

Integrating sustainability into the supply chain to improve public health

Thiago de Freitas Santos¹, Annibal Scavarda², Flávio Vaz Machado³.

ABSTRACT

This text emphasizes the growing importance of sustainable practices in the supply chain to minimize environmental impacts and promote public health. It discusses various aspects of sustainability within the supply chain, such as green logistics, sustainable agriculture, cleaner production processes, and collaborative efforts among stakeholders. The text also highlights the benefits of adopting these practices, including reduced greenhouse gas emissions, improved air and water quality, and decreased health risks associated with exposure to harmful chemicals. Furthermore, it outlines the methodology used in a study to explore the integration and effects of sustainable practices throughout the supply chain.

Keywords: Sustainable practices, Supply chain, Environmental impacts, Public health, Integration.

INTRODUCTION

Sustainable practices in the supply chain are gaining increasing attention as an effective means of minimizing environmental impacts and promoting public health. Sustainability, understood as the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs, is a concept widely adopted by companies seeking not only to reduce costs but also to create long-term value. These practices are especially critical in the supply chain, where each step, from the production of raw materials to the delivery of the final product to the consumer, can have significant effects on the environment and public health.

One of the most direct ways in which sustainable practices in the supply chain can minimize environmental impacts is by reducing greenhouse gas (GHG) emissions. Green logistics, for example, aims to optimise transport routes, use alternative fuels and promote energy efficiency in transport vehicles. Studies indicate that the adoption of green supply chain management (GSCM) practices can improve both the environmental and economic performance of companies, also positively impacting operational performance (GREEN et al., 2012).

In addition, the use of electric or hybrid vehicles in freight transport can significantly decrease air pollution, contributing to the improvement of air quality in urban areas and, consequently, to public health. Companies that have adopted sustainable logistics practices have been able to reduce their CO₂ emissions by up to 20% over a five-year period (RAHIM et al., 2016).

¹ Celso Suckow da Fonseca Federal Center for Technological Education (CEFET/RJ) – Rio de Janeiro

² CEFET – Rio de Janeiro

³ Institute of Medical Education (IDOMED) – Rio de Janeiro



The sustainable production of raw materials is another crucial area. Sustainable agriculture, which includes practices such as crop rotation, the use of organic fertilizers, and soil conservation, can reduce environmental degradation and the emission of pollutants. A report by the Food and Agriculture Organization (FAO) highlights that sustainable farming methods can increase long-term soil productivity, reduce the need for chemical pesticides, and improve water quality (THORLAKSON et al., 2018). These practices not only protect the environment but also reduce the health risks associated with exposure to harmful chemicals.

In the manufacturing stage, the adoption of cleaner and more efficient production processes also plays a key role. This includes utilizing technologies that consume less energy, reducing industrial waste, and recycling materials. Companies such as Interface, a carpet manufacturer, have implemented sustainability programs that have been able to significantly reduce their GHG emissions through the recycling of materials and the use of renewable energy sources (CHAKRAVARTY, 2014).

Integrating these practices into all stages of the supply chain, on the other hand, requires a commitment from companies to sustainability and collaboration between different actors, including suppliers, manufacturers, distributors, and consumers. Transparent communication and the adoption of internationally recognized sustainability standards, such as ISO 14001, are essential to ensure that everyone involved is aligned with environmental and public health objectives.

The effects of these practices on the reduction of pollutants are evident. A study conducted by the Environmental Protection Agency (EPA) of the United States revealed that companies that implemented sustainability practices in the supply chain reduced solid waste generation by an average of 25% and water consumption by 30% (GOVINDAN et al., 2014). In addition, decreasing the use of hazardous chemicals in production and improving energy efficiency directly contribute to reducing air and water pollution, promoting healthier environments for local communities.

OBJECTIVE

The present study aims to describe in a narrative way the contribution of sustainable practices in the supply chain to minimize environmental impacts and promote public health. This study also aims to describe how these practices can be integrated into different stages of the supply chain, evaluating their effects on the reduction of pollutants.

