

Circular Supply Chains: Sustainability in Consumer Goods

Sandeep Ramanamuni

(Manager, Digital Supply Chain)
sandeep.ramanamuni@gmail.com

How Companies Can Integrate Sustainability Into Supply Chain Operations

Abstract

Circular supply chains are recognized as a better alternative to the linear economic model. Circular supply chain management integrates the philosophy of circular economy into supply chains, offering it a compelling perspective on sustainability. The concept of a circular supply chain has recently attracted a lot of attention in terms of integrating sustainability into operations. Unlike linear supply chains from the past, this new approach is resource-efficient, waste-reducing, and is a closed-loop system.

Circular supply chains reduce the environmental impact of the linear economy by optimizing the resources and minimizing waste. The method potentially improves the resilience of the supply chain through localization, collaboration, and digitalization. The study aims to ascertain the process of circular supply chains to check its feasibility of generating sustainability in consumer goods. Integrating sustainability in the supply chains is possible by adopting the circular economy model. The study explores best practices to accomplish this and evaluates the importance of adopting digital technologies in integrating closed-loop supply chains.

Keywords: Circular economy, circular supply chains, sustainability, production, consumer goods, digital technologies

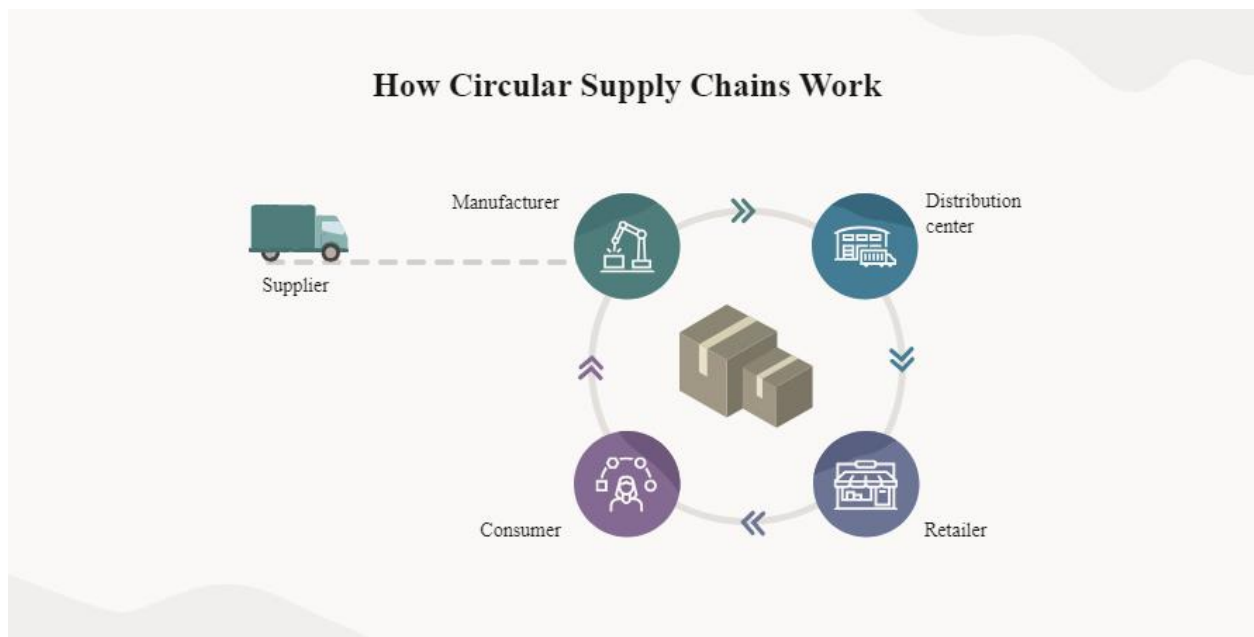
Introduction:

The economic paradigm of taking, making, and disposing of resources was rooted in the assumption of the unlimited availability of resources (Ellen MacArthur, 2013). The depletion of natural resources and the irreversible harm to the environment highlight the ineffectiveness of the linear paradigm and the need to adopt sustainable business models (F.A. De Lima, S. Seuring, 2022). The circular economy approach is the best way to invert this linear trend by promoting the sustainable use of resources. The transition from the linear to the circular economic model will require the organization to adopt specific managerial practices (A. Urbinati, D., Chiaroni, et al., 2017) and redesign the entire supply chain (L. Cui, H. Wu et al., 2021).

