriched by one publication resulting from a backward search. Thus, 28 articles were selected for the sample. The full list of references is available at https://osf.io/zdaq9/ (DOI: 10.17605/OSF.IO/ZDAQ9).

Our process of data extraction in study phase 1 returned 157 in-vivo codes. Higher-order code categories were derived inductively through code generalisation and abstraction. This systematic approach allowed for tracing and verifying the procedure and, thus, established a certain level of inter-subjectivity.

The retrieved in-vivo codes were reviewed one by one. At the first occurrence of a criticism code, a first-order category was formed and assigned a name that was close or identical to the original text. For each subsequent in-vivo code, it was decided whether the code fell under an existing category or needed a new category. To identify overarching categories in the GME review, the level of abstraction was increased by clustering a total

of 86 first-order categories into 17 second-order categories. Then, overarching categories were derived by identifying commonalities and similarities among the second-order codes, a process known as axial coding (Corley & Gioia, 2004). Ultimately, six overarching criticism categories were formed in the GME review (see Section 4).

3.2 Study phase 2: Literature review in OSCM

Similar databases were selected for study phase 2. However, a new, yet targeted search string was developed for the OSCM literature review compared to the one used in the GME review. The rationale for the different search strategy was the distinct purpose of study phase 2: assessing the awareness and actual consideration of CE criticism in OSCM studies. OSCM research (if at all) was assumed to discuss CE criticism as secondary considerations, only in combination with broader topics such as supply chain barriers and material challenges. Thus, the OSCM review required a broader and more inclusive search strategy to account for the different ways, CE criticisms were addressed in the field. To capture these discussions, additional terms besides the obvious keyword "*critic**" were included. Related terms frequently used in OSCM literature to describe sustainable supply chain complexity were incorporated, such as "*barrier*" and "*boundaries*" (e.g., Sarkis, 2012; Gupta *et al.*, 2020), using Boolean operators. Furthermore, our search strategy was extended to the articles' full texts rather than solely titles and keywords. See Table 1 for the complete OSCM search string.

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"Circular Economy" OR *"Circularity"* OR *"Circular Business"* OR *"Circular**"* AND *"critic**"* OR *"challenge**"* OR *"barrier**"* OR *"boundaries**"* AND *"Operations Management"* OR *"Supply Chain Management"* OR *"Operations and Supply Chain Management"*

Table 1: Keyword string applied in database search

In the OSCM review, a test run in March 2024 resulted in over 12,000 literature items. Thus, the search was refined by implementing stricter formal criteria which comprised journal and review articles as well as conference proceedings in English over a ten-year period beginning in 2013. A total of 2,941 publications were found in a first search. After screening publication titles and abstracts (1st check), 133 titles were identified as suitable for further analysis. An initial screening of the full texts (2nd check) resulted in 41 articles suitable for the review, enriched by four publications resulting from a backward search. Thus, 45 articles were selected. The full list of references is available at https://osf.io/zdaq9/ (DOI: 10.17605/OSF.IO/ZDAQ9).

The larger size of our OSCM-specific sample compared to the GME sample can be attributed to two factors: (1) the distinct purposes of each sample, with the GME sample serving as an initial overview of the scope and severity of CE criticism, and (2) a variation in search strategy. The GME review searched for articles that *explicitly* focused on reporting CE criticisms, for instance Jesus & Mendonça (2018); Corvellec *et al.* (2022); thus, the restricted search string and search scope (only title and keywords). The second

search attempted to be more inclusive, identifying all sources within OSCM that somehow (usually only in combination with other topics) address the question of CE criticism, for instance Takacs *et al.* (2022); Sonar *et al.* (2023).

A similar procedure for data extraction, analysis, and synthesis as described in Section 3.1 was applied in the OSCM review. Thus, higher-order code categories were derived inductively through code generalisation and abstraction. Reviewing the OSCM sample of 45 articles, our data extraction returned 1,011 in-vivo codes. From there, 167 first-order categories were clustered into 28 second-order categories. Contradicting our initial assumption of the OSCM literature being potentially sparse on CE criticisms (and, thus, to our surprise), the similar six overarching categories as in GME resulted independently also for OSCM (see Section 4). Based on that insight, a "cross-case analysis" between the two reviews on the second-order code level was conducted to elaborate and align both coding frameworks. Through iterations, a clear and standardised coding scheme was developed. For both phases of our study, the coding and data synthesis are available at https://osf.io/zdaq9/ (DOI: 10.17605/OSF.IO/ZDAQ9).

3.3 Descriptive analysis and cross-citation check

A descriptive analysis of the two literature samples shows that our 73 articles are published across 33 different academic journals between 2007 and 2024. Of these, 16 journals primarily focus on economic and environmental issues. A total of 9 journals have published two or more articles, including: *Journal of Cleaner Production* (12 articles), *Resources, Conservation and Recycling* (9 articles), *Sustainability* (5 articles), *Business Strategy and the Environment* (5 articles), *Ecological Economics* (5 articles), *Sustainable Production and Consumption* (4 articles), *Production Planning & Control* (4 articles), *Journal of Industrial Ecology* (3 articles), and *International Journal of Production Research* (2 articles). In contrast, 24 other journals have published one article each. Over both samples, seven articles have been cited more than 1,000 times. Another seven articles have been cited between 500 and 1,000 times and twenty-two articles between 100 and 500 times.

As stated previously, the two reviewed literature streams and the selected samples were considered to be distinct, yet an intuitive expectation of a significant overlap is acknowledged. Although both reviews followed the similar procedural logic, the separation between GME and OSCM literature emerged during the OSCM sample's screening stage rather than through explicit pre-filtering of journals in the search process. The GME sample includes all papers explicitly focussing on CE criticism, whereas the OSCM review prioritised all studies addressing operational, logistical, and supply chain aspects of CE, even if they only indirectly mention CE criticism. This approach naturally limited the sample overlap, as studies centred on CE criticism as secondary considerations were excluded from the GME sample. Similarly, those that focus solely on CE criticism without sufficient OSCM relevance were filtered out of the OSCM sample, aligning with the objective of phase 2. Learning effects between searches (especially during the OSCM coding stage) were avoided, as an independent third person, different for each study phase, supported the process.

To support our claim of two distinct, yet interlinked literature samples, a cross-citation analysis was conducted to better understand the interrelations between the two samples. If a significant number of cross-citations were found, the streams would share similar

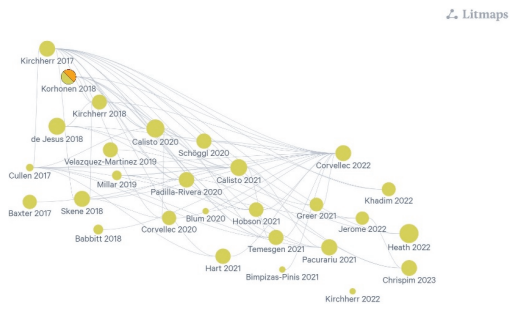
research directions and should not be considered distinct in the following comparative analysis. On the software side, the cross-citation analysis was conducted manually, with results documented in an Excel file available at https://osf.io/zdaq9/ (DOI: 10.17605/OSF.IO/ZDAQ9). LitMap was used to visualise the links between the publications with green knots representing GME articles and orange knots representing OSCM articles.

Notably, the article by Korhonen *et al.* (2018a) is the only publication that appears in both review samples, indicating its fundamental role in the literature on CE criticism. According to Google scholar, the article has been cited over 4,700 times (as of March 18, 2025). A key reason for the small overlap between the two samples, beyond Korhonen *et al.* (2018a), is the differing roles of CE criticism in each field. The GME literature often critiques CE at a fundamental level, questioning its theoretical consistency and policy implications, whereas OSCM research tends to incorporate these criticisms as secondary considerations within discussions of business feasibility and technological barriers. As a result, several OSCM papers reference foundational CE criticisms from GME literature but do not engage with them as a primary focus, leading to their exclusion from the GME sample in study phase 1.

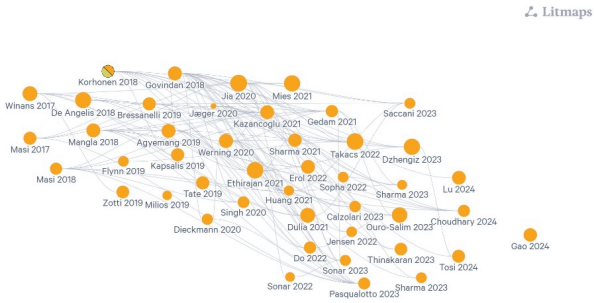
As shown in **Figure 2a**, our GME sample is densely interconnected. Of the 28 articles in the sample, 27 articles have one or more interconnections. Notably, one article (Kirchherr, 2022) appears fully independent and not connected to both the remaining 27 articles in the sample as well as to the OSCM sample. We assume that the paper's specific focus on post-growth circularity, coupled with a call for a CE model that incorporates growth, is the reason for the observed lack of interconnection. As shown in **Figure 2b**, also our OSCM sample shows strong interconnections. Of the 45 articles in the sample, 44 articles have one or more mutual linkages. Notably, one article (Gao *et al.*, 2024) appears fully independent and not connected to the remaining 44 articles in the sample or the GME sample. We argue that the paper's recent publication in 2024 is the reason for the missing interconnection.

As shown in **Figure 2c**, the articles in our GME sample are further influenced by the OSCM research stream. Of the 28 articles in the GME sample, ten articles (35 % of the total GME sample) contain references to our OSCM sample. Finally, as shown in **Figure 2d**, our OSCM sample is influenced by the GME research stream. Of the 45 OSCM articles, 30 articles (66 % of the total OSCM sample) reveal references to our GME sample. The higher influence of GME articles on the OSCM literature sample indicates the more specific research field of OSCM. Scholars interested in CE studies in OSCM build on the grounding literature majorly published in the GME stream to develop their own research cases and questions. This is supported by the fact that seven of the 12 GME articles referenced by the OSCM stream are cited over 200 times. In contrast, only four articles from the OSCM literature referenced by the GME sample receive over 200 citations.

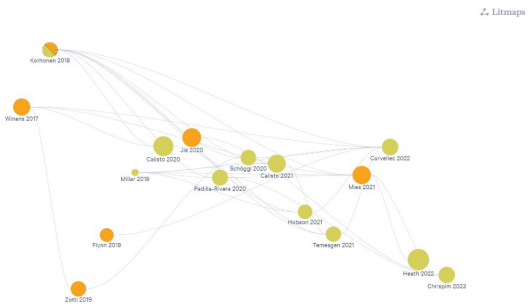
2a: Cross-citation network map: GME literature



2b: Cross-citation network map: OSCM literature



2c: Cross-citation network map: GME influenced by OSCM literature



2d: Cross-citation network map: OSCM influenced by GME literature

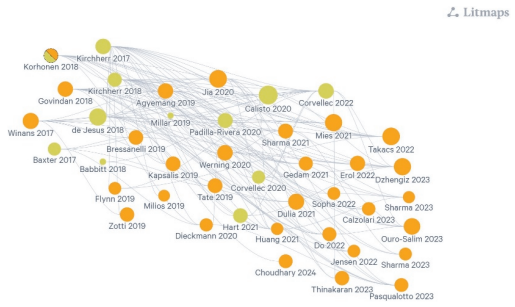


Figure 2: Cross-citation analysis of retrieved literature samples; green knots represent GME articles; orange knots represent OSCM articles.

