Chapter 6

Impact of Circular Models on the Carbon-Free Supply Chain

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ABSTRACT

Because of climate change, companies are now moving toward carbon-free supply chains, and circular models appear to be a good answer. Such supply chains focus on using materials again, recycling them, and adding renewable energy, as this leads to less carbon output and efficient use of resources. They are not the same as standard supply chains since they strive to reduce waste and reuse things as much as possible. It reviews how circular economic models can help reach sustainability goals and also identifies the problems in using them and any new technologies involved. Although it is hard to fix some problems in infrastructure, policies, and stakeholder cooperation, firms can use AI, blockchain, and IoT to improve their circular operations. Product longevity, the process of handling products returned after use, and sustainable design raise the overall sustainability of the company. Thanks to effective government policies and more demand for eco-friendly items,

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circular supply chains help the economy become carbon neutral and stronger.

INTRODUCTION

Rising concerns about climate change have prompted many nations to act swiftly in reducing carbon emissions across various sectors, with particular emphasis on supply chains. Traditional linear supply chains, due to their design, tend to consume more resources and generate substantial greenhouse gas (GHG) emissions. In this model, raw materials are extracted, products are produced, and waste is discarded, leading to environmental issues and resource depletion, as highlighted by Kirchherr et al. (2018). Since up to 80% of a company's CO2 emissions stem from supply chains, optimizing their design and operation is critical for achieving sustainability goals and carbon neutrality.

In a circular economy, the primary objectives are to reuse resources, reduce waste, and integrate renewable energy throughout supply chains. By doing so, the need for new materials is minimized, and emissions from operations are reduced (Geissdoerfer et al., 2020). For instance, Dell Technologies has adopted a model where recycled plastics and metals from returned devices are used to manufacture new electronics, effectively cutting the need for virgin raw materials while reducing carbon emissions (Dell Technologies, 2021).

Circularity is also gaining traction in the automotive sector. For example, the Renault Group's Choisy-le-Roi factory in France specializes in remanufacturing car parts to restore them to as-new condition. Circular supply chains in heavy industries like automotive are significantly better for the environment, having reduced CO2 emissions by an estimated 80% (Renault Group, 2020). However, despite these advantages, circular supply chains still face substantial challenges related to technology, infrastructure development, and ensuring collaboration across all stakeholders. Advanced digital tools such as blockchain and IoT are critical to efficiently track the entire process from material collection to sorting (Genovese et al., 2017). For instance, Maersk is piloting blockchain to monitor its supply chains, ensuring sustainable sourcing and recycling practices (Maersk, 2022).

To enable circular supply chains, policy frameworks are essential. The European Union's Circular Economy Action Plan, for example, sets out regulations to help businesses create sustainable products, take responsibility for their waste, and minimize their discard rates. This framework presents new opportunities for companies to transition from the traditional linear 'take-make-dispose' model. Similarly, China's circular economy law promotes resource reduction and pollution control within businesses (Liu et al., 2019).

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