The primary aim of circular supply chains is to combine the traditional objectives of supply chain management with the circular economy objectives to minimize input resources, mitigate waste, and

reduce emissions and the use of toxic materials (V. Prieto, C.Jaca, et al., 2019). Circular supply chains might exhibit more resilience. This is due to localization, which reduces the exposure to risks that are associated with interruptions in the sourcing and production processes (J. Sarkis, 2019). Also, the adoption of digital strategies might enhance the resilience of circular supply chains through information sharing among members of supply chains.

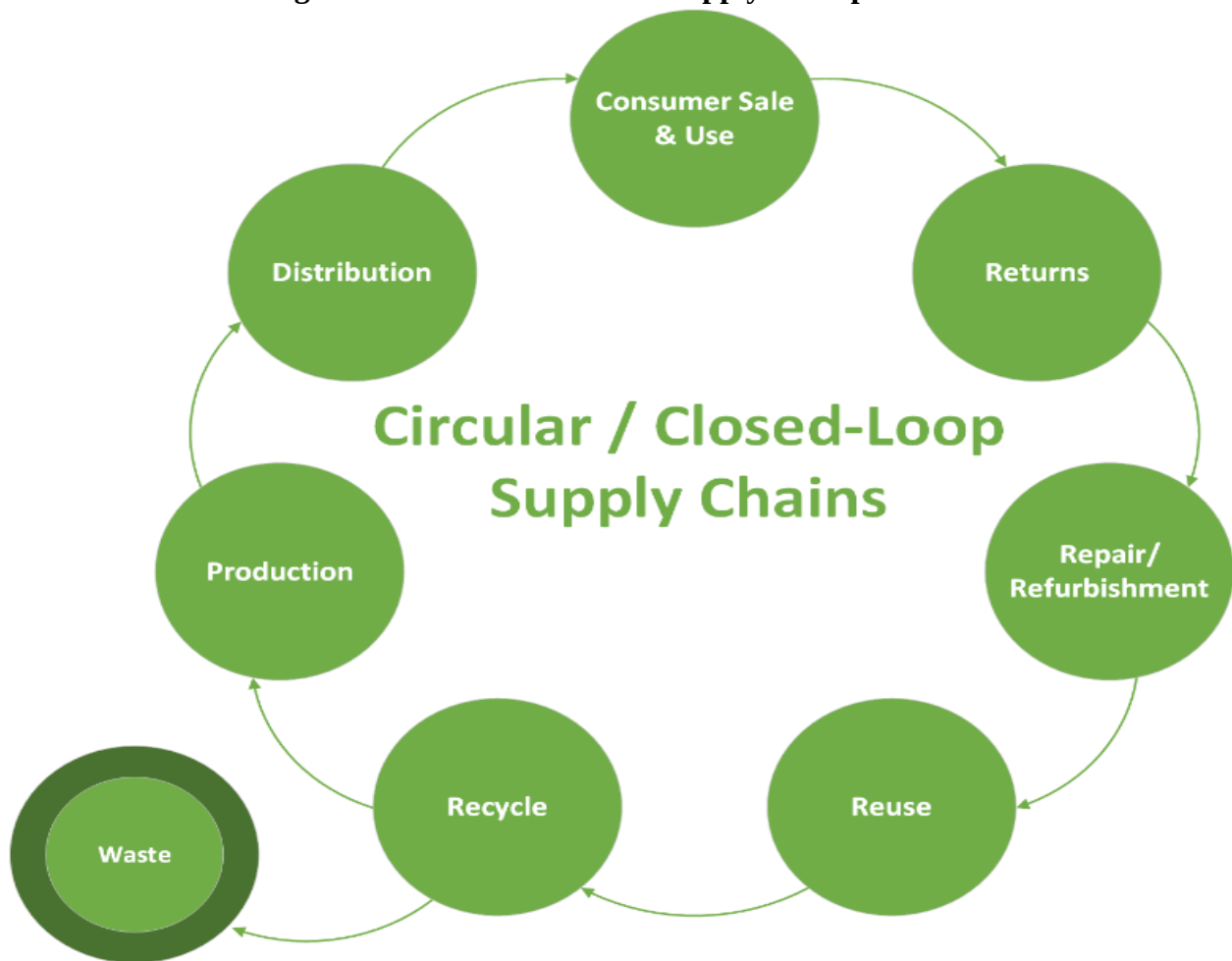
Figure 1: How do circular supply chains work



Process of circular supply chains to enable sustainability in consumer goods:

1. **Source:** This process includes the selection of the best materials and the selection of circular suppliers. The source materials in the circular supply chain should have a low environmental impact. They should be quickly returned, recovered, and disassembled (M. Farooque, A. Zhang et al., 2019). Source materials might include bio-natural materials, labels and packaging that can be recycled, and suppliers who are compliant with environmental standards.
2. **Make:** This involves practices that minimize the production inputs and resources in order to achieve efficient production. They aim to minimize the resources used in the production process and promptly dispose of the waste during the production and testing phase (M. Geissdoerfer, S. Evans, et al., 2018).
3. **Recover:** This process aims at reinserting the end-of-life products into the supply chain through recycling and refurbishing. The aim is to recover from the residual value of a product to obtain something new with equal or higher performance (M. Mandolini et al., 2019).

