

Towards AI-based circular business models: Review and definition

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Resumo

Technological innovations, shifting societal expectations, and the need for sustainability transform businesses (Bag et al., 2021). Circularity, digitalization, AI, and ecosystems are redefining strategies and changing how value is created and delivered (Furr et al., 2022; Langley et al., 2023). In this scenario, the circular economy demands a fundamental shift from traditional business models, leveraging AI to drive innovation, minimize waste, boost resource efficiency, and provide competitive advantages (Dey et al., 2023; Sjodin et al., 2023). For example, an electric vehicle battery manufacturer adopted AI-enabled digital product passports to manage sustainability and lifecycle. Sensors on each battery collected performance data, which AI analyzed to predict lifespan and recommend preventive replacements. Recycled batteries were processed by AI to identify reusable materials, minimizing waste and reducing reliance on virgin resources. Additionally, a battery leasing program supported by digital product passports ensured efficient reuse and recycling, fostering a circular and sustainable business model (Langley et al., 2023). Teece (2010, p. 191) offers a foundational definition of a business model as "the architecture of the value creation, delivery, and capture mechanisms a firm utilizes," encompassing the firm's value proposition, market segments, and value chain activities essential for realizing this proposition. Scholars in strategic management (Shepherd et al., 2023) emphasize the role of business models in generating customer value and fostering a company's competitive edge. Elaborating on that, the concept of the circular business model (CBM) (Neligan et al., 2023) has gained prominence and marks a significant shift from linear methods, focusing on eliminating waste from systems and establishing regenerative value cycles (Linder & Williander, 2017). Recently, scholars (Sjodin et al., 2023) have highlighted AI's role in enhancing value propositions by optimizing product utilization and lifecycle, reducing material usage, extending product lifespan, and improving resource efficiency and sustainability, thereby significantly contributing to the effectiveness of CBM and opens new avenues for innovation and competitive advantage. Although the extant research provides a rich repertory showing how companies apply AI to leverage CBM, it is essential to note that the literature has progressed in a fragmented manner. Prior research has emphasized the use of AI to redefine AI-based circular offerings (Sjodin et al., 2023), manage internal resistance to AI CBM (Pinheiro et al., 2022), continuously applying business expertise to curating AI models for CBM (Qi et al., 2023), and creating AI solutions for circular proposals with ecosystem partners (Langley et al., 2023). However, the literature lacks an integrative review of the AI-based CBM that synthesizes the literature, potentially leading to new insights to explain how to make the transition to AI-based CBM. To address these gaps, the present study seeks to answer the following research question: "How are companies applying AI to leverage circular business models?". We conducted a systematic literature review (SLR) to produce rigorous conceptual clarity from existing AI and circular economy research. Our main contribution to the CBM literature (Neligan et al., 2023) within the AI context (Sjodin et al., 2023) is proposing that transitioning to AI-based CBM involves strategic reframing, AI-driven

dematerialization, and ecosystem platformization. These components foster technological advancements while fulfilling societal demands and sustainability objectives (Bag et al., 2021). Unlike previous studies (Linder & Williander, 2017) that discuss generic CBM strategies without AI specifics, we advance the CBM literature (Neligan et al., 2023) by detailing an AI-based reframing strategy. For example, we outline how to define an AI-based value proposition, redefine AI-based sustainability offerings, become an AI solution provider, expand product scope with AI, and communicate strategic shifts to stakeholders. We also draw on recent research (e.g., Fallahi et al., 2023; Neligan et al., 2023; Sjödin et al., 2023) to conceptualize AI-based CBM, which involves using AI and related technologies to create, capture, and deliver value using the ecosystem platform as a structure to leverage technological innovations while addressing societal expectations and sustainability needs.

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Palavras Chave

Artificial Intelligence, Circular business models, Ecosystem