4. Categorisation framework and discussion

4.1 Categorisation of criticisms of the CE concept

The subsequent section outlines the categories of criticism identified and compiled in both phases of our study. To ensure consistency in abstraction and comparability, all first- and second-order codes from both reviews were cross-checked, resulting in a clear and standardised coding scheme. As stated above, six very similar overarching categories emerged independently in both reviews, for which we report the consolidated names:

(1) Criticism inherent to the **conceptualisation**; related to the vagueness and inconsistency of CE definitions, the lack of clear metrics, and conceptual ambiguity regarding its economic, social, and environmental impact,
(2) Criticism related to **efficiency**; concerns about CE's actual transformative potential in reducing resource consumption, including, for instance, material losses, which undermine the long-term sustainability claims of CE,
(3) Criticism inherent to the **implementation**; practical challenges in adopting CE, such as infrastructural gaps, supply chain inefficiencies, and limited expertise,
(4) Criticism related to (political) **regulation**; legal and policy-related barriers to CE adoption, including weak incentives, fragmented regulations, and a lack of enforcement, leaving CE practices largely voluntary,
(5) Criticism related to the **products/processes**; technological and design-related challenges, such as, for instance, limited recyclability and production constraints, and
(6) Criticism related to the **economic value**; financial and market uncertainties in CE models, including, for instance, profitability concerns and fluctuating demand for recycled materials.

The compiled categorisation framework is illustrated in Table 2 at the second-order category level. The first and second column provide examples of the second-order categories and their related references. In addition, column three indicates the literature stream, the respective second-order code originated from. The overarching categories are displayed in the table headers. A full overview, including the complete coding framework, is available at https://osf.io/zdaq9/ (DOI: 10.17605/OSF.IO/ZDAQ9). This data (including, amongst others, first-order categories and second-order definitions), allows for a deeper understanding and distinction of seemingly overlapping second-order categories, like "lack of communication and information along supply chain" and "lack of supply chain cooperation and coordination". In this example, the first item relates to interactional aspects of actual communication processes in supply chains, the second to institutional and managerial aspects of supply chains. We refer to our complete coding scheme and the respective first-order codes for further insight.

The fact that both frameworks, despite originating from different datasets, contain similar overarching categories directly challenged our initial belief that OSCM scholars were unaware of the critical issues surrounding the CE concept. This also challenged the accepted notion of CE utopia, suggesting that criticism has (at least) been mentioned in the OSCM literature (Bocken *et al.*, 2023). However, a logical follow-up question remained: How thoroughly are criticisms considered in the field's discussions and implications?

Our consideration analysis resulted in a sobering insight. The OSCM literature, while acknowledging the criticisms, largely fails to rigorously integrate them into discussions

and implications (e.g., Biancolin *et al.*, 2023; Thinakaran *et al.*, 2023; Tosi *et al.*, 2024). Rather than confronting the referenced criticisms head-on, most publications solely "mention" them in passing within their literature reviews. Note that our result might even be over-optimistic since studies of CE in OSCM that do not at least mention criticisms of the concept are not included in the sample due to the design of our search string. Thus, our findings triggered the problematising statement that precise alignment between identified critical aspects and tangible solutions remains rare in the literature. Only 20 % of publications in our OSCM sample, 9 out of 45 articles, do more than merely state CE criticisms, proposing concrete policies or actionable levers to overcome criticism or discussing their findings in this context (Angelis *et al.*, 2018; Bressanelli *et al.*, 2019; Gedam *et al.*, 2021; Sopha *et al.*, 2022; Takacs *et al.*, 2022; Calzolari *et al.*, 2023; Saccani *et al.*, 2023; Sharma *et al.*, 2023b; Lu *et al.*, 2024). This lack of consideration casts serious doubt on the depth of many publications, raising concerns about their true value (Norouzi *et al.*, 2021). Such superficiality has plagued other research areas, weakening the rigour of both results and methodologies (Bachrach *et al.*, 2017).

Criticism Category #1: Criticism inherent to the conceptualisation		
Second-order categories	**Exemplary references**	**Literature stream**
Conceptual definition	Corvellec *et al.* (2022); Kirchherr *et al.* (2017)	GME
	Dzhengiz *et al.* (2023); Zotti & Bigano (2019)	OSCM
Poor/absent measurements	Jerome *et al.* (2022); Pacurariu *et al.* (2021)	GME
	Singh *et al.* (2020)	OSCM
Conceptual consideration	Corvellec *et al.* (2022); Korhonen *et al.* (2018b)	GME
	Jaeger & Upadhyay (2020); Korhonen *et al.* (2018b)	OSCM
Social ambiguity	Schöggl *et al.* (2020); Chrispim *et al.* (2023)	GME
	Takacs *et al.* (2022); Angelis *et al.* (2018)	OSCM
Conceptual grounding	Calisto Friant *et al.* (2021); Jesus & Mendonça (2018)	GME
Conceptual comprehension	Calzolari *et al.* (2023); Do *et al.* (2022)	OSCM
Contextual ambiguity	Jensen *et al.* (2022); Angelis *et al.* (2018)	OSCM

Criticism Category #2: Criticism related to efficiency		
Second-order categories	**Exemplary references**	**Literature stream**
Poor assessment of actual efficiency	Corvellec *et al.* (2022); Skene (2018)	GME
	Sopha *et al.* (2022); Bressanelli *et al.* (2019)	OSCM
Consumer ambiguity	Chrispim *et al.* (2023); Corvellec *et al.* (2022)	GME
	Do *et al.* (2022); Sopha *et al.* (2022)	OSCM
Environmental ambiguity	Corvellec *et al.* (2022); Skene (2018)	GME
	Zotti & Bigano (2019); Korhonen *et al.* (2018b)	OSCM
Lack of expertise	Huang *et al.* (2021); Bressanelli *et al.* (2019)	OSCM
Poor balance of priorities	Lu *et al.* (2024); Dzhengiz *et al.* (2023)	OSCM
Criticism Category #3: Criticism inherent to the implementation		
Second-order categories	**Exemplary references**	**Literature stream**
Lack of implementation infrastructure	Greer *et al.* (2021); Jesus & Mendonça (2018)	GME
	Singh *et al.* (2020); Bressanelli *et al.* (2019)	OSCM
Lack of supply chain cooperation and coordination	Corvellec *et al.* (2022); Jesus & Mendonça (2018)	GME
	Gao *et al.* (2024); Sharma *et al.* (2023a)	OSCM
False assumptions	Kirchherr *et al.* (2018)	GME
Organisational culture	Kirchherr *et al.* (2018)	GME
Lack of organisational change	Gao *et al.* (2024); Dieckmann *et al.* (2020)	OSCM
Lack of inclusion and support	Erol *et al.* (2022); Gedam *et al.* (2021)	OSCM
Lack of communication and information along supply chain	Sharma *et al.* (2023a); Bressanelli *et al.* (2019)	OSCM
Lack of clear responsibilities	Sharma *et al.* (2023a); Mangla *et al.* (2018)	OSCM

Criticism Category #4: Criticism related to (political) regulation		
Second-order categories	**Exemplary references**	**Literature stream**
Insufficient regulation and law enforcement	Calisto Friant *et al.* (2021); Jesus & Mendonça (2018)	GME
	Sharma *et al.* (2023a); Erol *et al.* (2022)	OSCM
Lack of appropriate incentives	Bimpizas-Pinis *et al.* (2021); Kirchherr *et al.* (2018)	GME
	Sharma *et al.* (2023a); Govindan & Hasanagic (2018)	OSCM
Lack of governmental participation	Erol *et al.* (2022); Winans *et al.* (2017)	OSCM
Criticism Category #5: Criticism related to the products/processes		
Second-order categories	**Exemplary references**	**Literature stream**
Technological innovation	Heath *et al.* (2022); Babbitt *et al.* (2018)	GME
	Sharma *et al.* (2023a); Do *et al.* (2022)	OSCM
Poor CE product design	Singh *et al.* (2020); Bressanelli *et al.* (2019)	OSCM
Poor CE process design	Do *et al.* (2022); Jensen *et al.* (2022)	OSCM
Poor chemical / physical material stability	Takacs *et al.* (2022); Dieckmann *et al.* (2020)	OSCM
Criticism Category #6: Criticism related to the economic value		
Second-order categories	**Exemplary references**	**Literature stream**
Business models	Chrispim *et al.* (2023); Kirchherr *et al.* (2018)	GME
	Calzolari *et al.* (2023); Takacs *et al.* (2022)	OSCM
Economic uncertainty	Kirchherr *et al.* (2018); Jesus & Mendonça (2018)	GME
	Sharma *et al.* (2023a); Bressanelli *et al.* (2019)	OSCM
Cost uncertainty	Singh *et al.* (2020); Jaeger & Upadhyay (2020)	OSCM
Market uncertainty	Bressanelli *et al.* (2019); Govindan & Hasanagic (2018)	OSCM

Table 2: Criticism frameworks and comparison on second-order category level

4.2 Discussion of results

This study compiled six key categories of CE criticism encountered in the GME and OSCM literature. We propose a systematic framework that structures these criticisms to foster future development on the topic. The results emphasise the growing need to integrate these criticisms more thoroughly into the scientific discourse on CE, particularly within the OSCM domain. Our six-part categorisation advances prior systematic categorisations, such as Jesus & Mendonça (2018) and Korhonen *et al.* (2018a), by responding to the evolving research landscape surrounding the CE over the past years (Norouzi *et al.*, 2021). At the time of earlier considerations of criticism, "*the scientific and research basis of the CE approach seems to be only in its infancy*" (Korhonen *et al.*, 2018a: 41), with limited empirical grounding and fragmented conceptual development. In contrast, our study is situated in a period of scientific progress in the field, based on an expanded body of literature.

Enabling a more differentiated and rigorous analysis of CE criticisms, we do not merely refine previous categories, but recognise that the identified categories (conceptualisation, efficiency, implementation, regulation, product/process, and economic value) are deeply interlinked rather than standalone concepts, influencing and reinforcing each other in multiple ways. Acknowledging and analysing these interdependencies more granularly is essential for advancing both research and practice. For instance, we identify conceptual ambiguities regarding CE definitions and measurement gaps (Category #1), which directly impact efficiency assessments (Category #2). Vague indicators based in these ambiguities lead to misleading and comforting conclusions about CE's environmental and economic benefits. Similarly, implementation barriers (Category #3), such as supply chain inefficiencies, are often exacerbated by regulatory weaknesses (Category #4). Insufficient policy incentives often fail to support a systemic transition from a linear to a circular economy. Furthermore, the economic applicability of circular business models (Category #6) is closely linked to product and process innovations (Category #5). Material limitations and technological innovation determine whether circular strategies can be profitably implemented and scaled. These interconnections emphasise the broader risk of treating criticisms in isolation and highlight the necessity of an integrated CE initiative; one that does not isolate individual criticisms but instead examines how they interact across different levels of analysis. Accordingly, our contribution attempts not only a more comprehensive taxonomy, but a critical advancement that allows the future discourse to be based on a more nuanced and actionable understanding of CE's limitations.

The different systemic levels of analysis (macro, meso, and micro; see Dopfer *et al.*, 2004) each affect various aspects of the CE criticism. The meso-level (networks, industries, or supply chains) represents the intermediate level of analysis between the macro-level (broad, systemic structures like national economies or global policies) and the micro-level (individual firms, consumers, or products). Adding a level-of-analysis perspective helps to understand how designed CE interventions can be most effective. At the macro-level, CE criticisms are most relevant in discussions on policy development and global economic structures. For instance, regulatory barriers and economic uncertainties arise at the macro level. Research at this level should explore policy alignment and applicability, economic effects, and geopolitical challenges influencing CE transitions. At the meso-level, criticisms related to supply chain integration and industry-specific CE implementation are investigated. Challenges such as supply chain inefficiencies, material-

flow and sourcing constraints, and cooperative barriers between firms necessitate network analysis and cross-industry case studies. Finally, at the micro-level, criticisms focus on firm-level and consumer-level dynamics, including consumer behaviour and acceptance as well as technological feasibility. Product design flaws, production inefficiencies, and behavioural resistance to CE solutions are best studied at the micro level.

