



ÁREA TEMÁTICA: Reciclagem

Logística Reversa: estudo de caso em relação a garrafas PET pós-consumo reciclado (PET-PCR) de água mineral

Bianca Galdino Pereira¹ (galbianca@outlook.com); Vanessa Medeiros Corneli¹ (corneli.vanessa@gmail.com); Alessandro José Pereira² (alessanp@live.com)

¹Universidade Tecnológica Federal do Paraná

²Universidade do Estado de Santa Catarina

RESUMO

Embalagens plásticas de maneira geral, em função da expressiva geração, têm se configurado como um problema ambiental, principalmente quando associado à destinação inadequada. Neste contexto, o objetivo do presente trabalho foi analisar as estratégias e o processo de logística reversa empregados para produção de garrafas PET pós-consumo reciclado (PET-PCR) de água mineral, de uma fábrica localizada na cidade de Poland, estado do Maine, Estados Unidos (EUA) e apontar ações de logística reversa entre Brasil e EUA. Os dados para o mapeamento do processo de logística reversa foram obtidos a partir de dados secundários, disponíveis em meio eletrônico. O ciclo produtivo inicia-se com o consumidor por meio da destinação correta da garrafa, preferencialmente nas máquinas de venda reversa, permitindo que a empresa recicladora recicle o resíduo e possibilite a fabricação de pellets. A empresa objeto de estudo utiliza os pellets para a fabricação de novas garrafas PET-PCR, promovendo uma economia circular. Em relação às estratégias de logística reversa identificou-se a utilização da embalagem de água como meio de comunicação para informar a forma adequada de destinação, e o reembolso dado ao consumidor ao destinar suas embalagens em máquinas de venda reversa.

Palavras-chave: Plástico; Reciclagem; Economia Circular.

Reverse Logistics: a case study in relation to post-consumer recycled PET bottles (rPET) of mineral water

ABSTRACT

Plastic packaging in general, due to its significant generation, has been configured as an environmental problem, especially when associated with inadequate disposal. In this context, the objective of the present work was to analyze the strategies and the reverse logistics process employed for the production of post-consumer recycled PET (rPET) bottles of mineral water from a factory located in the city of Poland, Maine, the United States (US) and point out reverse logistics actions between Brazil and the US. Data for mapping the reverse logistics process were obtained from secondary data, available electronically. The production cycle begins with the consumer through the correct disposal of the bottle, preferably in the vending machines, allowing the recycling company to recycle the residue and enable the manufacture of pellets. The company under consideration uses pellets to manufacture new rPET bottles, promoting a circular economy. Regarding reverse logistics strategies, the use of water bottle label was identified as a means of communication to inform the proper way of disposal, and the reimbursement given to consumers when disposing of their packaging in reverse vending machines.

Keywords: Plastic; Recycling; Circular Economy.

1. INTRODUCTION

The accumulation of plastic waste causes negative impacts on the environment, such as air, water and, soil pollution. In this context are the plastic water bottles, which due to the expressive production have become an environmental problem.



It is necessary to think about production processes that aim to reduce the amount of waste, its reuse within the process, and/or recycling, that is, the adoption of the 3Rs principle (Reduce, Reuse and Recycle).

Polyethylene terephthalate (PET) is the type of material most used in the manufacture of packaging for water and soft drinks. Its properties, especially greater strength and lighter weight, compared to glass for, example are factors that corroborate its use on a large scale. As a result, PET has mainly replaced glass as a packaging material (WELLE, 2011).

Post-consumer recycled PET resin (rPET) is produced from recycled raw material, if this material is destined for food packaging, it is called food-grade rPET, undergoing a physical and/or chemical recycling technology, with high decontamination efficiency. Thus, one of the instruments to enable the use of rPET is the reverse logistics (RL) systems (SOARES, 2011).

RL helps to improve the environmental performance of companies, resulting in the recovery of materials from the return of waste to the production cycle. Therefore, it is necessary to plan and control the flow (CHAVES et al., 2014; SANTOS et al., 2014).

RL reverse distribution channels are characterized both from post-consumption, a portion of products or materials originated in the disposal after being used for its purpose, and from post-sale, the product returns to the manufacturer for a variety of reasons, such as, for example, manufacturing defects (GIACOBO et al., 2013).

2. OBJECTIVE

The present work aims to analyze the reverse logistics strategies and processes used for rPET bottles of mineral water, from a factory located in the city of Poland, Maine, the United States (US), and point out reverse logistics actions between Brazil and the US.

3. METHODOLOGY

For the present case study, the strategies and the RL process employed for rPET water packaging of a food company were analyzed, which within its various segments, the water industry stands out. Qualitative data for performing the RL process mapping of rPET bottles of mineral water in this case study were determined from secondary sources. Secondary data are collected data available and organized in files, databases, statistical yearbooks, and reports (MARTINS, 2008).

The analysis and mapping of the RL process of rPET bottles of mineral water were obtained through exclusive information in electronic means, such as the company's websites, electronic pages with information from the reverse vending machine (RVM), and the website of the rPET recycling company.

4. RESULTS AND DISCUSSION

4.1 Mapping the production of rPET water bottles

The first stage of the production cycle is the consumer, when consuming the water, he/she will appropriately dispose of the packaging, according to label instructions. The destination can be carried out either through the household collection selective service or through reverse vending machines. Both destinations, the waste is collected and transported by a company hired by the municipality to destine to waste center, where it will be classified, according to two criteria: bottles from household collection selective and bottles from reverse vending machines.

This differentiation is necessary because the bottles collected through reverse vending machines have a better classification efficiency, as they do not mix with leftover food, as can occur with bottles from the selective collection at home.

