Conceptualizing the Synergies Between Circular Economy and Operational Excellence in the Era of Industry 5.0

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Abstract. Supply chains are undergoing a profound transformation, driven by sustainability imperatives, digital innovation, and evolving customer expectations. Industry 5.0, with its emphasis on human-centricity, resilience, and sustainability, offers a new paradigm for rethinking operational models. In this context, the circular economy (CE) emerges as a strategic lever to enhance both environmental performance and supply chain resilience. This article aims to explore the synergies between Circular Economy and Operational Excellence (OpEx) within the framework of Industry 5.0. The research methodology combines a comprehensive literature review conducted through databases with the analysis of selected case studies. Key principles, enablers, and practices were identified and synthesized to develop a conceptual framework integrating CE, OpEx, and Industry 5.0 technologies.The results demonstrate that the integration of CE practices with OpEx methodologies significantly enhances supply chain sustainability, efficiency, and adaptability. Emerging technologies such as blockchain, IoT, and AI are identified as critical enablers of this integration, facilitating waste reduction, improved resource utilization, and enhanced traceability. The adoption of circular lifecycle approaches and durable product design aligns with the sustainability pillar of Industry 5.0, while the human-centric dimension ensures workforce empowerment and inclusive innovation.

Keywords: Industry 5.0, Operational Excellence, Circular Economy, Sustainability, Literature Review