The identified criticism categories necessitate distinct research approaches to investigate their implications for CE theory and practice (Korhonen *et al.*, 2018b). Overall, we propose interdisciplinary mixed-method research, for instance, combining descriptive literature reviews with practitioner insights. Bressanelli *et al.* (2019) demonstrated that many criticisms and key solution strategies are not fully captured in the literature alone but emerge through case studies involving firms actively engaged in CE practices already. Elaborating the identified categories in more detail, we propose specific research approaches for each category. For instance, conceptualisation-related criticisms, such as vague definitions, are best examined through qualitative research methods, including systematic literature reviews, expert interviews, and conceptual modelling (e.g., Lowe *et al.*, 2024). Similarly, regulatory criticisms, such as weak policy incentives, can be examined through qualitative policy analysis and stakeholder interviews to assess the fit of existing and future governance strategies. On the other hand, product- and process-related criticisms, which focus on technological feasibility and material quality, necessitate quantitative research, including prototyping, modelling and simulation, and industry-specific case studies (e.g., Kreye & van Donk, 2021). Economic value criticisms, which question the financial viability of CE business models, are best explored quantitatively through surveys and business case simulations (e.g. Mishra *et al.*, 2018). Efficiency-related criticisms, such as rebound effects, require quantitative research to assess empirical evidence. Life cycle assessments and material flow analyses are just a few approaches to quantify CE's impact on sustainability (e.g., Nasir *et al.*, 2017). Lastly, implementation-related criticisms, such as supply chain inefficiencies, would benefit from mixed-method research that combines case studies, surveys, and interviews with quantitative evaluations (e.g., Bansal *et al.*, 2024).

Note that our findings further reveal a much more profound issue in OSCM research on CE: articles in the field of OSCM often acknowledge CE criticisms, especially in their literature review sections, indicating why these articles were included in the sample. However, these articles rarely address the criticisms in their discussions and implication sections. Thus, despite the well-documented and even referenced limitations, the comforting and utopian illusion of CE remains largely unchallenged, suggesting a critical form of academic complacency. Such a disconnect raises concerns about the rigour and practical relevance of CE literature in OSCM. Notably, our review shows that only 20 % of the analysed studies moved beyond mentioning CE criticisms to propose actionable strategies, which underscored a broader reluctance to confront the complexities of CE head-on (Angelis *et al.*, 2018; Bressanelli *et al.*, 2019; Gedam *et al.*, 2021; Sopha *et al.*, 2022; Takacs *et al.*, 2022; Calzolari *et al.*, 2023; Saccani *et al.*, 2023; Sharma *et al.*, 2023b; Lu *et al.*, 2024). Without a shift towards integrating criticisms into discussions on future best practices and policies, OSCM risks further contributing to the utopian and idealised mental model of circularity that needs to be reconsidered.

It is crucial to note that the identified criticisms are not confined to one discipline. Instead, they are prominent across various fields, underscoring the need for interdisciplinary

collaboration rather than entrenching path-dependent silos (Brandão *et al.*, 2020). The multifaceted role that OSCM plays in the CE transition, from product design and manufacturing to end-of-life renovation, makes such cooperation even more critical (Bressanelli *et al.*, 2019). Without interdisciplinary efforts, realising the holistic vision of CE will remain an elusive goal (Lieder & Rashid, 2016). Furthermore, considering the broader impacts on social welfare strengthens the case for a discussion that transcends disciplinary boundaries (Merli *et al.*, 2018).

4.3 Contribution to theory and practice

This paper contributes to previous CE research in OSCM that has conceptualised CE drivers, enablers, and practices by emphasising the crucial need not only to incorporate the critical aspects of the concept into the conversation but to take their impacts into account when discussing CE in the context of OSCM. Thus, we connect our insights to the field of circular OSCM (Farooque *et al.*, 2019; Amir *et al.*, 2023). Our results enable future conceptual and quantitative studies to clarify each criticism's impacts on the CE effects on sustainability goals. Further, our results contribute to the conversation regarding how OSCM structures must develop to hold actual CE requirements rather than following a lock-in linear history.

Addressing these challenges requires a more integrated approach in future research, combining conceptual clarification with empirical validation. Scholars should focus on interdisciplinary collaboration to develop actionable solutions. Moreover, empirical research should prioritise assessing real-world impacts of CE initiatives, ensuring that future strategies are both economically viable and environmentally sustainable. By embedding these criticisms more deeply into research agendas, scholars can move beyond the idealised vision of CE towards more realistic, implementable solutions that drive systemic change.

Our findings also hold relevance for practitioners and policymakers. Although originating from the scientific literature, our framework builds a comprehensive reference of the most significant criticisms of the CE concept. Practitioners actively transforming existing linear structures could incorporate the findings into the development process of circular structures or policy action plans. It is crucial to critically reflect on current implementation plans together with existing and potentially new supply chain partners to succeed in the transition. For instance, conceptual ambiguities and inconsistent definitions hinder the development of standardised CE strategies, leading to inefficiencies in policy design and corporate adoption. Additionally, infrastructural and logistical barriers, such as inadequate reverse logistics systems and fragmented supply chain coordination, create operational inefficiencies that limit the feasibility of circular business models. Economic uncertainties, including high initial investment costs and secondary material markets, further discourage firms from adopting CE principles at scale. Thus, practitioners need to understand how CE is conceived, consented to, and implemented in their organisation, as proposed by Corvellec *et al.* (2022).

5. Conclusion, implications, and limitations

Motivated by the absence of a systematic categorisation of CE criticisms in the OSCM literature, this paper seeks to systematically map the criticisms of the concept based on both the GME and the OSCM literature. We conducted two independent systematic literature

reviews analysing 73 journal articles. Compiling the results of two distinct, yet interlinked data sets, our proposed criticism framework includes six overarching criticism categories: (1) conceptualisation, (2) efficiency, (3) implementation, (4) regulation, (5) product/process, and (6) economic value. The fact that both literature reviews independently resulted in similar categories directly challenged our initial assumption that OSCM scholars are unaware of the critical aspects of CE. Instead, the established theory of CE as utopia seems to be challenged even within the OSCM literature (Dzhengiz *et al.*, 2023).

However, our analysis exposes a more problematic reality: while scholarly research acknowledges the critical dimensions of CE, there remains a lack of robust integration of these criticisms into meaningful solutions addressing them. While most OSCM articles mention CE criticism in their literature reviews, only a minority truly engages with them in their analyses and discussions (e.g., Gedam *et al.*, 2021; Sopha *et al.*, 2022; Lu *et al.*, 2024). Considering this, it appears important that future conceptual and indicator-based models of CE not only acknowledge the identified criticisms but integrate them meaningfully with their implications during the analysis and discussion stages. This is crucial to successfully develop a CE concept that is actually suitable for addressing the grand challenge of our time (Korhonen *et al.*, 2018b) while preventing a naïve utopian approach to circularity.

From a methodological perspective, despite the principal rigour of our systematic literature review, certain limitations remain. The results are shaped by inclusion criteria, which might have led to the omission of relevant studies due to search terms or scope restrictions. Additionally, given the increasing dynamics surrounding CE research, some criticisms may become less relevant over time. Nevertheless, this study can serve as a reference point for periodic updates. The potential subjectivity in coding remains another limitation.

We have focused on one management discipline only: operations and supply chain management. Granted, we cannot completely exclude the possibility that peculiarities of this field bias our findings. However, based on our limited insights into the literature in other management disciplines, we perceive this as a rather unlikely issue, with other disciplines most likely following the pattern identified in our study for OSCM. Nevertheless, replication studies in other disciplines could shed more light on this potential shortcoming.

Looking forward, further research is essential to develop robust CE implementation examples incorporating the critical dimensions mapped in this review. Fostering a more realistic understanding of CE among scholars and practitioners, our criticism categories should inform future research and practical projects in this instance. Developing such research and project initiatives will be highly beneficial for both scholars and practitioners.

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Resilient Product Design: Effective Product Development for the Circular Economy

Thilo Pfletschinger, Merlin Stölzle and Matthias Kreimeyer

Summary: Companies are currently facing the challenge of having to transform their linear approach to product design into a circular one in order to remain competitive. The reason for this is the increasing pressure in the supply of primary resources, consumer and employee expectations, as well as requirements of financial institutions and tightening regulation with regard to general environmental impacts. A standardized procedure for implementation of circular design in product development is not yet established. Based on an interview study focusing on the product development of manufacturing companies in German-speaking countries, this article summarizes the greatest challenges in the implementation of circularity in products and offers possible solutions for implementation of circular design.

Keywords: Product design, product development, product architecture, circular economy

Resiliente Produktentwicklung – kreislaufgerechte Produktarchitekturen für zukunftsfähige Produkte und Unternehmen

Zusammenfassung: Unternehmen stehen derzeit vor der Herausforderung, ihre lineare Herangehensweise an die Produktgestaltung in eine zirkuläre umwandeln zu müssen, um wettbewerbsfähig zu bleiben. Der Grund dafür ist der zunehmende Druck bei der Versorgung mit Primärressourcen, die Erwartungen von Verbrauchern und Arbeitnehmern sowie die Anforderungen von Finanzinstituten und die Verschärfung der Regulatorik im Hinblick auf Umweltauswirkungen. Ein standardisiertes Vorgehen zur Umsetzung von kreislaufgerechter Produktentwicklung ist noch nicht etabliert. Basierend auf einer Interviewstudie mit Fokus auf die Produktentwicklung produzierender Unternehmen im deutschsprachigen Raum fasst dieser Artikel die größten Herausforderungen bei der Umsetzung von kreislaufgerechter Produktentwicklung zusammen und bietet Lösungsansätze für die Implementierung von Circular Design.

Stichwörter: Produktdesign, Produktentwicklung, Produktarchitektur, Kreislaufwirtschaft

Despite setbacks in environmental regulation, the fundamental trend towards sustainability and circular products remains and is even intensifying due to increased environmental

risks.[1] Businesses, especially in the manufacturing industry, must therefore adapt their product design to the challenges of a fundamentally changing economic world. Product planning, conceptualization, and design, referred to as 'development phase', determine the majority of costs and environmental impacts over the entire life cycle of a product.[2] This is why the development phase in particular offers significant potential for increasing resource effectiveness and efficiency as well as reducing greenhouse gas emissions.

To reveal the current challenges in the development of circular products in industrial practice, a total of 35 qualitative interviews were conducted in the first half of 2024. The semi-structured interviews lasted 90–120 minutes each. The majority of participants in the study were product architects, product sustainability managers, circular economy managers, and CxOs from the specialist areas of product and series development, sustainability, as well as research and pre-development. The participating functions were predominantly managers such as managing directors and board members, division and department heads, and project leaders and managers with responsibility for sustainability and the circular economy. In particular, automotive industry OEMs and 1st tier suppliers, mechanical and plant engineering, and medical technology from countries of the DACH region are strongly represented among the interviewees.

	R-Strategies	Description
Smarter product use and manufacture	R0: Refuse	Make product redundant by abandoning its function or by offering the same function with a radically different product
	R1: Rethink	Make product use more intensive (e.g. by sharing product)
	R2: Reduce	Increase efficiency in product manufacture or use by consuming fewer natural resources
Extend lifespan of product and its parts	R3: Reuse	Reuse by another customer of discarded product which is still in good condition and fulfils its original function
	R4: Repair	Repair and maintenance of defective product so it can be used with its original function
	R5: Refurbish	Restore an old product and bring it up to date
	R6: Remanufacture	Use parts of discarded product or its parts in a new product with the same function
	R7: Repurpose	Use parts of discarded product or its parts in a new product with a different function
Useful application of materials	R8: Recycle	Process materials to obtain the same or lower quality

Figure 1 R-Strategies according to Kirchherr[3]

The biggest barrier to be overcome to unlock the previously untapped potential of product development is a circular business model and the resulting targets as well as performance indicators for controlling the development process. Once a circular business model has been found, be it for a single R-strategy (see Figure 1) such as recycling, remanufacturing or refurbishment or a product-as-a-service model, the untapped potential of incorporating circular aspects in product development can be exploited. Car sharing models for example require a radical rethinking of how a car is designed: e.g. from a mileage of several hundred thousand kilometers to a few million kilometers.