Figure 2: How does a circular supply chain perform?



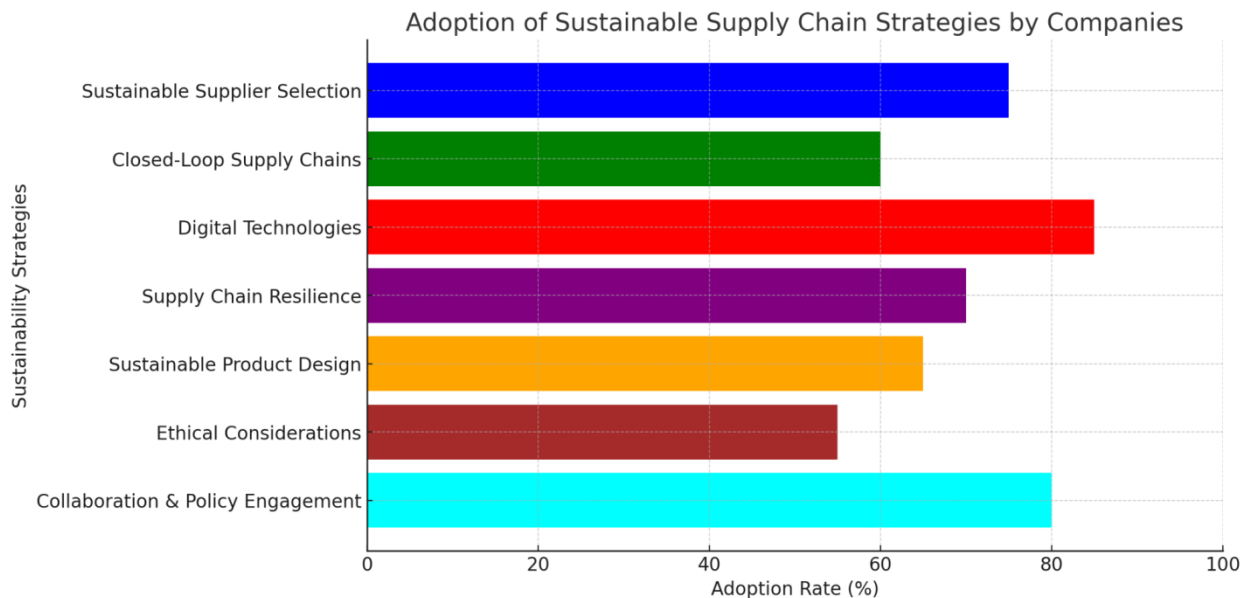
4. **Delivery:** This process mandates the building of a logistics network to ship the finished products to the end users. From the circular economy point of view, the logistics network should be local to mitigate carbon emissions and should also follow the optimization of routes and stocks.
5. **Use:** Integrate product, use, and result-oriented systems to deliver value to the end customers. For example, products should be sold together with complementary services for maintenance and repair. Use, and result-oriented systems maximize the utilization of assets, and together, they fall under produce as a service practice (E.Unal, A.Urbinati, et al., 2019)
6. **Plan and enable:** Compared to the linear supply chain, circular supply chains are complex to organize. This is because they have to satisfy the demands of the end user by balancing the available natural resources. By leveraging digital technologies, it is possible to have complete visibility of the lifecycle of the product and also monitor its residual value (C. Khandelwal, M.K. Barua, 2020).

Integrating sustainability in the circular supply chains - best practices

Integrating sustainability practices into supply chain operations has become a strategic imperative for organizations looking to enhance their environmental stewardship, social responsibility, and economic performance (Sarkis et al., 2011). This integration means that sustainability practices are built into all

stages of procurement, production, distribution, and end-of-life management. The rest of the discussion identifies key methods used to conceptualize sustainable supply chains in contemporary research.

Figure 3: Adoption of sustainable supply chain strategies by companies



1. Sustainable Supplier Selection and Development

The link between suppliers and environmentally considerate practices is the cornerstone of green supply chains. Companies should screen potential suppliers based on their environmental certifications and resource productivity with regard to their labor practices (Panigrahi et al., 2018). Supplier development through training and capacity building ensures that the supplier is on a sustainable path.

