



Invited Session: **Code: 279vb**

Integrating Product Development and Supply Chain Design for the Transition toward Sustainability and Circular Economy

Session Chairs:

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In recent years, global resource consumption has surged, with over three-quarters of the materials consumed in the last six years alone (Matthew et al., 2024), underscoring the urgent need for a sustainable shift toward a zero-waste economy. The circular economy (CE) model offers a solution by promoting the regeneration and restoration of resources, focusing on extending their lifecycle. At the heart of this model is the potential for collaboration and resource circulation, particularly through the integration of product development (PD) with supply chain (SC) design. Understanding the interconnections between product design and SCs can impact company performance by influencing decisions at the design level of the SC (Pero et al., 2010). This approach, from production to end-of-life (EOL) stages, allows for product reuse, recycling, remanufacturing, or refurbishing, offering a promising path toward sustainability.

Integrating CE principles into both PD and SC processes, particularly through the application of R-imperatives like recycling, refurbishing, and reusing, is essential for achieving sustainability goals. By embedding these strategies into SC design, companies can preserve the value of materials and products, significantly reducing waste. This integration not only retains resources within the economy but also ensures zero waste when products reach their EOL.

The synergy between PD and SC design is also critical for determining the right SC strategies—whether cost-efficient or market-responsive—based on the type of product being developed. This alignment enhances competitive capabilities and boosts sustainability performance. Leading companies like Dell, Apple, and Samsung have embraced circular practices and set a powerful example for the industry. These companies are making significant strides towards a more sustainable future by implementing R-imperatives and sustainable solutions in their products and supply chains. For instance, Dell focuses on repairable designs, Apple targets a closed-loop supply chain, and Samsung utilizes recycled materials (Aggarwal et al., 2023).

While theoretical frameworks provide insights into the interconnections between PD and SC design for CE transitions, companies need more practical guidance to implement R-imperatives effectively. Moreover, moving towards sustainable SCs requires a reflection on the relationship between product design and infrastructure design e.g. in mobility, as well as the role of modularity in design and its implications for SCs, to enhance sustainability in increasingly complex systems. This session aims to bridge this gap by focusing on the impact of integrating R-imperatives on PD and SC design and exploring the requirements and challenges organizations face in redesigning their products and SCs to enhance circularity and sustainability. It invites researchers to align CE principles with business strategies, address technical, economic, and regulatory challenges, and foster innovation in business models to support the transition toward CE. The session provides a platform for discussing practical solutions and value creation opportunities, establishing foundational principles for circularity design, and guiding companies in implementing sustainable practices from product conception to end-of-life.

References

Aggarwal, R., Singh, H., & Garg, P. (2023). Dell Technologies Inc.: Innovating toward circularity. *Journal of Information Technology Teaching Cases*, 20438869231215089.

Matthew, F., Álvaro, C., & Laxmi, H. (2024). *Circularity Gap Report 2024*. <https://policycommons.net/artifacts/11317813/cgr-global-2024/>

Pero, M., Abdelkafi, N., Sianesi, A., & Blecker, T. (2010). A framework for the alignment of new product development and supply chains. *Supply Chain Management: An International Journal*, 15(2), 115-128.

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Important Dates (Deadlines)

Full paper submission: *November 30, 2024*

Notifications to authors: *January 30, 2025*

Camera-ready paper submission: *February 28, 2025*