METHODOLOGY

To carry out this study, a methodology based on a literature review was adopted, using the Scopus and Virtual Health Library (VHL) databases. The search strategy included the following terms: Supply Chain OR Supply Chain AND Sustainability OR Sustainability OR Sustainable AND Health OR Health.



Data collection took place in March 2024, with no restrictions on the publication dates of the articles, in order not to limit the results. The findings, presented throughout the research, highlight relevant aspects of environmental impacts and public health promotion related to the supply chain.

DEVELOPMENT

Integrating sustainable practices into the supply chain involves an approach that considers all aspects of the product lifecycle. From the selection of raw materials to final disposal, each step provides opportunities to improve sustainability and reduce environmental impacts. Choosing suppliers that adopt sustainable farming practices, for example, can ensure that the materials used in production are sourced in an environmentally friendly manner. According to the *Food and Agriculture Organization* (FAO), sustainable agricultural practices such as crop rotation and the use of organic fertilizers not only protect the environment but also increase productivity in the long run (THORLAKSON et al., 2018)

The adoption of clean manufacturing technologies is also crucial for minimizing the use of natural resources and waste generation. Studies show that the implementation of cleaner production technologies can reduce energy consumption and significantly decrease the amount of industrial waste (VIEIRA et al., 2016). The company Interface, for example, has been able to reduce its greenhouse gas emissions by 92% since 1996 by adopting sustainable manufacturing practices and recycling materials (BADURDEEN et al., 2009).

Using recyclable or biodegradable packaging is another essential practice that can reduce the amount of solid waste sent to landfills. According to the *Environmental Protection Agency* (EPA), replacing conventional packaging with sustainable alternatives can reduce packaging waste by up to 50%, contributing to the reduction of environmental pollution (GOVINDAN et al., 2014). Companies such as Tetra Pak are leading this movement by developing packaging that is not only recyclable but also compostable, meeting the growing demands for greener solutions (MASOUMI et al., 2019).

Promoting energy efficiency and reducing greenhouse gas emissions are central objectives in sustainable supply chain practices. Investing in renewable energy technologies, such as solar panels and wind turbines, is an effective strategy to power operations in a more sustainable manner. Siemens, for example, has implemented a sustainability program that includes extensive use of solar energy in its factories, resulting in a 35% reduction in CO₂ emissions (BADURDEEN et al., 2009). Implementing energy management systems that monitor and control consumption can also identify areas to improve efficiency and reduce costs (SHUAIB et al., 2011).

In this context, reverse logistics, which refers to the process of returning products and materials to the production cycle after use, is a practice that contributes significantly to sustainability. According to one study, reverse logistics can reduce the need for new raw materials and decrease waste generation



(KALVERKAMP et al., 2018). This includes recycling obsolete products, remanufacturing components, and reusing materials, helping to close the lifecycle of products and promoting a circular economy.

Companies that adopt sustainable logistics practices can also optimize transportation routes, use alternative fuels, and promote energy efficiency in transportation vehicles. Reports indicate that optimizing transport routes can reduce CO₂ emissions, while using alternative fuels can further decrease the carbon footprint (WONG et al., 2016). The DHL company, for example, has implemented a green logistics program that includes the use of electric vehicles and route optimization, resulting in a significant reduction of its carbon emissions (RAHIM et al., 2016).

In addition to the environmental benefits, the adoption of these practices can provide competitive advantages for businesses. Consumers are increasingly aware of the environmental impacts of their choices and tend to prefer products from companies that demonstrate a genuine commitment to sustainability. Studies show that consumers would change their consumption habits to reduce their environmental impact and that companies should help improve the environment (NILSSON-LINDÉN et al., 2019).

In addition, sustainable practices can result in long-term cost savings through improved efficiency and reduced waste. Companies that implement sustainability strategies can reduce their operating costs while increasing their resilience to environmental and regulatory risks (REBITZER, 2002). Energy efficiency, for example, not only reduces emissions but can also lead to significant savings in energy costs, providing an additional financial advantage.

