Reverse Logistics and Waste in the Textile and Clothing Production Chain in Brazil

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Reverse logistics and waste in the textile and clothing production chain in Brazil

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Abstract. The global environmental concern turns to the production of waste and its correct disposal. The chance of the natural degradation of this content is minimal, and logistics become an urgent discussion for all production chains. The lack of knowledge of Brazilians about recycling and non-education for conscious consumption hinders the development of initiatives in the segment. On the other hand, instead of adopting the necessary measures to implement reverse logistics and recycle these materials, companies are importing waste from other countries, neglecting the potential for income generation and sustainable business that could invest. The objective of this article is to evaluate the scenario of recycling initiatives and reverse logistics carried out in the textile and clothing industry in Brazil, through bibliographical research and surveys in Google and Facebook, internet sites and open data analysis of national and international bodies on the subject. There is a shortage of studies, and the appropriateness of the subject is urgent and necessary. From the results, it can be verified that without official records, government agencies' efforts to implement reverse logistics and recycling and encourage the benefits of the activity, there is no way to solve the issue.

Keywords: Circular economy; recycling; reuse; textile data.

1 Introduction

Some figures from the impact of the US textile industry: 1200 million tons of greenhouse gases, use of 93 billion cubic meters of water, 8 million tons of fertilizer for cotton, 200 thousand tons of pesticides for cotton, 42 million tonnes of chemicals and one million tonnes of dyes [1].

The textile and garment chain, which starts in the production of cotton fibers, is one of the most polluting and has a significant share in the Brazilian GDP, with an income of US$ 52 billion in 2017 [2]. The fast-fashion garment industry, which produces low-cost clothing and generates waste in excess, both for its vast production and for the rapid disposal of the product, in both cases have an inadequate destination.

How the waste from the textile chain and clothing is discarded, both by industries and by the population, is a recent field of study with few references. A portion of the textiles are discarded in household waste, but there are no numbers to measure the waste [3].

Another side of this equation is that although Brazil is among the five largest producers of textiles and clothing, and therefore a significant generator of waste, the country imports textile waste instead of using household waste to this purpose [4]. There is conflicting information, and there is no governmental body that deals with the subject, the reason why no official figures on this activity were found. The complexity of the problem is further compounded by the lack of knowledge about recycling in Brazilian society. A national survey showed that 66% of Brazilians know nothing or very little about the selective collection and 39% of the population does not separate organic waste from recyclable waste [5].

The objective of this article was to evaluate the recycling and reverse logistics performed by the textile and clothing industry in Brazil and present the initiatives that have been tackling the problem.

2   Background

Sustainability, a global requirement after the 1990s, presents a dilemma with industry, which derives from the economic paradigm of 'linear' production, which seeks to extract, transform and discard, a model that depends on large quantities of materials, water, and energy [6]. By 2015, world garbage production has reached 2.2 billion tons of garbage per year [7]. In 2018, the Brazilian contribution to this mountain of garbage reached 64 million tons, of which 24 were improperly disposed of, according to the Brazilian Association of Public Cleaning and Special Wastes [8].

The industrial process of the textile chain, from the planting of cotton, or the production of synthetic fibers, and activities such as dying of fabrics and stamping, is chemically aggressive. Authors [9] attribute that at least 10% of the world's textile production is improperly disposed of and even if in garment production, 10% of production is lost in the cutting department. The Brazilian textile industry, in 2015, generated 175 thousand tons of solid textile waste, of which 90% had incorrect disposal [10]. The number is approximated only in one phase of the industry and by a calculation of loss of 10% of the fabric in the cutting process. Of this total, about 40% (70,000 tons) are re-processed by recyclers, and 60% are improperly discarded in landfills and landfills [11].

The impact of the use of inputs and recycling in the textile chain has been studied [9]. The authors found that it is a recent field of study, despite being a strategic area for the Brazilian textile industry. Khandelwal et al. [12] evaluated 153 studies on urban solid waste published since 2013 and found six studies related to Brazilian textile segment. In turn, [13] corroborated these figures by analyzing 91 studies conducted between 2006 and 2017 and verifying that in Asia it is also limited to a few countries, finding reasons such as difficulty, time-consuming and expensive data collection process.

The adoption of the circular economy can generate 1.8 trillion euros by 2030 [14]. Leal Filho [15] determines that recycling plastics can be an important contribution to making the European economy more circular and an action plan for this purpose has been adopted [16]. Recycling of textiles could be an important beginning in the

paradigm shift to the circular economy, especially in the poorest countries, bringing sustainable development and reducing production costs for the companies involved. Recycling second-hand clothing can reduce greenhouse gas emissions by 53%, reduce pollution by chemical processes by 45%, and reduce water eutrophication by 95% [17].

3   Methods

Initially, the bibliographic research was used to find the most recent articles on the subject in Google Scholar and ScienceDirect and to build up the conceptual reference. We used government and area association data and specialized websites. A survey was conducted on Google and Facebook to find companies and other textile reverse logistics initiatives in Brazil, with the following keywords: textile industry waste, textile recycling, textile recycling, textile waste, reverse logistics textile industry. Other social networks were not used.

A search was made at Google on several different days in March 2019 to find companies and initiatives for reverse textile logistics, and the number was 14 of them related in the first five pages of the survey. On Facebook, the result came to 13 webpages dealing with the subject. Such pages were searched only in Portuguese.