1 World Economic Forum. Global Risks Perception Survey 2023–2024.
2 VDI Zentrum Ressourceneffizienz (2024). Produktentwicklung & ihr Einfluss auf Ressourceneffizienz. https://www.ressource-deutschland.de/themen/produktentwicklung/. Last checked: 15.11.2024.
3 Julian Kirchherr, Denise Reike, Marko Hekkert. Conceptualizing the circular economy: An analysis of 114 definitions. Resources, Conservation and Recycling, Volume 127, 2017, Pages 221–232, ISSN 0921–3449.

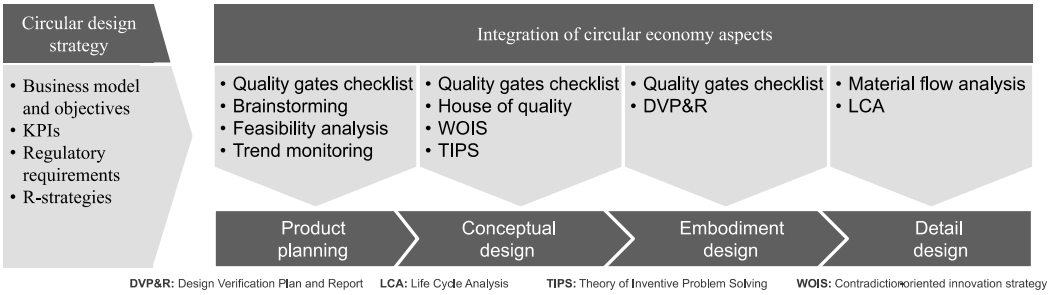

Figure 2: Potential methods used to integrate circular economy aspects in the product development process

But how to transition a highly standardized and well-established research and development (R&D) into the circular economy? Study results show that first ideas exist but no standardized approach to circular design has yet been established in industry (see Figure 2).[4]

Extending existing development processes, methods and tools to a circular approach with an update of quality gate checklists is crucial, but does not go far enough. In addition to the state-of-the-art product development principles of systems thinking, lean and agile, the design methodology must be supplemented by circular principles and practices. A systems engineering approach can be the solution for linking these aspects. This begins with defining clear targets based on double materiality and circular business model analysis at the very start of the development process, e.g.

- What are our material topics? These topics can be inside-out like pollution, emissions or high energy, critical material or water consumption as well as outside-in like climate risk impacts, scarcity of resources or new regulatory requirements.
- Which R-strategy is being pursued? Due to the specifics of the individual circular strategies, implementation must be evaluated individually in each case.
- How tight are the component and material cycles set? This means closing loops within a product, company, industry or even beyond.
- What are our hotspot materials? Specify which materials to be handled with specific care throughout product development like for example nickel, lithium or cobalt in electric mobility.

Integrating "Design-for-X" and other circularity criteria catalogs into the conceptual design phase, e.g. Design-for-Recycling, -Disassembly, -Upgradeability, etc. contributes to the more efficient implementation of circularity in the embodiment design phase. In addition, the following overarching circular architecture design characteristics must be considered throughout the phases of the product development process of future circular products:

- *Modularity:* Modular product architectures make the future products easier to disassemble. By defining clear interfaces, detachable and therefore circular connection technologies can be used in a targeted manner.

4 Pfletschinger, Stölzle, Kreimeyer. Study Report Resilient Product Design – Circular product architectures for future-proof products and companies. 2024.

- *Upgradeability:* Individual modules can be designed in such a way that they can be replaced if necessary and, in the best case, upgraded. In conjunction with an update of the product architecture, new functions can also be integrated into an "old" product.
- *Longevity:* Modular product architecture designed for the circular economy can have a major impact on the longevity of a product, which can be extended through upgradeability and functional enhancements.
- *Application-specific materials:* Reduction in the variety of materials. Use of monomaterials such as single-origin plastics and metals as well as biodegradable, renewable alternatives and secondary raw materials.

Monitoring the ecological impact and therefore the effectiveness of the circular product design in the form of a Life-Cycle-Assessment (LCA) not just in the detailed design phase at the end of development but from the early stages of development onwards is crucial. However, companies are currently still facing challenges in this regard due to a lack of standardized approaches and methods. Building the necessary data infrastructure maximizes the product life cycle through enabling adaptive closed-loop management with solutions like a virtual twin or a digital product passport to realize the full circular economy potential and build up a 'virtual mine'. Taking a holistic approach in circular product design integrating all aspects of sustainability like pollution, water and land use as well as biodiversity besides climate change and circularity in R&D marks the next step towards a nature positive product.

Pioneers of the circular economy are doing exactly that. Volvo car corporation for example uses a Life Cycle Impact Assessment (LCIA) method to assess the biodiversity footprint, following the ReCiPe model. ReCiPe is an established method using generic data for translating emissions and resource extractions into estimated environmental pressures including land use, water use, climate change, and different types of pollution. The ReCiPe model also converts these different types of impact into a single common metric, expressed in 'species.year.'[5]

In conclusion, transitioning to a circular economy is essential for reducing environmental impact and increasing resource effectiveness and efficiency. By incorporating circular principles and practices into the product development process, businesses can significantly improve sustainability, as demonstrated by pioneers of the circular economy. From an economic perspective, adopting circular product design can also lead to cost savings through reduced material waste, extended product lifecycles, and the potential for new revenue streams through services like product leasing or refurbishment. Embracing a holistic approach to design, with a focus on modularity, upgradeability, longevity and application-specific materials, not only supports long-term environmental sustainability but also fosters economic resilience by optimizing resource use and enhancing market competitiveness.

5 Volvo Car Corporation. (2024). Volvo Cars Position on nature and biodiversity [Press release]. https://www.volvocars.com/images/v/-/media/project/contentplatform/data/media/sustainability/volvo_cars_position_on_nature_and_biodiversity.pdfed: 15.11.2024.

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Chemical Sites as Catalysts for the Transition to a Circular Economy

Carsten Gerhardt

Abstract: The chemical industry, often referred to as the "industry of industries", plays a crucial role in the Circular Economy, an economic model aimed at closing material loops and minimizing harmful environmental impacts. However, the sector in Europe is currently facing unprecedented economic pressure, unlike anything in its history—since the groundbreaking inventions over the past two centuries, like the Haber-Bosch process, coal tar dye chemistry, and the concept of Verbund-sites where the by-product of one process serves as input for the next. This article highlights the opportunities and challenges facing the industry in the context of a Circular Economy.

Keywords: Chemical Industry, Circular Economy, economic future of Europe, Long-term outlook, renewable energies, post-consumer feedstock, bio-based feedstock

Chemiestandorte als Katalysatoren der Circular Economy

Zusammenfassung: Die chemische Industrie, die oft als „Industrie der Industrien" bezeichnet wird, spielt eine entscheidende Rolle in der Kreislaufwirtschaft, einem Wirtschaftsmodell, das darauf abzielt, Stoffkreisläufe zu schließen und schädliche Umweltauswirkungen zu minimieren. Allerdings steht der Sektor in Europa derzeit unter einem beispiellosen wirtschaftlichen Druck, wie es ihn in seiner Geschichte noch nie gegeben hat – seit den bahnbrechenden Erfindungen der letzten zwei Jahrhunderte, wie dem Haber-Bosch-Verfahren, der Teerfarbstoffchemie und dem Konzept des Verbunds, bei dem das Nebenprodukt eines Prozesses als Input für den nächsten dient. Dieser Artikel beleuchtet die Chancen und Herausforderungen, vor denen die Branche im Kontext einer Kreislaufwirtschaft steht.

Stichwörter: Kreislaufwirtschaft, Chemieindustrie, wirtschaftliche Zukunft, Langfristperspektive, biobasierte Ausgangsstoffe, erneuerbare Energien

Europe is losing economic relevance with the rise of Asian economies, especially China. The global market share of the European Chemical industry is going down – in the past 20 years it has shrunk from 27 % to 13 %. The Chemical industry in Europe is facing severe challenges due to energy prices, labor costs and raw material challenges. Its long-term prospects are good, but the question is how it will survive until level-playing fields are established globally. Short and mid-term efficiency improvements and consolidation are needed. This will release space and human capital that can be used for a Circular Economy. The Chemical industry can become the key enabler of the Green Deal. It is capable of recycling the most complex materials, if needed, at molecular level. With this recycling and all the necessary preparatory steps done on today's Chemical production

sites, these will become the hotspots and catalysts for the transition to a Circular Economy for Europe.

The chemical industry is closely linked to overall economic development. Therefore, it is essential to consider global developments in various regions to better understand the current situation of the industry in Europe.

Europe's Economic Significance is Diminishing in Global Comparison

In terms of nominal Gross Domestic Product, the USA ranks first, followed by the European Union, China, Germany, Japan, India, and the United Kingdom. However, when adjusted for purchasing power, China has significantly surpassed the other countries and regions, standing at the top, followed by the USA, the EU, India, Russia, and Japan, while Germany ranks lower. Given India's ongoing economic development, it is expected that the EU will lose one of its top positions in the near future and will only rank fourth globally.

This relative loss of significance for Europe is particularly evident in the chemical industry over the past two decades. In 2002, the share of the European chemical industry in global chemical sales was still 27 %, while it dropped to 13 % by 2024—a reduction of more than half. However, this decline is less due to a weakness in the European chemical industry, which has doubled its revenue from €363 billion to €659 billion during this period, and more due to the rapid growth of the global chemical industry, especially in China. The global chemical sales have nearly quadrupled from €1,352 billion in 2002 to €5,214 billion in 2024. The doubling of European sales and the simultaneous quadrupling of global sales mathematically result in the halving of the European market share during the same period.

The Chemical Industry in Europe Faces Unique Challenges

In this phase of relative loss of significance, the European chemical industry is confronted with three major challenges: First, the crisis of multilateralism and the decline of free and open global trade. Second, the pressure from overcapacities in the Chinese industry that are flooding the European market at dumping prices. Third, the current weakness of key customer industries in Europe, such as the automotive industry, further burdens the chemical industry. These factors lead to significant underutilization of many European chemical parks, often below 75 %, and in some cases even as low as 50 %.

This competitive situation in Europe is challenging but not hopeless. It requires a European chemical strategy with a clear focus on future viability and resilience. Key challenges include high energy prices, overburdening regulations in Europe, and relatively high labor costs compared to the global context. Furthermore, Europe must consider that, unlike China or India, it does not have large, readily accessible markets. With a population of less than 500 million, the EU is only one-third the size of China or India. Additionally, Europe has significantly less access to raw materials than other regions, and its production facilities are, on average, older than those in China, where most facilities have been built in the last 30 years. The availability of skilled labor in Europe is also declining, while it is increasing in China from a higher baseline.

Another issue is a partial lack of understanding of the importance of the chemical industry. For too long, in some parts of society it has been perceived as a burden in

terms of environmental impact rather than as essential for addressing future challenges. To strengthen resilience and reduce dependence on foreign markets, the chemical industry is indispensable.

Long-Term Prospects for the Chemical Industry in Europe are Positive

The long-term prospects for the chemical industry in Europe, which focuses on production for the European market and makes full use of the benefits of a Circular Economy, are positive for three main reasons.