Integrating sustainable practices into the supply chain also requires an ongoing commitment to innovation and collaboration among all actors involved. Businesses, suppliers, distributors, and consumers must work together to develop and implement sustainable solutions that are beneficial to the environment and public health. Adopting internationally recognized sustainability standards, such as ISO 14001, can help ensure that all participants are aligned with the same goals and practices (JAENGLOM; TARIQ, 2013). In addition, transparent communication and disclosure of environmental results are key to maintaining the trust of consumers and other stakeholders.

Against this backdrop, sustainable practices in the supply chain are essential to reduce environmental impacts and promote public health. By taking a holistic approach that considers all stages of the product lifecycle, from the production of raw materials to final disposal, businesses can make a significant contribution to global sustainability. Evidence shows that these practices not only protect the environment but also provide competitive advantages and cost savings, making sustainability a vital component of any modern business strategy.



FINAL THOUGHTS

In concluding this text, it was understood that the adoption of sustainable practices in the supply chain is an essential strategy to minimize environmental impacts and promote public health. By integrating sustainability into every step of the product lifecycle, from the production of raw materials to logistics and final disposal, companies can significantly reduce the emission of pollutants and the consumption of natural resources. These practices not only protect the environment but also improve the quality of life for local communities by reducing exposure to harmful chemicals and improving air and water quality.

Implementing sustainable practices requires ongoing commitment and collaboration between all actors in the supply chain. However, the long-term benefits, both for the environment and public health, are immense. Companies that lead the way in sustainability not only contribute to a greener future, but also establish a resilient and competitive business model. In a world that is increasingly aware of environmental challenges, sustainability in the supply chain becomes not only an ethical responsibility but also a strategic advantage.



REFERENCES

- BADURDEEN, F., et al. (2009). Extending total life-cycle thinking to sustainable supply chain design. *International Journal of Product Lifecycle Management*, 4(1-3), 49-67.
- CHAKRAVARTY, A. K., & CHAKRAVARTY, A. K. (2014). Sustainable Supply Chains. In *Supply Chain Transformation: Evolving with Emerging Business Paradigms*, 273-305.
- GOVINDAN, K., et al. (2014). Impact of supply chain management practices on sustainability. *Journal of Cleaner Production*, 85, 212-225.
- GREEN JR, K. W., et al. (2012). Green supply chain management practices: impact on performance. *Supply chain management: an international journal*, 17(3), 290-305.
- JAENGLUM, K., & TARIQ, Z. (2013). The role of purchasing management towards sustainable supply chain: A lifecycle perspective. In *2013 IEEE International Conference on Industrial Engineering and Engineering Management* (pp. 776-780).
- KALVERKAMP, M., et al. (2018). Sustainability of cascading product lifecycles: The need for adaptive management to end-of-life supply chains. In *IFIP International Conference on Product Lifecycle Management* (pp. 159-168).
- MASOUMI, S. M., et al. (2019). Sustainable supply chain management in the automotive industry: A process-oriented review. *Sustainability*, 11(14), 3945.
- NILSSON-LINDÉN, H., et al. (2019). Product chain collaboration for sustainability: A business case for life cycle management. *Business Strategy and the Environment*, 28(8), 1619-1631.
- RAHIM, S. A., et al. (2016). Sustainable green supply chain management and impact on organisations. *Journal of Emerging Trends in Economics and Management Sciences*, 7(3), 147-155.
- REBITZER, G. (2002). Integrating life cycle costing and life cycle assessment for managing costs and environmental impacts in supply chains. In *Cost management in supply chains* (pp. 127-146).
- SHUAIB, M., et al. (2011). Design and performance evaluation of sustainable supply chains: Approach and methodologies. In *Advances in Sustainable Manufacturing: Proceedings of the 8th Global Conference on Sustainable Manufacturing* (pp. 347-352).
- THORLAKSON, T., et al. (2018). Companies' contribution to sustainability through global supply chains. *Proceedings of the National Academy of Sciences*, 115(9), 2072-2077.
- VIEIRA, D. R., et al. (2016). Elements of managerial integration for sustainable product lifecycle management. *International Journal of Product Lifecycle Management*, 9(2), 87-107.
- WONG, C. W. Y., et al. (2015). Environmental management practices with supply chain efforts. In *Environmental Management: The Supply Chain Perspective* (pp. 29-72).