After sorting, the bottles are compressed into half-ton bales to be delivered to a recycling company. The baling is carried out to reduce the volume and, therefore, to facilitate the transport of the bottles. The recycling company (contracted by the company understudy) is responsible for the entire production process of rPET pellets (small plastic resin granules) and is also responsible for



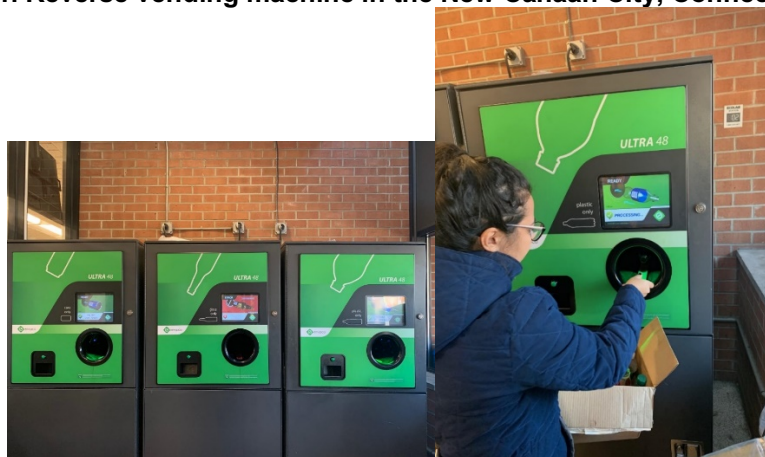
transporting these pellets to the company under consideration for the manufacture of new rPET bottles.

4.2 Reverse Vending Machine

In the US, 11 states have the reverse bottle-bill logisticss law, Oregon, Vermont, Michigan, Maine, Iowa, Connecticut, Massachusetts, Delaware, New York, California, and Hawaii. In supermarket chains there is a reverse vending machine, called a reverse vending machine (RVM), which is a machine where the consumer returns empty beverage containers, such as bottles and cans, for recycling. The machines are from outsourced companies, contracted by the state government (CONTAINER RECYCLING INSTITUTE, 2007).

Each waste, such as plastic bottles, glass bottles, and cans, has a different machine (Figure 1). On the device, there is an indication of how the consumer must position and insert each material.

Figure 1. Reverse vending machine in the New Canaan City, Connecticut, US



Source: Elaborated by the author, 2020

After identification, the machine returns a refund to the final consumer. The value to be returned depends on each state. In Connecticut and Maine, it is \$0.05 for each plastic bottle. The term refundable is used since the final value of the product (by the time the consumer buys) includes this extra amount, if the consumer recycles in the machines, he/she will have this return. In other words, it is an incentive for the use of machines and proper disposal of packaging.

Upon delivery, a receipt is generated with amounts referring to the recyclable waste that was inserted into the machine, this amount can be exchanged for cash at the supermarket cashier where the machine is installed, or used as credit for purchases in the same establishment. Cost management works like this: Manufacturers begin the process by adding the cost of the bottle to the appropriate deposit rate (five cents or fifteen cents) for each beverage container subject to this program that is sold in the state. Beverage retailers pass this cost on to the consumer at the time of purchase, charging the deposit fee. This deposit encourages consumers to return their empties to an RVM. The recycling company collects the containers from RVM and recycles the containers collected for the company object of this study (MAINE, 2019).

In Brazil, there are similar actions, with the installation of a vending machine in a supermarket chain; the project was called "Recycle and Earn Extra", in which the delivery of PET or aluminum packaging was offset by exchange coupons in the market. Another project is the "Pão de Açúcar-Unilever Recycling Station", a partnership of two companies whose "voluntary delivery stations" receive recyclable materials, which are donated to waste picker cooperatives. In five years, service stations were installed in 100 stores located in 17 municipalities (GONÇALVES-DIAS; TEODÓSIO, 2006).



4.3 Analysis of strategies for the reverse logistics process of water rPET bottles

When analyzing the reverse logistics process for the production of rPET water bottles, the importance of communication and incentive strategies was observed so that the generator makes the correct destination of the packaging, so that the process can be made viable.

Using packaging as a communication mechanism to instruct people on how to proceed with proper disposal is a reverse logistics strategy to attract the good practice of the final consumer.

Vending machines are in virtually every city in the US states that have bottle-bill laws. They are commonly found in supermarkets, which is an important strategy to enable reverse logistics and recycling. It is inferred that this strategy could be applied in Brazil on a large scale, since so far, what we have are punctual initiatives.

Article 33 of the National Solid Waste Policy establishes that manufacturers, importers, distributors, and traders must structure and implement reverse logistics systems independently of the public service of urban cleaning and solid waste management (BRASIL, 2010). Thus, the use of RVMs could be one of the strategies of the packaging sector.

The sectorial agreement for the packaging sector prioritizes the participation of cooperatives or other forms of association of reusable and recyclable material collectors constituted by low-income individuals. Thus, it is inferred that these could contribute to the phases of collection, transport, and baling of materials. To ensure a greater quantity of material destined for an environmentally appropriate manner and an income opportunity for the collectors (COALIZAÇÃO EMBALAGENS, 2019).

5. CONCLUSION

Although there are advances in terms of recycling, in relation from Brazil and the US, growth needs to be continuous, as the amount of recycled material does not keep pace with what is produced and consumed something that goes through the lack of implementation of public policies aimed to this effect among other factors.

The RL strategies observed in this project encourage good end consumer practices. Using the bottle packaging, the company sought to guide the consumer on how to allocate them so that the production cycle is continuous. The consumer starts the cycle through the consumption of water, disposes of the bottle correctly, preferably in the RVMs, allowing the recycling company to recycle the residue and enabling the manufacture of pellets.

The company under study uses pellets to manufacture new rPET bottles, promoting a circular economy.

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