First, energy prices in the industrialized nations of the northern hemisphere are expected to converge in the long term, as renewable energies such as solar and wind in Europe are comparably inexpensive as in China or the USA.

Second, automation and digitalization are expected to lead to a global trend toward high-quality jobs that are comparably expensive across different regions.

Third, the availability of raw materials is also expected to increase, as post-consumer materials are increasingly used as raw materials of the future. A chemical industry that is less dependent on oil or naphtha and relies more on the reuse of carbon from post-consumer streams will be less dependent on imported raw materials.

Today, the costs of renewable energies in Europe are already cheaper than those of fossil fuels, with electricity generation costs for new photovoltaic plants below €0.03 per kilowatt-hour compared to about five times higher costs for coal.

Survival of the Chemical Industry in the Short and Medium Term

Long-term positive prospects are of little use if the chemical industry does not survive until global competitive conditions normalize and a "level playing field" is established. The current unprofitability in many areas of the industry must be addressed in the short term. The industry will consolidate its capacities in unprofitable areas to become profitable again. These adjustments will free up both space and human capital in the chemical parks for alternative uses. We advocate viewing these releases as an opportunity. An example of successful utilization in chemical parks is the Chemelot Chemical Park in the Netherlands, where the Brightlands Research Center has been established. Here, partners from industry, science, and government are working on a green and circular chemistry of the future based on the use of post-consumer plastics as raw materials.

In addition to this medium-term perspective, there are numerous short-term measures to increase productivity that can enhance competitiveness. These include process simplifications, digitalization, automation, and the standardization of operational processes to ensure consistent product quality. Many operational processes can benefit from digital support, and improved planning and control of value chains can further reduce losses. Appropriate governance can significantly accelerate decision-making processes. The sum of these measures can lead to a significant increase in productivity.

The Chemical Industry as an Enabler of the EU Green Deal

At the EU level, as well as in individual member states, there are ambitious goals for the Circular Economy. The EU Packaging Regulation aims for a recycling rate of 55 % for plastic packaging by 2030, with 30 % of all packaging to consist of recycled material. The EU Battery Regulation stipulates that the recycling efficiency of lithium-ion batteries

should reach 70 % by 2030, and a recovery rate of 95 % for cobalt, nickel, and copper should be ensured by 2031. The coalition agreement of the new German government from May 2025 highlights various Circular Economy topics, including chemical recycling and recycling in construction, as well as ambitious goals for the automotive industry. The importance of circularity as a key lever for achieving net-zero targets is widely recognized.

Since 95 % of all products contain chemical products, the chemical industry is directly affected by the recycling targets of the EU and its member states—without it, these goals cannot be achieved. The chemical industry is a central enabler of the European Circular Economy goals. It is not only about making European production circular with a focus on high R-strategies like redesign or reuse, but also about ensuring that products manufactured in Europe and imported products can be returned to molecular levels after use and transformed into new products or high-quality alternatives.

With the EU commission's heightened emphasis on the competitiveness of Europe's industry in the context of the Clean Industrial Deal, the Chemical industry is tasked to close material loops of its products at highly competitive costs.

Closing Industrial Value Chains in Chemical Parks

The large integrated sites of the chemical industry are crucial locations for the transformation to a Circular Economy. These sites are predominantly located in Europe near major metropolitan areas, which will represent their future raw material sources. For example, the sites in Marl, Dormagen, Leverkusen, and Wesseling are located in the Rhine-Ruhr metropolitan region with over 10 million inhabitants, while Frankfurt-Höchst and Ludwigshafen, the largest chemical integrated site in the world of BASF, serve the Rhine-Main region with over 6 million inhabitants. Similarly, other large chemical sites in Central Europe are located near important metropolitan regions. These conditions make Europe ideal for a circular economy based on post-consumer products. The chemical sites near urban centers provide space for the future tasks of pre-processing post-consumer raw materials. This proximity leads to significant savings in logistics costs compared to transporting post-consumer products to Asia, where they would be recycled and then transported back to Europe.

Traditionally, chemical integrated sites have produced hundreds of carbon-based chemical compounds from a few raw materials (primarily naphtha). In the future, the goal will be to produce equally high-quality products from raw materials of diverse origins as previously from fossil raw materials. Post-consumer raw materials are extremely diverse, ranging from used mattresses and shoes to textiles. High-performance composite products are difficult to recycle and typically require multi-stage pre-treatment. To ensure the product quality of recyclates, the chemical industry plays a central role in the preparatory processing stages. Solar panels, electrolyzers, and batteries can only be recycled at a high quality through chemical processes. The preparatory steps, such as disassembly, sorting, and cleaning, require proximity to the subsequent production stages.

If, as a result of industry consolidation, space for processing stages becomes available at large chemical sites, these should be utilized consistently, as should the available workforce capacities.

Additional Carbon from Biogenic Sources in the EU

In the long term, recycled carbon is unlikely to be sufficient to meet the entire demand of the chemical industry. Fortunately, Europe has good conditions to source the necessary "virgin material" from biobased sources. It is crucial that biomass is primarily used for industries that cannot be decarbonized, particularly carbon chemistry with its material use of carbon. In Germany, significantly less than 20 % of arable land would be sufficient to fully meet the material needs of the chemical industry. With high reuse rates of carbon from post-consumer sources, the need for arable land to cover a carbon gap for the chemical industry from biogenic sources could be significantly reduced. Only 5 % of German arable land would suffice for the material carbon needs of the German chemical industry—less than half of the area currently used for growing maize for biogas plants for electricity generation.

Despite a strong emphasis in the last two sections on carbon chemistry, we'd like to emphasize that the same logic holds true beyond polymers. The Chemical industry and its sites play a crucial role in recovering all kinds of critical raw materials, e.g. platinum group metals and other key transition materials.

Complex Challenges in Recycling

The chemical industry faces enormous challenges in the area of recycling. It must not only return centrally generated monomaterials of known origin from Europe with product passports back into the loop but also recycle imported composite materials without precise knowledge of their compositions. Many durable consumer products, such as mattresses and tires, represent compact, easily identifiable sources of raw materials. At the same time, it is necessary to return widely distributed, short-lived consumer products of often low weight back into the loop and prevent their entry into the environment. The greatest challenge comes from chemical or pharmaceutical substances that, for example, enter the environment as pesticides or metabolic products.

For the processes in chemical industry facilities, controlled and known input qualities of the respective raw materials are essential. It is a joint task of post-consumer collection, transport, and sorting systems, along with the chemical industry, to ensure these qualities. This can be particularly effective when important parts of the processing are carried out directly at the chemical sites with their expertise.

The future advanced collection, sorting, purification, and processing facilities will require highly qualified chemists and technicians in the coming years and decades. In this context, the current decline in student numbers in the field of chemistry is concerning. As the "industry of industries", the chemical industry needs sufficient talent to act as a catalyst for the circular transformation in Europe.

Diversity of Input Materials in Future Integrated Sites

The goal is to have a chemical industry that continues to produce the accustomed high quality of chemical compounds from a wide variety of post-consumer raw materials and different biobased raw materials in future integrated systems. With such competencies, Europe will be able to achieve an excellent position in the global market, particularly in machinery and plant engineering. Market leaders in Germany are comprehensively addressing the challenges. Examples include BASF's ChemCycling, various CQ solutions

from Covestro, and the biobased and biodegradable surfactants from Evonik. Both OMV and LyondellBasell are investing in industrial-scale chemical recycling facilities integrated into existing chemical parks. The next step must be to integrate upstream processing stages of post-consumer materials at these sites to achieve maximum efficiency in the supply chain.

The Transformation as a Collective Task

Such a transformation can only be approached as a major collective task involving industry, politics, science, and civil society. In the short to medium term, it is the responsibility of the industry to tap into existing efficiency potentials and adjust capacities within the framework of consolidations. At the same time, it is the task of politics to protect the existing industry where there is currently no fair competition and where the chemical industry outside Europe benefits from unfair competitive conditions. In the long term, it is a joint task of industry and politics to repurpose free capacities for the circular economy. This concerns both the aforementioned areas in chemical parks and the currently released human capacities. The necessary technologies are largely already available in the form of pilot plants. The various technologies of chemical recycling are a good example of this. Now, it is crucial to scale these technologies up to industrial sizes in a timely manner. Furthermore, additional efforts are needed from the scientific community to further develop post-consumer materials and biobased raw materials as feedstock for the chemical industry and bring them into application.

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Driving the Circular Economy on Social Media: Sustainability Influencers and Their Business Models

Julia Gisler and Johanna Gollnhofer

Abstract: Influencers who advocate for environmentally friendly and ethical practices play a crucial role in promoting the principles of the circular economy, including the 4 Rs: repair, reuse, recycle, and reduce. This paper investigates the business models utilizsed by sustainability influencers and discusses the role of influencers in driving the circular economy. Through qualitative research, including in-depth interviews and a netnographic analysis, three primary business models are identified: (1) Educational Advocates, (2) Lifestyle Marketers, and (3) Change Leaders. The findings reveal significant opportunities for sustainability influencers to mainstream sustainability and extend their impact beyond social media. The paper contributes to the academic literature on business models in the circular economy by bridging the gap between influencer marketing and the circular economy.

Keywords: Sustainability influencer, circular economy, influencer marketing, environmentalism, 4Rs, business models

Die Kreislaufwirtschaft in den sozialen Medien vorantreiben: Nachhaltigkeitsinfluencer und ihre Geschäftsmodelle

Zusammenfassung: InfluencerInnen, die sich für umweltfreundliche und ethische Praktiken einsetzen, spielen eine zentrale Rolle bei der Förderung der Prinzipien der Kreislaufwirtschaft – insbesondere der 4R-Strategien: Reparieren, Wiederverwenden (engl. *reuse*), Recyceln und Reduzieren. Dieser Beitrag untersucht die Geschäftsmodelle von NachhaltigkeitsinfluencerInnen und beleuchtet ihre Rolle bei der Förderung der Kreislaufwirtschaft. Auf Basis qualitativer Forschung – einschliesslich Tiefeninterviews und einer netnografischen Analyse – werden drei zentrale Geschäftsmodelle identifiziert: (1) Educational Advocates, (2) Lifestyle Marketers und (3) Change Leaders. Die Ergebnisse zeigen bedeutende Potenziale auf, wie NachhaltigkeitsinfluencerInnen Nachhaltigkeit in den Mainstream tragen und ihre Wirkung über die sozialen Medien hinaus entfalten können. Der Artikel leistet einen wissenschaftlichen Beitrag zur Literatur über Geschäftsmodelle in der Kreislaufwirtschaft, indem er eine Brücke zwischen Influencer-Marketing und Kreislaufwirtschaft schlägt.

Stichwörter: Nachhaltigkeitsinfluencer, Kreislaufwirtschaft, Influencer-Marketing, Umweltbewusstsein, 4Rs, Geschäftsmodelle

1. Introduction

Traditionally, marketing and sustainability have been perceived as conflicting paradigms. Marketing focuses on fostering consumer demand, driving the consumption of products and services (Fronell et al., 2006; Sozuer et al., 2020), which contrasts with sustainability principles that emphasize reducing consumption and promoting environmentally responsible behaviours (Haws et al., 2014; Heiskanen & Pantzar, 1997). This contradiction is especially evident on social media, where conspicuous consumption often encourages overconsumption. Originally designed for personal communication, platforms like Facebook, Instagram, and TikTok have evolved into powerful tools for brand communication and marketing (Hudders et al., 2021; Kozinets et al., 2010).

However, social media also serves as a platform for sharing meaningful content and inspiring consumers (Hudders & Lou, 2023; Riedl et al., 2021). In light of the pressing climate crisis, sustainability-themed influencers are on the rise (Zukunftsinstitut, 2019). These influencers advocate for the integration of ethical and eco-friendly practices into everyday life. In doing so, they serve as intermediaries between businesses and consumers, bridging the gap between theoretical sustainability principles and practical applications in daily life.