4   Discussion

Textile production, cotton or synthetic, is a segment that moves US $ 797 billion worldwide and is significant for the Brazilian economy, comprising 27 thousand formal companies [15]. Brazil is self-sufficient to produce cotton garments. Along with synthetic products, cotton production totaled almost nine billion pieces a year, of which about seven billion are garments (numbers 2016). The country is a world reference in the production of denim jeans, beachwear, and bedding, table, and bath for the home [2].

4.1   Production and import of waste in the textile and clothing industry

At the Bom Retiro garment factory in São Paulo county, it is estimated that 1200 companies produce 12 tons of textile waste/ day, about 2% of the country's total, estimated at 175,000 tons/year, of which only 36,000 tons are reused to produce twines, blankets, new garments and yarns [18]. For comparison, US textile waste generation was 10 million (t/year) in 2003, reaching 13.09 million (t/year) in 2011 [19; 20]. At least 10% of the textile production is disposed of at the production stage. When considering that all clothes purchased will be discarded and sent to landfill waste, the problem is aggravated by the fact that 70% of the fabrics are made up of synthetic fibers, which makes degradation difficult [7].

In order for correct disposal to take place, infrastructure and attention to the macroeconomic and social aspects that this demand generates are necessary, a situation that is not yet adequate in Brazil. Amaral et al. [4] show that the Brazilian textile recycling industries imported almost 10 thousand tons of textile waste, more than US$ 11 million,

due to the disorganization of garbage collection. For the authors, the misinformation of the population and the disorganization of the collection of textile waste led the recycling companies to import them, because the material arrives in better conditions for use than the recycled in Brazil.

In 2010, a US $ 2 billion loss was attributed to the country for not recycling textiles, which could be improved through the formalization of cooperatives and compensatory incentives to raise the income of the collectors [21]. Data from 2018 show that the damage reaches $ 30 billion a year in products that could be recycled and go to waste. The country recycles only 3% of the 64 million tons of tailings generated annually. An average American throw about 80 pounds of used clothing per year and estimates at US$ 45/ton to eliminate the old clothes [20]. In the case of plastic, the return could be US$ 1.4 billion for the economy [22]. Incentives could be used to eradicate about 3,000 dumps and start regional landfills, which could help to minimize the problem [11].

Table 1. Total of imported fibers waste in Brazil

Year	FOB	kg
2013	4.016.526	5.434.262
2014	8.553.100	14.886.680
2015	7.366.819	13.199.691
2016	6.242.472	12.926.299
2017	7.492.304	14.584.420
2018	7.955.204	13.107.156
Totais	41.626.425	74.138.508

Obs. The table includes the NCM codes of imported products indicated by ABIT as specific rags and wastes, which include wool, cotton, artificial and synthetic fibers (5003, 5005, 5103, 5202, 5301, 5302, 5303, 5305, 5505, 6310) Source [2]

Reverse logistics becomes an essential instrument in the control of natural resources and in mitigating the damages caused by manufacturing processes.

4.2   Reverse logistics

The logistics process must return to the business sectors the solid waste from their products, to be reused in their production cycles or properly destined, through reverse logistics [23]. Rogers and Tibben-Lembke (1999) present the efficient and low-cost control of flows from raw materials, inventories, products, and information, in the opposite direction to logistics, from the point of consumption to the point of origin for recovering value or avoiding improper disposal.

An action plan was adopted in December 2015 by the European Union to make recycling and reuse of plastics a priority, and by 2030 all plastic manufactured in the EU is recyclable, with plastic for single use [16]. Recycling in general and the textile industry can mean business opportunities. Authors [24; 19] points out as advantages the reduction of space in landfills, water, and energy consumption, natural resources, and operating costs.

4.3   Textile recycling

The actions carried out for the recycling and reuse of textiles, all over the world, point to charitable activities [15]. Charity actions provide directly to recycling companies [25]. In the United Kingdom, the collection of textile waste is done by charitable organizations that resell in their stores and surplus stocks sold to recycling companies [26]. Heidari et al. [27] analyzed Tehran's solid waste disposal methods and observed that increasing waste separation rate improves the performance of the disposal system about sustainability indicators. An article [15] points out on the Brazilian situation of collectors of recyclable material, most of whom live in poverty and are integrated into cooperatives or associations with the support of local governments, for the activity of waste cleaning.

The fabrics are composed of more than one type of material and still lacks technologies capable of making such separation. It is necessary to invest in a culture that encourages new social practices and attracts interest in the reverse logistics operation [28]. In research on industry reprocessing, [29] indicate the difficulty of establishing partnerships between the reprocessing industry and the manufacturing sector, and that partnership is fundamental to the transition to a circular economy.

5   Final remarks

The main problems that make the country import instead of using its tailings are the lack of recycling culture and the waste being discarded with dirt and presenting several mixed raw materials, having a high cost for the separation, transportation, and logistics of the material, and there are no financial incentives for the activity.

The investigation of the aspects of the textile chain and garment production that implies in sustainability must go through the search for innovative solutions, such as the reuse of fabrics and clothes, through the recycling and reuse of materials, minimizing the disposal of these products which are polluting through reverse logistics. These attitudes could give rise to a paradigm shift leading to a circular economy, which makes the discussion of the issue both necessary and emerging.

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