

The limits of plastic recycling and its challenges in Brazil



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Abstract: Discussing the challenges of recycling is fundamental in addressing the plastics crisis. Especially in Brazil, where the recycling chain is structured around the work of recyclable waste pickers, a large portion of the plastics on the market are not recovered by the recycling industry, become rejected waste, end up in landfills, and have a direct economic impact on waste pickers, whose work is wasted. Recycling has been considered a promising measure to recover plastic waste that is widely discarded in various ecosystems, but a series of technical, technological, territorial, and economic limitations have prevented this from happening in practice. Given these challenges, solutions go beyond technical or governance issues. The viability of recycling cannot be discussed without considering structural changes in the productive and economic system to guarantee greater socioenvironmental justice.

Discussions about the challenges of plastic recycling have taken on a central role in the global context of tackling the plastic crisis. This issue is particularly important in Brazil, as the recycling chain is structured around the work of recyclable waste pickers. Close to 90% of recyclable waste is reintroduced into the recycling industry by waste pickers. Although plastic is the material that represents the largest revenue for waste picker organizations in all regions, accounting for 65% of revenue (Anuário da Reciclagem, 2024), a large portion of plastics on the market cannot be sold to the recycling industry and, when they become rejected waste, they end up in landfills. In addition to being a breach of the law, the economic impacts of waste fall directly on waste pickers.

Since the beginning of its production on an industrial scale in 1950, plastic has been widely present in all market segments. Its production has surpassed that of any other manufactured material, with more than 8.3 billion tons produced worldwide, half of which happened in the last decade alone. Approximately 42% of plastics produced are used for packaging and most as discarded within less than a year of use (Geyer, Jambeck and Law, 2017). Globally, only 9% of plastics produced

were recycled (of which only 10% were recycled more than once) and 60% were sent to landfills and discarded into the environment (Geyer, Jambeck and Law, 2017). In Brazil, according to the industry, 25.6% of plastics were recycled, and approximately 68% of this total corresponds to packaging from the food and beverage segment (ABIPLAST, 2024). Recycling has been considered a promising measure to recover plastic waste that is widely discarded in various ecosystems, but technical, technological, territorial, and economic limitations have prevented this from happening in practice.

TECHNICAL, TECHNOLOGICAL, TERRITORIAL, AND ECONOMIC LIMITATIONS

Technical limitations to the mechanical recycling of plastics include those related to the characteristics of the resins and the composition of the products, in addition to the degradation of the material over the course of different recycling cycles – which is intrinsic to the process, requiring the incorporation of virgin raw material and additives to compensate for the loss of material properties. The wide variety of plastics on the market represents a challenge, since they have different characteristics, flows, recycling processes, and levels of recyclability. In 2003 in Brazil, PET was the most recycled resin (41%), followed by PEAD (21%), PEBD and PELBD (14%), PP (17%), and PVC and PS (2%) (ABIPLAST, 2024).

The combination of different resins and materials – a common practice in the industry to improve barrier properties to moisture, light, oxygen, and fats –, the use of additives – plasticizers and flame retardants –, and the design of colorful packaging to attract consumers, makes the process difficult and more expensive (Al-Salem, Lettieri and Baeyens, 2010), in addition to reducing the quality of recycled plastic and limiting its use, compromising recyclability (Geyer, Jambeck and Law, 2017). In practice, this happens with multi-material and multi-layer packaging for snacks, tomato sauce, biscuits, coffee, and pasta, which are usually made of BOPP (a variety of PP). This also occurs with colored bottles for water and hygiene and cosmetic products, which are usually made of colored PET. All these examples are not recyclable and highlight the numerous challenges to implement a Circular Economy (Cardozo, 2024).

There is also a territorial limitation for plastic recycling to take place in Brazil, considering that plastic recycling industries are concentrated mainly in the South and Southeast regions of the country (ABIPLAST, 2024). The further away the waste sources are from the recycling industry, the higher the logistical costs of recovering the plastics. Thus, the existence and supply of technology represents a current technological limitation for large-scale recycling of certain types of plastics created by the industry. There is currently no technology available to recycle white PET (or milk PET), multi-layer and multi-material packaging, and flexible BOPP films. Finally, there is an economic limitation that can be observed when considering the double taxation on recycled material, which affects its economic viability in relation to virgin raw material. Moreover, the low added value of recycled material and high-cost or unavailable technologies make the cost of recycling plastics higher than the cost of producing items from virgin plastic.

SOCIAL CHALLENGES AND WASTED WORK

In view of this context, a social challenge arises: the costs of the wasted work of collecting, sorting, processing, storing, and disposing of plastics that are not recycled (or have a market value that is lower than the cost of labor – as is the case with Styrofoam) fall on the waste picker organizations that are not paid by any link in the production chain. Although they play an essential role in the recycling chain, waste pickers are at its base and on the fringes of society and the market, working in precarious and informal conditions, without adequate remuneration (Silva and Gonçalves-Dias, 2019).

In the master's thesis by Fábio Cardozo (2024), who investigated rejected waste in three recyclable waste picker cooperatives in the municipality of São Paulo, among the materials found in this rejected waste, plastics was found to represent 32% of the total – and was the greatest in volume and second greatest in weight. There is a predominance of plastic packaging from the food segment, composed of: PET in the form of trays, resin mixtures classified as “Other” regarding type, and multi-layer packaging such as BOPP, which have low to no recyclability due to color, polymer mixture, contamination, presence of additives, and low economic value. Among the most recurrent brands were Nestlé, Bauducco, Coca-Cola, Danone, Colgate, Lacta, Aurora, and Sadia, with a predominance of the food sector (Cardozo, 2024).

FINAL CONSIDERATIONS

The limits of plastic recycling are ultimately imposed by the current economic system. The plastic production chain, as part of the capitalist system, assumes the relentless pursuit of profit, capital accumulation, and the exploitation of resources and labor to generate value, which prevents social and environmental justice from being fully achieved. Thus, solutions to overcome the challenges associated with plastic recycling go beyond technical issues, such as changing product design, creating a market for recycled materials, or finding buyers for solid waste. They also go beyond governance solutions, such as implementing public policies and regulatory standards to structure and foster the recycling market. These are limited responses that focus on the operational level, without addressing the structural challenges of an economic system that is conditioned by the continuous exploitation of resources, making the very notion of a circular economy unfeasible.

The limitations presented make us question the economic dynamics that sustain the cycle of excessive production, consumption, and disposal of plastics. Recycling is not limited to the act of separating and processing materials; it is influenced by decisions made by the plastics industry when developing products. Consumer decisions and public policies are only made at another level. Waste pickers cannot continue to absorb the indirect costs of a huge amount of plastic packaging that is not recyclable or that has low economic value. While the profits from plastic go to the processing industries, the losses and damage are left to the waste pickers, who have their work wasted. Thus, discussing the economic viability of recycling is essential, but it cannot be based on the false idea that full circularity can be achieved without a profound review of the capitalist production model.

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