This approach sets them apart from more conventional influencers, who are often primarily motivated by self-presentation and commercial interests (Erz et al., 2018; Leung et al., 2022). Quite the opposite, sustainability influencers rarely include branded posts in their content. This approach raises questions about how they monetizse their social media presence, given their distinct values and approach. Thus, understanding the business models (BMs) of sustainability influencers is crucial, yet research in this area remains limited (Ye et al., 2021). This study addresses this gap by investigating the predominant BMs of sustainability influencers and exploring their role in driving the circular economy (CE).

To gain deeper insights into this emerging field, we adopt a qualitative methodology, including in-depth interviews with sustainability influencers and a netnographic analysis of their social media profiles. We identify three predominant BMs: *Educational Advocates*, *Lifestyle Marketers*, and *Change Leaders*. The findings highlight the potential of sustainability influencers to bring knowledge of sustainability and the CE into mainstream discourse, generating impact beyond social media. This research contributes to the understanding of sustainability influencers and their BMs within the CE, offering practical insights for influencers, brands, and policy makers to leverage sustainability in their digital strategies.

2. Literature review

2.1 Business models in the circular economy

In the context of escalating environmental crises – such as extreme weather events, species extinction, and ecological disasters driven by climate change – the need for pro-environmentalism has become more urgent than ever. While significant responsibility is placed on individual consumers, environmentally conscious consumers exert equal pressure on companies, brands, and governments to adopt environmentally friendly practices (Connors et al., 2017; Fronell et al., 2006). Consequently, businesses striving to actively combat climate change must realign their BMs with the principles of the CE (Takacs, 2021).

2.1.1 Circular economy principles

The CE is an economic model that aims to decouple economic growth from resource consumption (Velenturf & Purnell, 2021). Several frameworks conceptualize the CE, often centring around three core principles: (1) designing processes to eliminate waste and pollution, (2) keeping products and materials in use for as long as possible, and (3) regenerating natural ecosystems (Kirchherr et al., 2017).

Recent CE literature has proposed comprehensive frameworks, such as the 10R hierarchy (e.g., Potting et al., 2017), which expands the scope of circular strategies to include Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, and Recover. These strategies reflect a broader and more systemic view of circularity across production and consumption systems.

At the same time, a particularly influential and widely used framework within public discourse is the 4R model, which focuses on four key strategies: Reduce, Reuse, Recycle, and Recover (Alcalde-Calonge et al., 2022). This approach is increasingly seen as a viable solution to address environmental challenges while maintaining economic viability (Geissdoerfer et al., 2017). The wide recognition and consumer applicability makes this framework particularly useful – especially in the context of influencer communication, where accessibility and simplicity are key.

2.1.2 Business model frameworks

Adopting CE principles often requires businesses to rethink and adapt their BMs to align with circular strategies. A firm's BM articulates its specific business logic (Osterwalder & Pigneur, 2002). Various interpretations of BM components exist (Zabel, 2021). In contrast to more detailed and multifaceted approaches like the business model canvas by Osterwalder and Pigneur (2002), Gassmann et al.'s (2013) conceptualizsation adopts a more streamlined model, referred to as the "magic triangle", which focuses on four central dimensions: The Who, the What, the How, and the Value. Its concise yet holistic perspective makes the model particularly useful.

The "Who" dimension centres on the question: 'Who is the customer?' (Casadesus-Masanell & Ricart, 2011). It identifies the target audience that the business aims to serve, placing this decision at the core of the business model. The "What" pertains to the business's offerings to its customers, often referred to as the value proposition (Johnson et al., 2019). The "How" encompasses the activities and processes the business must excel at in order to deliver its value proposition (Hedman & Kalling, 2003). Lastly, the "Value" dimension defines the revenue model, specifying how the business generates financial returns (Gassmann et al., 2013).

While a substantial body of research has explored BMs in general (Chesbrough & Rosenbloom, 2002; Johnson et al., 2019), the examination of sustainable BMs has only recently garnered scholarly attention (Centobelli et al., 2020). These studies predominantly focus on the BMs of companies adhering to CE principles. However, little attention has been given to the BMs of human brands in the sustainability industry such as sustainability influencers. Unlike traditional companies, influencers drive sustainable behaviours through content creation, personal branding, and digital engagement (Ki et al., 2020; Ye et al., 2021), rather than directly managing material flows and focusing on operational efficiency (Centobelli et al., 2020). Therefore, the BMs of sustainability influencers are

inherently different to the ones researched so far. Understanding these differences is crucial for comprehending how sustainability influencers contribute to the broader adoption of CE principles, such as the 4Rs.

2.2 Business models of influencers

In recent years, research on influencers has attracted significant scholarly attention (Lamberton & Stephen, 2016). While most studies have examined influencers from a marketing effectiveness perspective (Hudders et al., 2021; Ki & Kim, 2019), research on the strategic and entrepreneurial decisions of influencers – such as their BMs – remains limited (Edeling & Wies, 2024; Ye et al., 2021). One exception is Zabel's (2021) literature review. In essence the paper describes the BMs of influencers as follows: Influencers create value by combining community-driven and commercial content (the "What"). Their core activities include content creation, distribution and community engagement (the "How"). Additionally, they engage in collaboration processes, which involve initiating and managing partnerships, as well as evaluating performance. Compensation is frequently non-monetary, such as product samples, while direct financial payments become more prevalent as influencers grow in professionalism and audience size (the "Value"). While this review provides a holistic overview of influencer activities, it remains general and overlooks critical elements such as the customer segment (the "Who"). Moreover, unlike conventional influencers, sustainability influencers primarily use social media to educate the public about sustainability and advocate for behavioural change (Aboelenien et al., 2023), rather than focusing on traditional commercial activities like product endorsements. As such, their motivations and social media strategies differ significantly, indicating that their BMs are distinct and merit dedicated scholarly investigation.

3. Methodology

To address the research question, we combined qualitative interviews with sustainability influencers and a netnographic analysis of their Instagram profiles (Kozinets, 2015; Kozinets, 2019; Scaraboto, 2015). Our focus was on Instagram (Perera et al., 2021) given its substantial user base of over 1.4 billion active users worldwide in 2024 (Insider Intelligence, 2022) and its prominence as a leading platform for influencer marketing campaigns (Fourstarzz Media, 2020).

We utilizsed purposive sampling to identify profiles of sustainability influencers (Spiggle, 1994). We searched directly on Instagram for sustainability influencers and reviewed recommendations of profiles. To ensure the relevance and frequent engagement of Instagram in disseminating content, we included only profiles with at least 1,000 followers. This approach resulted in a list of 110 profiles of sustainability influencers, who we contacted. We were able to interview 16 of them from June 2023 to February 2025. The interviews averaged 1:04:20 hours in length, totalling 21:55:38 hours. Our sample consisted of only women aged between 24 and 44. Table 1 lists all sustainability influencers interviewed in this study including a summary of characteristics.

Influencer	Country of residence	Content focus	Follower count*	Business model classification	Number of posts examined
Alina	Switzerland	Sustainable lifestyle	15,300	Lifestyle Marketer	111
Maya	USA	Sustainable fashion	53,800	Educational Advocate	54
Andrea	Switzerland	Slow lifestyle, veganism	2,800	Lifestyle Marketer	36
Jenna	USA	Science of sustainability	5,900	Educational Advocate	33
Sonja	UK	Sustainable fashion, journalistic work	16,100	Educational Advocate	93
Karen	Spain	Sustainable lifestyle	4,600	Lifestyle Marketer	78
Ayla	USA	Sustainable lifestyle, thrifting	4,400	Change Leader	329
Yalle	USA	Sustainable lifestyle, sustainable living	4,600	Change Leaders	75
Lauren	Belgium	Sustainable lifestyle	13,500	Educational Advocate	161
Jules	USA	Sustainable living, low waste	2,500	Lifestyle Marketer	190
Sally	Canada	Sustainable living in the suburbs	44,900	Lifestyle Marketer	121
Katharina	New Zealand	Sustainable living	61,700	Educational Advocate	150
Alena	USA	Ocean science	8,800	Educational Advocate	18
Jess	USA	Sustainable lifestyle	4,000	Lifestyle Marketer	171
Mary	Denmark	Political environmentalism, zero waste	195,000	Change Leader	255
Ally	USA	Community education and action	116,000	Change Leader	220

Table I: Summary of sustainability influencers interviewed.
** on March 10, 2025*

In the interviews, we first asked informants to describe their social media profiles, including their primary motivations, the purpose of their profiles, their posting strategies, and their audience. As the interviews progressed, we explored their individual perceptions of sustainability, focusing on their decision-making process regarding content creation and their rationale. Additionally, we inquired about their approaches to brand collaborations and other sources of income.

We analyzsed the data using a hermeneutic iterative approach (Spiggle, 1994), which allowed us to develop the different BMs. Emerging themes were identified throughout the analysis and continuously tested and refined to ensure the validity and robustness of our interpretations (Arnould & Wallendorf, 1994; Bajde & Rojas-Gaviria, 2021; Husemann & Eckhardt, 2019).

To enrich our interview data, we also conducted a netnographic analysis of the Instagram profiles of our 16 informants. Netnography is a qualitative method that adapts traditional ethnographic research practices – namely, the immersive study of cultural practices and meanings within communities – for digital environments, enabling the study of online behaviours and meaning-making (Kozinets, 2015; Kozinets, 2019). As part of this netnographic analysis, we examined all posts published in the 12 months preceding data collection (September 2024 to March 2025), resulting in a total sample of 2,095 posts. We focused specifically on the content of the posts – namely, the images and accompanying captions – while disregarding follower interaction metrics (e.g., likes, comments, shares), as they provided limited added value to the aims of the study. The netnographic analysis was guided by our interview questions and themes. Notably, the online content closely reflected the themes identified in the interviews, thereby reinforcing the emerging BMs and primarily serving to complement our data with rich visual material.

4. Findings

Based on the conceptual framework proposed by Gassmann et al. (2013), we identified three distinct BMs employed by sustainability influencers: *Educational Advocates*, *Lifestyle Marketers*, and *Change Leaders*. The following section elaborates on each model, using the components of Gassmann et al.'s (2013) framework. While these BMs are distinguishable from each other, some sustainability influencers don't strictly adhere to one of them but rather follow a hybrid approach where they follow strategies from different models. However, for analytical clarity, we classified our informants into one of the three BMs identified.

4.1 Educational Advocates

Influencers who adopt the BM of Educational Advocates primarily use their social media platforms as tools for disseminating knowledge and raising awareness about sustainability-related topics. Their central motivation lies in providing in-depth insights into various aspects of sustainability and equipping their audience with the information needed to make more environmentally responsible choices. As Lauren explains:

> "I try to dive deeper into topics and educate people about things."
> *(Interview, Lauren)*

Lauren's statement underscores the pedagogical focus of this model, where the influencer's role is framed as that of a teacher or guide. The BM of Educational Advocates is built around the creation and distribution of educational content aimed at increasing public awareness of sustainability issues. Through this approach, they seek to position themselves as trusted sources of information, offering value to their followers by enhancing their understanding of sustainability practices and principles.

Who: The target audience of Educational Advocates consists of followers who seek explanatory and informative content, often possessing limited prior knowledge of sustainability topics. These influencers tailor their content to individuals at the beginning of their sustainability journey, as evidenced by Maya's experience: "*What I realized with my first couple of reels that went viral is that a lot of people don't know the basic things that I thought everybody knew. What plastic is, what fast fashion is.*" Recognizing the knowledge gap among many of her followers, Maya adjusted her content to focus on basic sustainability concepts, targeting consumers who are not yet experts in the field. Despite addressing a novice audience, Educational Advocates primarily attract individuals who are already inclined toward sustainability and eager to learn more. As Sonja describes her community: "*I don't think there's any doubt that the people who comment on my page already have a similar interest in sustainability. They already care about the topics I write about.*" This illustrates that, while the audience may lack expertise, they share a fundamental interest in sustainability, forming a community that values education and growth in their understanding of these topics.