2. Closed-loop Supply chains in Implementation

Based on reuse, remanufacturing, or recycling of products minimizes waste and conserves resources. It reduces environmental damage and profits economically by realizing the value of returned products. A multi-objective optimization model for sustainable closed-loop supply chain networks design under uncertainty significantly recognizes the balance between economic and environmental objectives (Ahmed et al., 2020).

3. Leveraging on digital technologies:

Digital technologies like the Internet of Things (IoT), blockchain, and artificial intelligence (AI) help ensure transparency, efficiency, and sustainability for supply chain functions. The next-generation digital procurement workspaces should focus on information integration, automation, analytics, and sustainability. They show how digital solutions can enable procurement processes to be resilient and environmentally responsible (Stütz et al., 2023).

4. Enhancing Supply Chain Resilience

Resilience in supply chains is established so that they can inflict disruptions while remaining sustainable. Negri et al. (2021) performed a systematic literature review of sustainability versus

resilience in supply chains, thus drawing up a research agenda that illustrates the necessity for strategies that deal with both environmental and operational risks.

5. Sustainable Product Design and Lifecycle Assessment.

Product design for sustainability involves the choice of eco-friendly raw materials. It mitigates energy consumption in production, along with a complete consideration of the product lifecycle. Lifecycle assessments identify negative environmental impacts at each phase of the product's life, serving as a guide for improvements. Hasan et al. (2024) conducted a systematic literature review on sustainable and green composite materials supply chains based on Industry 5.0 values, where human-centric and sustainable manufacturing are in focus.

6. Cross-sector collaboration:

It is possible to integrate a circular economy within the supply chain by collaborating with industry peers, non-governmental organizations, and policymakers. Such joint initiatives will amplify sustainability efforts, standardise practices, and enhance innovation within the supply chain (Brunori, G. Galli et al., 2016).

The incorporation of sustainability into the working supply chain is a delicate balancing act requiring an intricate approach; suitable suppliers, technological advancement, resilience development, ethics, and collaborative action must work hand in hand with transparent reporting. These ingredients allow worldwide firms and corporations to weigh and balance profits with responsibility for the regenerative health of the environment and the welfare of mankind.

Circular supply chains market growth and data analytics:

Investment in circular supply chains is a tremendous opportunity for economic growth across diverse industries. Studies reveal that adopting this strategy could generate an additional \$4.5 trillion in economic output by the year 2030 (World Economic Forum, 2019).

- The global circuit economy market was valued at about \$339 billion in 2019. It was projected to grow at a CAGR of about 8.2 percent between 2020 and 2027 (Ellen MacArthur Foundation, 2019).
- Investment in circular economy initiatives also recorded astronomical growth. About \$350 billion has been committed to the circular solution, especially in packaging, textiles, and electronics (Ellen MacArthur Foundation, 2019).
- The incorporation of big data analytics in supply chain management gained tremendous importance.
- Studies were conducted to ascertain its emphasis on optimizing reverse logistics, mitigating waste, and enhancing the efficiency of resources.

Recommendations:

Supply chain management in a circular business model focuses on balancing the capabilities of the natural resources with the demands of the supply chain. This topic paves interesting opportunities for further research.

- Future studies could focus on the activities that are needed to gain insight into the balance between the capabilities of natural resources and the requirements in the supply chain.
- To enable collaboration within the supply chain, the key aspects in the business model should gather and share information that mandates cross-organization workflows. Research is required in developing these cross-organizational workflows (Govindan et al., 2013). The economic, social, and environmental benefits of the model should also be studied.
- The development of a performance measurement system for circular supply chains will enable performance reporting, control, and improvement.
- The impact of the buyback and the takeback programs on the economic and the environmental impact of supply chains paves the way for more detailed studies.

Conclusion

The supply chain will include diverse segments that cater to the demands of the customer directly or indirectly. It includes the organizations that engage in the upstream and downstream services, products, information, and finance flow to the customers from the suppliers (Mentzer et al., 2001). Circular or sustainable supply chains will deal with the association between the environment and supply chain management at large. Companies implement Circular Economy practices based on customers' demands for creating environment-friendly and sustainable products and services (Green et al., 2012). Circular economy practices improve supply chain integration and promote supply chain flexibility. It promotes supply chain integration, improves the flow of resources, and serves as a strategic collaboration within the organization. It is possible to integrate CE within the existing framework by considering digital technologies, through cross-sector collaboration and policy engagement, and by integrating closed-loop supply chains.

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