

PACKAGING IN SUPERMARKETS: THE PATH TO SUSTAINABILITY THROUGH REVERSE LOGISTICS

1 INTRODUCTION

Reverse logistics (RL) plays a crucial role in mitigating the environmental impact of packaging disposal by facilitating the return of materials to the production cycle for recycling, reuse, or proper disposal, preventing them from becoming pollutants (Lai *et al.*, 2022). Supermarkets are packaging hubs that play a key role in implementing effective reverse logistics practices, extending their responsibility beyond sales to ensure responsible packaging management. Studies have emphasized the importance of adequate environmental education on disposal for employees and customers to improve the effectiveness of reverse logistics (De Souza *et al.*, 2023; Oliveira *et al.*, 2023). Strategies such as labeling packaging for proper disposal and incentivizing returns through refunds or reverse vending machines have been identified as effective measures for promoting recycling practices and the circular economy (Pereira; Pereira; Corneli, 2023).

The successful implementation of reverse logistics in supermarkets faces several challenges that require a collaborative approach from all stakeholders in the supply chain. Consumer awareness and education play crucial roles in encouraging proper waste disposal, and establishing appropriate infrastructure for waste collection and sorting is essential for implementing effective reverse logistics operations (De Souza *et al.*, 2023). Building strong partnerships with recycling cooperatives and specialized entities is crucial for overcoming obstacles in the reverse logistics process (Kariuki; Ngugi; Mburu, 2022; Mattos; Santos, 2022).

Reverse logistics presents several opportunities and challenges for the supermarket sector that must be overcome to meet industry-specific environmental standards. By adopting sustainable practices, supermarkets can improve their reputation among environmentally conscious consumers, focusing on green supply chain management (Wang; Liao, 2023).

Given this context, this study aimed to analyze the perceptions of managers interviewed regarding environmental issues and their level of understanding of reverse logistics and environmental education applied in supermarkets. Through descriptive analysis, we sought to understand the potential and limitations of implementing reverse logistics packaging in supermarkets to contribute to efficient and sustainable management, which can serve as a model for other institutions in the sector.

1.1 Literature Review

1.1.1 Packaging

Packaging plays a crucial role in logistics, acting as the first line of protection for products during transport, storage and handling. The definition of packaging includes not only the materials used to protect and contain products, but also their functionality in identifying, marketing and preserving the quality of content (Palsson, 2018).

Good packaging should be safe for the stored product, provide convenient access to the content, be suitable for transport and ideal for storage, contain the necessary information about the product, be legible to customers and logistics operators, be aesthetic and environmentally friendly (Stanislowski; Szymonik, 2024).

Packaging is classified in three main categories: primary, secondary and tertiary. Each has specific functions that directly impact the effectiveness and efficiency of the logistics process: a) Primary packaging that is in direct contact with the product; b) Packaging designed to contain one or more primary packaging, sometimes unsuitable for transport; and c) Final packaging that has strength and durability compatible with the distribution environment.

From a logistical perspective, packaging is the way goods and materials are packaged to facilitate physical, informational and monetary flows along the supply chain (Bozarth; Handfield, 2019). Logistics has evolved significantly, following the technological advancements that allow tracking of items throughout the entire path in supply chains with a high level of precision, improving the control of the transport of goods, and enabling buyers to follow the journey along the route to the final destination.

1.1.2 Reverse Logistics

Reverse logistics (RL) is related to the process of moving goods to their final destination, with the aim of recovering value or avoid inappropriate disposal (Adesoga et al., 2024). Law 12,305/2010, which governs the National Solid Waste Policy (PNRS), is the main legal instrument for RL in Brazil, defining the shared responsibility and specific obligations of each sector of the production chain, such as producers, traders, consumers, and government agencies.

In the context of supermarket packaging, reverse logistics can bring substantial benefits, such as reduced costs and greater sustainability, by encompassing the management of packaging waste, reverse flow and reuse or recycling of these materials (Scioşteanu; Criveanu, 2023). In the environmental field, LR reduces the volume of waste destined for landfills, either through recycling or reuse of materials, and minimizes soil, water and air contamination associated with inappropriate disposal (Lisec *et al.*, 2017). In the economic sphere, the LR recovers value and offers competitive advantages by optimizing resource use and reducing waste, through recycling or remanufacturing materials present in packaging (Adesoga *et al.*, 2024).

The effective implementation of RL can stimulate the construction of a positive image of companies before consumers, who value more sustainable actions. This business behavior not only contributes to the acceptance of conscious consumers, as it induces competitiveness in the market (Deimling; Masutti, 2023). In addition, the adoption of RL tends to contribute to the generation of jobs in the recycling sector, contributing to economic growth and development of the community in which it is implemented.

2 METHODOLOGY

2.1 STUDY AREA

The analyzed supermarkets are located in the cities of Belém and Ananindeua, both integrated into the Metropolitan Region of Belém (RMB) in the state of Pará. Belém, the capital of Pará, is the most populated municipality in the state, with an estimated population of 1,303,389 inhabitants and a density of 1,230.25 hab./ km², according to IBGE census data. In the northern region, it occupies the second position in terms of population and the twelfth in all of Brazil. Ananindeua currently has a population of 478,778 people, with a demographic density of 2,512.20 hab./ km², consolidating itself as the second most populous municipality in Pará (Brazilian Institute of Geography and Statistics, 2022 Census).

2.2 CHARACTERIZATION OF THE RESEARCH

This is descriptive research with a qualitative approach, considering that the objective is to estimate a level of reality without the need to measure it numerically, seeking the understanding, deepening and familiarization of researchers with the object of study (Villela, 2020). This study aims to generate new guidelines and clarifications for implementing reverse logistics packaging in supermarkets.