What: The primary value proposition of Educational Advocates is to provide accessible and comprehensible information on sustainability. These influencers often incorporate principles of the CE, such as the 4Rs, into their content, breaking down complex concepts into digestible formats for their audience. For instance, Jenna offers an in-depth explanation of what recycling (one of the 4Rs) truly entails, highlighting the nuances that are often overlooked:

> "I started with a packaging recycling program at my children's school. I took them [my followers] along. I took pictures of where did I get the boxes? […] And then I showed them how I was making the containers to be able to recycle the packaging and then I took pictures at school and […] then I created a post explaining what I did and how I did it and then I said, do you have questions."
>
> *(Interview, Jenna)*

As Jenna's explanation illustrates, her primary motivation is to educate her followers on specific aspects of sustainability, such as recycling. By guiding her audience through the intricacies of recycling programs step-by-step, she tailors her content to be easy to follow and accessible. In this way, Jenna acts as a knowledge translator for her followers, transforming complex sustainability concepts (i.e., one of the 4 Rs) into information that is both digestible and actionable and eventually leads to behaviour changes among her followers.

How: The core processes employed by Educational Advocates align with those of conventional influencers, centring around content creation and dissemination (Borchers & Enke, 2021). However, given the educational focus of their content, a significant portion of their efforts involves conducting independent research and experiments to answer specific questions or gain valuable insights for their audience. Jenna, for example, not only consults scientific studies to support her content with up-to-date statistics and research but also conducts her own experiments:

> "I got a package in the mail and the internal packing material inside the box looked compostable, but I wasn't sure. So, I thought I should test that and probably video this. It was styrofoam. A really easy way to see if it's starch versus a petroleum-based

styrofoam is to put it in water and if it's starch based it'll dissolve in water. So, I videoed that."
(Interview, Jenna)

By conducting her own experiments, Jenna gained the confidence to share her newly acquired insights with her followers, including practical advice on identifying sustainable packaging materials and how best to manage them. This extra effort is an integral part of her role as a sustainability influencer with the BM of an Educational Advocate and requires a considerable amount of time. The emphasis on independent research and experimentation highlights the distinction between Educational Advocates and other influencer types.

Value: Many Educational Advocates perceive their social media profiles primarily as educational platforms rather than consumption-focused spaces. Consequently, most of them are unable to sustain a full-time livelihood solely through their social media activities, often treating this work as a secondary endeavour. Some Educational Advocates, like Sonja, have made deliberate choices to avoid commercialisation entirely. She states, "*I've made a purposeful decision that I would never take money from brands to promote their stuff.*" This stringent policy naturally limits her capacity to generate income directly through her social media presence. However, it resonates with the authenticity consideration of many sustainability influencers as they fear to be perceived as untrustworthy if they promote brands and their products but otherwise advocate for less consumption in general. Nevertheless, they are still able to monetise their social media profiles by using it to promote their additional offerings that emerged out of their social media presence and reach.

Figure I: Screenshot of the Post by Katharina from the 12th of October 2023; Netnographic data

Educational Advocates often translate their content into tangible products, such as books, allowing them to derive value from their BM as sustainability influencers. For instance, Katharina authored a book that compiles her extensive knowledge of sustainability and provides practical guidance on how to incorporate sustainable practices into everyday life (see Figure I).

By translating her knowledge on sustainability and the CE into a tangible product she is able to monetise what she does on social media in a way that does not contradict the inherent principles and values of her profile. Her popularity on social media further enables her to reach a broader audience, enhancing the potential sales of the product.

4.2 Lifestyle Marketers

Lifestyle Marketers are sustainability influencers who utilise their social media profiles to highlight the benefits of adopting a sustainable lifestyle, aiming to inspire their followers through engaging and relatable content. As Alina articulates:

> "I believe that the biggest impact I can have is that I set an example and don't impose it on others in a missionary way, but simply showing 'ok, she's trying something different and she's doing well and seems to be having fun'."
>
> *(Interview, Alina)*

As Alina's description illustrates, the primary intent of her BM as a sustainability influencer is to demonstrate the positive impact individuals can have by fostering a more sustainable future. Her approach centres on serving as a role model who offers inspiration without resorting to proselytising. In this way, Lifestyle Marketers strive to bring sustainability into the mainstream rather than confining it to niche audiences. The following section outlines how Lifestyle Marketers construct their BM to achieve this objective.

Who: The primary goal of Lifestyle Marketers is to demonstrate the feasibility of a sustainable lifestyle while addressing and overcoming common misconceptions about sustainability (e.g., expensiveness, inconvenience). Consequently, their target audience consists of sustainability-conscious consumers who aspire to adopt more sustainable practices but may be uncertain about how to do so or hesitant to impose significant restrictions on their lifestyles. Karen elaborates on this target demographic:

> "I'm excited to work with them [a sustainable make-up brand] because I use them every day and because they use all natural ingredients and because their packaging is really great. […] People are going to be buying the non-sustainable version of these products no matter what. So, if we can illuminate them to the realities of it and get them to buy the more sustainable versions of these necessary products then I consider that a win."
>
> *(Interview, Karen)*

Karen's explanation of her collaboration with a sustainable brand and the promotion of its products highlights the characteristics of her target audience. With her BM as a Lifestyle Marketer, she aims to engage consumers who are not yet aware of more sustainable alternatives they can incorporate into their daily lives. Acknowledging the reality that it is unlikely she can persuade consumers to cease consumption altogether, Karen emphasises that her approach focuses on introducing her followers to more sustainable options. Consequently, the BM of Lifestyle Marketers targets consumers who are open to

adapting their consumption practices toward more sustainable alternatives, although most are not inclined to pursue a perfectly sustainable lifestyle that may impose restrictions.

What: The primary motivation of Lifestyle Marketers is to highlight the feasibility and benefits of adopting a sustainable lifestyle and following CE principles. They achieve this by inviting their followers into their daily lives and providing inspiration for what a sustainable lifestyle can look like. As Andrea articulates:

> "I show what I wear and show where I got it from. A lot of the times I repeat outfits, and you know, like I have the saying 're-wearing is caring'. So, a lot of times my shoe wear is the same just because I don't buy a lot of shoes."
> *(Interview, Andrea)*

Andrea's description illustrates her commitment to providing her followers with concrete examples of what a sustainable lifestyle can entail. By showcasing how affordable and fashionable a sustainable wardrobe can be, she positions herself as both a role model and a source of inspiration for her audience. In doing so, Andrea also incorporates principles of the circular economy (i.e., reusing), embodying her motto, *"re-wearing is caring"*. This approach allows her followers to observe a practical application of CE concepts, offering a tangible illustration of how these principles can be integrated into the daily life.

How: The core processes of Lifestyle Marketers closely resemble those of conventional influencers, centring around content creation and dissemination (Borchers & Enke, 2021). Their content predominantly features snippets of their daily lives, including their consumption activities and living practices. In doing so, they often highlight the products they utilise throughout the day which are mostly sustainable alternatives and thus help promoting a sustainable lifestyle. Karen elaborates:

> "I actually really like what they [collaboration partner] sell in their shop, and I use it all the time. So, that comes a bit more naturally to me because it doesn't feel like I'm selling a product that I wouldn't normally use, I have my house filled with them, and I use them all the time. So, shooting content for those kind of products makes sense to me."
> *(Interview, Karen)*

Karen's description illustrates that content production is a fundamental component of her BM as a Lifestyle Marketer. Because she genuinely uses the products she promotes and collaborates with brands whose offerings align with her values, she is able to create content naturally and seamlessly integrate promotional elements into her posts.

Value: Lifestyle Marketers primarily generate revenue through branded posts. Compensation for these partnerships typically takes the form of either monetary payments or product exchanges. As Andrea explains:

> "That means I advertise for them. In other words, they request a certain number of contributions and posts from me and if enough people order using my code, I can then order things from them for free."
> *(Interview, Andrea)*

In order to receive payment from her collaboration partners, Andrea must not only integrate the brand's products into her social media stories and post a predefined number of times but also ensure that a specific number of consumers purchase from the brand using

her promotion code. This dual requirement underscores the performance-based nature of her compensation as an influencer. Additionally, Andrea has established clear criteria for her partnerships, stating, *"I'm in favour of anything vegan or organic."* She strictly declines inquiries that do not align with these values. However, this high standard can complicate financial success for Lifestyle Marketers. As Sally notes *"It's still really tricky to make money in the sustainability place if you're really true to your values and in alignment with the other things that you talk about."* This difficulty arises from the inherent conflict between promoting consumption and adhering to sustainability principles.

4.3 Change Leaders

The third BM identified is that of Change Leaders. These influencers concentrate on raising awareness of systemic environmental issues and advocating for meaningful policy change rather than focusing solely on individual actions. Ayla explains it in the following:

> "Ultimately, big corporations should be responsible. […] In the seventies, what they did in the US is they shifted that perception, that corporations are good but you as an individual, you need to recycle, you need to do all of this. But it's like no, you guys are massive and you produce so much waste and somehow me, a small individual, has to do it. The responsibility should be on corporations and on legislation."
> *(Interview, Ayla)*

As Ayla's description illustrates, Change Leaders often extend their focus beyond individual consumption behaviours. They leverage their platforms to raise awareness for larger-scale and more systemic views on the climate crisis and environmental actions.

Who: Change Leaders target a diverse audience, including socially-conscious consumers who are concerned with sustainability and systemic change, as well as activist communities such as grassroot movements and NGOs. Yalle describes her followers in the following way:

> "I think they are people like me, who start doing advocacy for themselves and end up influencing the government. It really starts at a personal level – you're not going to join a group banning plastics unless you're already consuming less plastic."
> *(Interview, Yalle)*

Yalle's description underscores that her followers are already engaged in sustainable practices and share a similar mindset regarding societal change. However, the influence of Change Leaders extends regular consumers to policy influencers and decision-makers, including lawmakers and government bodies involved in environmental policy.

What: The BM of Change Leaders is centred on promoting systemic change and mobilising their audience toward collective action. Instead of focusing on showcasing sustainable product alternatives, their core value proposition lies in advocating for large-scale environmental and social reforms. A fundamental aspect of their model is the provision of expertise and credibility. Change Leaders often establish themselves as knowledgeable figures within the environmental activism space, offering well-researched insights, engaging in policy discussions, and presenting solution-oriented content. Moreover, the BM of Change Leaders is built on empowerment and mobilisation. They inspire their audience to actively participate in movements for change, such as organising protests, advocating for legislative reforms, or joining community initiatives.

For instance, in her post, Ally uses her reach for raising awareness for a governmental agency supporting climate protection and calls her followers to action by providing a link to sign a petition to support their work (see Figure II).

Figure II: Screenshot of the Post by Ally from the 6th of March 2025; Netnographic data

Thus, the focus of Change Leaders lies less on educating about the CE or showing products from companies who follow CE principles but rather fostering systemic change in accordance with the CE.

How: At the core of Change Leader's operations is the development of content centred around environmental policies, social movements, and collective action. Unlike conventional influencers, their content emphasises broader societal issues rather than individual consumer choices, aiming to influence public opinion and government policy. Therefore, partnerships with NGOs and advocacy groups are an essential component of their model. These partnerships enable them to amplify their message, engage in campaigns, and support wider environmental and social initiatives.

Additionally, public speaking and events play a crucial role in their strategy. Change Leaders often participate in conferences, protests, panels, and other in-person events to convey their messages directly to their audience. This face-to-face engagement facilitates immediate and personal connections, fostering a sense of community and collective action.

