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Reverse logistics and circular economy: strategies for sustainability in the supply chain .

Reverse logistics and circular economy: strategies for sustainability in the supply chain

Lucas Emanuel Almeida Barboza

ABSTRACT

The transition from a linear economic model to a circular economy presents unprecedented challenges and opportunities for contemporary supply chain management. This article presents a qualitative literature review aiming to analyze the strategic integration between reverse logistics and the principles of the circular economy as vectors of sustainability. The methodology is based on an integrative literature review, selecting seminal works and recent articles on the reverse flow of materials. The results indicate that reverse logistics is not only a legal compliance obligation but also a vital component for the regeneration of systems and the maintenance of the value of resources in circulation for extended periods. It is concluded that the systemic adoption of these concepts, supported by Logistics 4.0 technologies, mitigates environmental impact and generates competitive advantage through operational efficiency and the strengthening of corporate governance (ESG).

Keywords: Reverse Logistics; Circular Economy; Supply Chain; Sustainability; ESG.

INTRODUCTION

The production paradigm consolidated since the Industrial Revolution, characterized by linear logic.
The "extraction-production-disposal" model shows clear signs of exhaustion in the face of the finite nature of...
This model, focused on maximizing natural resources and the worsening climate crisis.
Consumption and planned obsolescence generate negative externalities that compromise the
The resilience of ecosystems and the long-term economic viability of organizations.
In this context, supply chain management (SCM) is no longer seen as a function.
From merely operational and fragmented to becoming a strategic and integrative discipline.
(CHRISTOPHER, 2011). Reverse logistics emerges as a fundamental mechanism for
Waste mitigation, allowing the flow of products and materials to return from the point of consumption.
back to the point of origin, for value recapture or environmentally sound disposal.
(ROGERS; TIBBEN-LEMBKE, 1999). The objective of this study is to analyze how convergence
Between reverse logistics and the principles of the circular economy, supply chains are structured.
Sustainable and efficient, responding to pressures for corporate responsibility and compliance.
legal.

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THEORETICAL FRAMEWORK

Pillars of Reverse Logistics: Post-Consumption and Post-Sale

Reverse logistics is defined as the process of planning, implementing, and controlling the flow of goods and services.
efficient management of raw materials, work-in-process inventory, and finished goods from the point of consumption to the point of sale.
of origin, for the purpose of recapturing value or proper disposal (ROGERS; TIBBEN-
(LEMBKE, 1999). According to the established literature, this process is subdivided into two channels.
main points:

• **Post-Consumer Reverse Logistics:** Focused on products that have reached the end of their useful life.
or were discarded by users, such as packaging and electronics, with the aim of reuse, to
remanufacturing or recycling (LEITE, 2017).

• **Post-Sales Reverse Logistics:** Refers to the flow of products that are little or not used,
resulting from returns due to defects, excess inventory, or errors in the distribution channel.
(LEITE, 2017).

Rogers and Tibben-Lembke (1999) argue that efficiency in these channels requires a
Robust receiving and sorting infrastructure, capable of transforming what would be "waste" into raw materials.
productive, reducing dependence on virgin raw materials. Ballou (2006) reinforces that management
The integration of these flows is a necessary condition for long-term logistical competitiveness.

Principles of Circular Economy and System Regeneration

The Circular Economy proposes a systemic redesign of production, based on the principle of...
Elimination of waste and pollution from the product design stage (ecodesign). Unlike
In isolation from recycling, circularity seeks to keep the value of materials in circulation for longer.
possible, through technical and biological cycles (STAHEL, 2019).

According to Stahel's (2019) principles, the circular economy is a catalyst for resilience, because
It replaces the concept of consumer with that of user and that of waste with that of technical nutrient. This
This approach requires a deep synchronization of the value network, integrating suppliers and manufacturers.
and customers in a continuous feedback loop, which demands organizational capabilities.
specific throughout the entire chain (PIRES, 2009).

MATERIALS AND METHODS

This study is characterized as qualitative research, developed through a
Integrative literature review. The method allowed for the synthesis of multiple published studies.

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providing a comprehensive understanding of the phenomenon under investigation.

Data collection was carried out using scientific databases (such as Scielo, Google Scholar and...). university databases), encompassing reference books and scientific articles from the period from 2010 to 2024. The selection criteria included the theoretical relevance of the authors, adherence to The theme of sustainability in logistics and the presence of discussions about the transition to Logistics 4.0 and ESG. The data analysis followed the content analysis technique, categorizing the findings in strategic, operational, and technological dimensions.

RESULTS AND DISCUSSION

Data analysis reveals that the strategic integration of reverse logistics with the The circular economy transcends legal compliance and positions itself as a source of advantage. competitive (CHRISTOPHER, 2011). The transition to Logistics 4.0 plays a crucial role. In this evolution, technologies such as IoT, RFID, and Blockchain enable traceability of End-to-end processing is essential for managing product returns and ensuring the authenticity of materials. recycled.

It was observed that the adoption of ESG (Environmental, Social, and Governance) metrics requires... companies expanding their responsibility boundaries beyond the factory floor, covering the entire product life cycle (LEITE, 2017). However, practical bottlenecks persist. significant, such as:

• **Logistics Costs:** The trade-off between the cost of collection and the value recovered is frequently... discourages investment, which requires optimization of routes and collaboration models (BALLOU, 2006).

• **Network Complexity:** Structuring efficient reverse channels requires cooperation. multisectoral and extended producer responsibility legislation (ROGERS; TIBBEN-LEMBKE, 1999).

• **Organizational Culture:** The shift from a linear to a circular mindset requires new... skills in supplier management and product design, an aspect that Pires (2009) associates to the need for strategic reconfiguration of supply chains.

FINAL CONSIDERATIONS

The study achieved its proposed objective by demonstrating that reverse logistics is the operational arm. indispensable for enabling the circular economy in the supply chain (STAHEL, 2019). A

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Research suggests that sustainability should not be treated as an additional cost, but as...
a vector of financial efficiency and reduction of operational risks (LEITE, 2017).
The theoretical contributions of this work lie in the systematization of the interdependence between the
Reverse flows and value regeneration. As avenues for future research, it is suggested
To investigate the impact of using Digital Twins in simulating stress scenarios in networks.
reverse logistics and conducting empirical studies on successful case studies in supply chain implementation.
of circular supply chains in the Brazilian context.

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