For data collection, a questionnaire with open and closed questions was applied, divided into four main sections: i) Identification (of the company and management); ii) Perception of environmental issues; iii) Identification of packaging resulting from activities; and iv) Knowledge and actions of reverse logistics.

All questions on perception followed a 5-point Likert scale, as described by Lucian and Dornelas (2015). The scale ranged from an extreme attitude of "non-application" or "ignorance" to an "attitude of excellence" regarding the instrument investigated. The questionnaire was completed by four supermarket managers. Data was analyzed using Content Analysis (CA), according to Bardin (2015) and Franco (2020), considering the broad outline of the approach of the thematic treatment. The collected data were categorized to better structure the results.

3. ANALYSIS AND DISCUSSION OF RESULTS

3.1 IDENTIFICATION OF THE COMPANY AND PARTICIPANTS

Of the surveyed companies, one is a micro-enterprise, two are small and one is medium-sized, all have as their branch of activity the retail trade of goods with emphasis on sales of food products. All the participants held the position of store manager, were between 35 and 59 years old, and three were male and one female. Regarding the level of education, three participants had completed higher education and one had incomplete higher education.

3.2 ANALYSIS OF RESULTS

3.2.1 Perception of environmental issues

By analyzing the participants' perception of their level of knowledge about the different types of environmental pollution, it was possible to identify that a low level of knowledge about the different types of pollution prevailed. Of the participants, only one reported having high knowledge about air and thermal pollution, and only one considered having low knowledge about all forms of pollution, although it was evident that the participants had a complete or incomplete higher level of knowledge.

This shows that environmental issues are not being properly addressed in the business environment, such as the absence of training courses in environmental education for employees, considering the respondents' level of education. Regarding the level of knowledge about environmental conservation and preservation policies and measures, a very low and low level of knowledge was found regarding the Law of Environmental Crimes and the State Policy on the Environment, and a low and moderate level of knowledge was found regarding the following policies: National Policy of Environmental Education and the National Solid Waste Policy.

3.2.2 Identification of the packaging resulting from the activities

Frame 1 shows the distribution of scores assigned to each type of packaging. Plastic bags were predominantly concentrated at score 3 (100-500 kg); cardboard packages were mainly distributed between scores 3 (100-500 kg) and 4 (500-1000 kg); plastic packaging had a higher concentration in scores 3 and 4; glass packaging concentrated, for the most part, on score 1 (up to 5 kg), the same as with metal packaging. Styrofoam (expanded polystyrene) was predominantly scored 3 (100-500 kg). Reusable bags had a higher frequency of score 1 (up to 5 kg), as did cardboard boxes for bulk products. The packaging of perishable products was concentrated mostly at score 5 (above 1000 kg).

Frame 1 - Generation of waste (packaging) resulting from supermarket activities.

Type of packaging	1	2	3	4	5
	Up to 5 kg	From 5 up to 100 kg	From 100 up to 500 kg	From 500 up to 1000 kg	Over 1000 kg
Plastic bags	1		3		
Cardboard packing		1	2	1	
Plastic packaging	1		1	2	
Glass packing	4				
Metal packaging	4				
Styrofoam packaging	1		3		
Reusable bags	3		1		
Cardboard boxes for bulk products	4				
Packing of perishable products	1			3	

Source: authors (2025)

The analysis shows that plastic bags, cardboard, and plastic packaging are responsible for significant volumes of waste and require effective reduction and recycling strategies. Glass and metal packaging have a low environmental impact, while styrofoam and perishable product packaging require special attention due to the moderate to high volume of waste. Given this scenario, it is recommended to replace materials with more sustainable alternatives, strengthen recycling practices, raise awareness among employees, and search for environmentally appropriate alternatives, especially in the case of packaging and perishable products.

3.2.3 Knowledge and actions of reverse logistics

When asked if the supermarket is doing enough to implement the reverse logistics practices of packages that are discarded in their stores, the answers ranged from "yes, the company performs a sufficient number of actions" to "not sure whether the company performs actions" and "the company does not perform." The main challenges faced by the supermarkets in implementing reverse packaging logistics practices were marked as responses of the four participants, the "federal, state and municipal regulations" and "the lack of consumer awareness" for this type of action.

When asked about the specific goals to reduce packaging waste, two participants stated that there is no specification for this issue yet and two replied that supermarkets are in the phase of project/implementation analysis. Despite the perception that there are no actions directed to the reverse logistics of packaging in the surveyed supermarkets, when asked "what is the importance that the company attaches to issues involving environmental sustainability?", the four participants answered that supermarkets consider the theme very important.

4 CONCLUSION

This study found that addressing reverse logistics in supermarkets is a way to generate reflections on their benefits. The importance of integrating other initiatives, such as environmental education, was highlighted. However, despite the interviewees' favorable perception of reverse logistics as a vital tool for solid waste management, the study revealed a gap in the implementation of concrete actions. One factor noted was the participants' limited familiarity with current environmental policies and the evident lack of environmental education initiatives in the industrial sector.

Therefore, to obtain an effectively sustainable and environmentally friendly operation, a deep commitment to implementing waste management practices and environmental education is necessary. By adopting a proactive approach, supermarkets can play a crucial role in environmental impacts and promote a more sustainable future, contributing to a more balanced and healthier ecosystem for future generations.

Thus, it is suggested that future work should conduct an in-depth analysis of the causes that lead companies in the supermarket sector to invest minimally in LR practices. However, this study faced limitations, such as the reduced number of participants and difficulties in accessing information. These restrictions do not compromise the results, but point to the need for more comprehensive future studies.

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