For example, due to her significant reach on social media, Mary had the opportunity to participate at a session at the European Parliament, highlighting the importance of the messages she shares through her platform (see Figure III).

Figure III: Screenshot of the Post by Mary from the 28th of November 2024; Netnographic data

Value: Change Leaders primarily generate revenue through channels that align with their mission of driving systemic change and advocating for environmental and social justice. Unlike conventional influencers, their focus shifts away from product promotion toward securing support from individuals and organisations committed to sustainability.

Consequently, a key source of revenue comes from partnerships with NGOs and advocacy groups that resonate with the influencer's environmental or social causes (see Figure II).

Additionally, paid speaking engagements constitute another significant revenue stream for Change Leaders. As thought leaders in their field, they are frequently invited to participate in panels, conferences, and events where they discuss topics related to sustainability, policy reform, and environmental activism. In doing so, they receive compensation for their expertise and influence, further supporting their advocacy work. For instance, Mary lists her work, which provides her with income and is linked to her social media profile, as follows.

> "I am also a lecturer and give public talks, workshops and work with people. I'm also an advisor and also work with teaching companies as well as politicians about current political climates and climates relating to environment and sustainability."
> *(Interview, Mary)*

This quote exemplifies how Change Leaders strategically monetise their expertise while remaining aligned with their advocacy. Instead of relying on traditional influencer revenue models such as product endorsements, Mary derives income from speaking engagements, advisory roles, and educational collaborations. Her social media presence serves as a key enabler of these opportunities, as it is the primary reason she is invited to – and compensated for – such events. These monetisation strategies not only ensure financial sustainability but also enhance her credibility and influence within the sustainability space. As a result, her online and offline activities are mutually reinforcing.

5. Discussion and contribution

This study has identified three distinct BMs employed by sustainability influencers: Educational Advocates, Lifestyle Marketers, and Change Leaders (see Table II). Educational Advocates focus on disseminating knowledge and fostering awareness about sustainable practices, effectively positioning themselves as trusted sources of information. Lifestyle Marketers showcase how sustainability can be seamlessly integrated into everyday life, thereby appealing to a broader audience. Meanwhile, Change Leaders advocate for systemic change, mobilising their followers to engage in activism and policy discussions that drive momentum for sustainability initiatives. The findings emphasise the importance influencers play in promoting sustainability such as CE principles and fostering behaviour change among followers.

Business Model Components	Educational Advocates	Lifestyle Marketers	Change Leader
Who	Followers with a limited knowledge of sustainability seeking educational content	Sustainability-conscious consumers who seek practical alternatives without major lifestyle changes	Socially conscious individuals, activists and NGOs
What	Provide knowledge on sustainability, circular economy (4 Rs) and simplify complex topics	Showcase practical, stylish sustainable living and how CE principles can be integrated into the daily life	Advocate for systemic reforms and focus on policy change and corporate accountability
How	Create educational content and share own research	Content on daily sustainable consumption and collaborate with sustainable brands	Promote policy discussions, mobilise action and partner with NGOs and speak at events
Value	Social impact through education and monetisation via own products (e.g., books)	Revenue through branded posts and product collaborations	Income from NGO partnerships and paid speaking engagements

Table II: Summary of distinct business models of sustainability influencers based on the business model framework by Gassmann et al., 2013

5.1 The role of influencers in driving the circular economy

While sustainability influencers adopt diverse approaches on social media and operate under different BMs, they collectively contribute to promoting more sustainable behaviours among their audiences and, in doing so, advance the CE. We elaborate on this below.

Knowledge dissemination: Misconceptions surrounding sustainability and the CE remain prevalent (Aschemann-Witzel & Zielke, 2017). Sustainability influencers – particularly Educational Advocates – use their platforms to share actionable insights and raise awareness about sustainable practices. Their ability to distill complex concepts into accessible, engaging content plays a vital role in enhancing public understanding of CE principles.

Mainstreaming sustainability: Sustainable consumption has traditionally been associated with more radical consumer behaviours – such as zero-waste living, minimalism, or product boycotts (Thompson & Arsel, 2004; Wilson & Bellezza, 2022) – implying that meaningful contributions to climate action require full commitment. In contrast, sustainability influencers – particularly Lifestyle Marketers – adopt a more pragmatic approach, demonstrating that sustainability can be integrated into everyday consumption practices. This balanced positioning enables them to engage a broader audience beyond the niche communities typically reached by traditional sustainability advocates, thereby facilitating behaviour change on a larger scale.

Behaviour change: Similar to conventional influencers, sustainability influencers act as role models and opinion leaders (Casalo et al., 2020). Leveraging this influence, they are able to drive behaviour change among their followers (Ki et al., 2020). Educational Advocates facilitate this change by demystifying the complexity of sustainability, making it more accessible and achievable for consumers. Lifestyle Marketers increase the likelihood of sustainable practices being adopted in everyday life by presenting them as convenient, aspirational, and aesthetically pleasing. Change Leaders scale behaviour change by promoting systemic shifts and fostering a sense of collective responsibility among consumers (Luukkonen et al., 2024).

In addition to promoting sustainability more broadly, sustainability influencers also support sufficiency-oriented strategies within the CE, such as reducing consumption or extending product lifecycles (e.g., Centobelli et al., 2020; Villalba-Eguiluz et al., 2023). These contributions are reflected not only in their content but also in the structure of their BMs. The following outlines two key mechanisms through which influencers advance sufficiency: by shaping social norms and by helping overcome barriers to reduce-oriented practices.

Supporting social norm change: Sustainability influencers help shift social norms around sufficiency by highlighting alternatives to consumerist behaviours (Suski et al., 2022). Educational Advocates and Change Leaders frequently share content that encourages practices such as "using what you already have," repairing instead of replacing, or buying second-hand. By embedding sufficiency into everyday content – rather than presenting it as a radical lifestyle shift – they help normalise consumption reduction. Even Lifestyle Marketers, though more commercially oriented, occasionally promote circular or durable products and collaborate with service-based brands, broadening what is seen as aspirational consumption (Audrezet et al., 2020).

Overcoming barriers to reduce strategies: Sufficiency is one of the most challenging pillars of the CE, requiring not only individual restraints but also a redefinition of soci-

etal consumption norms (e.g., Bohnenberger, 2021; Jungell-Michelsson & Heikkurinen, 2022). Sustainability influencers lower psychological barriers to sufficiency by making it feel more attainable and rewarding through relatability, storytelling, and visual appeal. Many avoid promotional content or reject conflicting brand offers to stay aligned with their values, signalling authenticity and maintaining audience trust (Audrezet et al., 2020; Husemann & Eckhardt, 2019). Their BMs – especially among Educational Advocates and Change Leaders – reduce reliance on product promotion by generating income through speaking engagements, educational resources, or NGO partnerships. These strategies help influencers navigate resistance and structural limitations, contributing to circular economy goals through sufficiency-led practices and monetisation models.

5.2 Challenges of sustainability influencers

Despite their positive impact, sustainability influencers face several challenges that hinder their financial sustainability and reach.

Limited monetisation opportunities: Unlike mainstream influencers, sustainability influencers have fewer brand collaboration options since their content prioritises ethical consumption and systemic change over product promotions. Many brands hesitate to invest in them due to audience scrutiny and lower commercial appeal, making revenue generation more challenging. Furthermore, as of their strict ethical vetting of collaborations, they often decline lucrative offers.

Algorithmic bias: Social media algorithms favour high-engagement, entertainment-driven content, often sidelining educational or advocacy-based posts. To maintain visibility, sustainability influencers may feel pressured to adopt more commercial content strategies, potentially compromising their values.

High expectations and accusations of greenwashing: Sustainability influencers face intense audience scrutiny, with every decision evaluated against strict ethical standards. Even ethical monetisation efforts or partnerships with sustainability-focused brands may invite accusations of greenwashing, damaging credibility and limiting income opportunities.

5.3 Theoretical contribution

This study contributes to the academic literature by bridging the gap between influencer marketing and the CE. While prior research has focused primarily on conventional influencers (Borchers & Enke, 2021; Casaló et al., 2020), this research sheds light on how sustainability influencers operate within the principles of the CE, particularly in promoting the 4Rs (Alcalde-Calonge et al., 2022). The findings emphasise the critical role that influencers can play in educating and inspiring their followers to adopt more sustainable consumption habits.

Furthermore, the study contributes to the limited literature on BMs of influencers, a research area that has remained largely underexplored (Ye et al., 2021; Zabel, 2021). By identifying and analysing the distinct BMs of Educational Advocates, Lifestyle Marketers, and Change Leaders, this research enhances our understanding of how these influencers operate within the framework of the CE. This contribution is particularly significant as it aligns with the emerging discourse on BMs in the CE (Centobelli et al., 2020; Takacs, 2021; Takacs et al., 2020). By acting as intermediaries, sustainability influencers

bridge the gap between individual consumer actions and broader sustainability initiatives, demonstrating how their unique models can advance CE principles.

This study also advances the theoretical understanding of how BMs in the CE can support sufficiency-oriented strategies (Bocken et al., 2016; Villalba-Eguiluz et al., 2023) which are often overlooked in both marketing and sustainability scholarship. By showing how different influencer models enable the communication and normalisation of "reduce" behaviours – whether through educational content, lifestyle inspiration, or activist discourse – our findings highlight the potential of influencers as agents of social norm change. In doing so, we extend prior work on CE BMs (Centobelli et al., 2020; Evans et al., 2017) by demonstrating how they can actively support behavioural levers central to CE transitions.

5.4 Practical implications

Influencers: Sustainability influencers play a vital role in driving the CE by fostering awareness, educating their audiences, and advocating for systemic change. To enhance their impact, influencers should leverage transparency in brand partnerships, ensuring their collaborations align with their sustainability values, as seen in the reluctance of Educational Advocates to engage in sponsorships that could compromise their credibility. By focusing on authentic engagement and demonstrating real-life applications of sustainability principles – whether through education, lifestyle inspiration, or activism – sustainability influencers can maintain audience trust and drive long-term behavioural change. Additionally, navigating algorithmic challenges by adopting engaging storytelling formats can help maintain visibility without resorting to commercial content that may dilute their mission.

Brands: Brands seeking to engage in sustainability marketing must ensure that their partnerships with influencers are value-driven and credibility-enhancing (Lou & Yuan, 2019). The study highlights that Lifestyle Marketers are more open to collaborations, but strict vetting processes are necessary to avoid accusations of greenwashing. Brands should prioritise long-term relationships with influencers whose values align with their corporate social responsibility (CSR) goals. Rather than viewing influencers merely as promotional tools, brands can co-create educational and advocacy-driven content, reinforcing authenticity and trust among ethically minded consumers.

Policy makers: The study emphasises that Change Leaders extend their influence beyond social media, actively engaging with policymakers and organisations to advocate for corporate accountability and systemic sustainability efforts. By recognising sustainability influencers as key players in policy discussions, governments and institutions can collaborate with them on environmental campaigns, policy awareness initiatives, and funding opportunities for sustainability education. Furthermore, regulations ensuring transparency in sustainability claims within influencer marketing can help mitigate greenwashing and maintain public trust. Given the algorithmic challenges that limit sustainability content visibility, policymakers should also encourage digital platforms to promote credible, advocacy-driven content, fostering greater public engagement with CE initiatives.

5.5 Future research

Future research should explore the long-term sustainability of these BMs, particularly as the CE continues to evolve. Further investigation into alternative monetisation strategies, such as crowdfunding, could provide sustainability influencers with additional pathways to financial sustainability while remaining true to their ethical values. Additionally, given the female-dominated sample in this study, future research might explore the dynamics of male sustainability influencers and whether they face different challenges or opportunities in this space.

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