REVERSE LOGISTICS IN FOOTWEAR PRODUCTION - IN THE STAGE AFTER RETURNED FROM CONSUMER

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ABSTRACT

Purpose: Analyze the possibility of carrying out reverse logistics in the footwear production chain, with a specific focus on the post-consumer return stage.

Theoretical background: In order to build the theoretical lens to interpret the empirical data, the authors reviewed the scientific literature that deals with waste from the footwear manufacturing process, as well as reverse logistics in the Brazilian footwear industry.

Method/design/approach: A single case study strategy was chosen, in one of the largest shoe manufacturers in Brazil, a qualitative approach, data collection through semi-structured interviews with managers of the investigated organization, directly linked to processes related to the reverse logistics of the product, in addition to a documentary survey, based on internal industry records and non-participant systematic observation.

Results and conclusion: The research results showed that the reverse logistics of footwear, in the post-consumer stage, would be feasible to be implemented, but with high initial investment and maintenance costs, which could not be supported by the industry.

Research implications: As managerial contributions, the set of empirical evidence that points to the technical viability of reverse logistics in the analyzed sector stands out, which can induce more academic research and thus benefit society.

Originality/value: This is a study that is still little explored in the scientific literature.

Keywords: Reverse Logistic, Footwear Production, After Return Stage, Sustainability.

LOGÍSTICA REVERSA NA PRODUÇÃO DE CALÇADOS – NA ETAPA DE RETORNO PÓS-CONSUMO

RESUMO

Objetivo: Analisar a possibilidade de realizar a logística reversa na cadeia de produção de calçados, com foco específico na etapa de retorno pós-consumo.

Referencial teórico: Com o intuito de construir a lente teórica, para interpretar os dados empíricos, os autores revisaram a literatura científica que versa sobre os resíduos oriundos do processo de fabricação de calçados, bem como sobre a logística reversa na indústria calçadista brasileira.

Método: Optou-se pela estratégia de estudo de caso único, em uma das maiores fabricantes de calçados do Brasil, abordagem qualitativa, coleta de dados por meio de entrevistas semiestruturadas com gestores da organização.

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investigada, diretamente vinculados a processos relacionados com a logística reversa do produto, além de levantamento documental, a partir de registros internos da indústria e observação sistemática não participante.

**Resultados e conclusão:** Os resultados da pesquisa evidenciaram que a logística reversa de calçados, na etapa pós-consumo, seria viável de ser implantada, mas com investimento inicial e custo de manutenção, elevados, que poderiam não ser suportados pela indústria.

**Implicações da pesquisa:** Como contribuições gerenciais destaca-se o conjunto de evidências empíricas que apontam para a viabilidade técnica de logística reversa no setor analisado, o que pode induzir mais pesquisas acadêmicas e assim beneficiar a sociedade.

**Originalidade/valor:** Trata-se de um estudo ainda pouco explorado na literatura científica.

**Palavras-chave:** Logística Reversa, Produção de Calçados, Etapa Pós Retorno, Sustentabilidade.

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**1 INTRODUCTION**

Reverse logistics, as a structured organizational process, has been a relevant challenge for most organizations, due to the complexity involved in reviewing existing organizational processes, as well as the rearrangement of logistics and manufacturing operations involved (Demajorovic & Migliano, 2013). It is worth highlighting that the National Policy of Solid Waste instituted reverse logistics, as a legal obligation, for a list of products and economic sectors, which were considered as having the highest environmental risk, since its approval, in the year 2010 (Brazil, 2010).

Among the difficulties of implementing the reverse logistics process, the structuring of the collection network of products that are in the post-consumption stage, as well as the design of operational processes, manufacturing, intended to receive and disassemble the products, separating the inputs according to their potential for recycling, reuse and reuse (Gonzaga; Silva & Andrade, 2021). In addition to the technical complexity, for its feasibility, the organizations involved point to restrictions of an economic nature, related to the required investment, as well as maintenance costs of the entire structure to promote reverse logistics (Oliveira, 2015).

Footwear is not among the priority products for reverse logistics deployment, which in turn does not make it part of the list of sustainable products (Brazil, 2010). Most of the inputs used in its manufacturing process originate from non-renewable materials and are characterized by lengthy decomposition when deposited in landfills. Furthermore, given the growing volume of units sold both globally and on the domestic market, if disposed of at the end of its life in landfills, it is a significant contributor to shortening the useful life of landfill sites for solid waste (Rahimifard; Staikos & Coates, 2007).

In order to contribute to the discussion on the topic of reverse logistics, providing evidence of aspects that could offer subsidies both for improvements in already structured operations, and for the design of new operations, the research was conducted, whose objective was to analyze the feasibility of operationalizing the reverse logistics process in footwear production, with emphasis on the post-consumption stage.

To achieve this goal, the authors opted for the single case study strategy (Yin, 2010), in one of the largest footwear industries in Brazil, qualitative approach, with the collection of empirical data, through semi-structured interviews, with the managers of operational sectors of said organization, documentary survey, from consultation to internal records and systematic observation not participating (Minayo, 2010).
The work begins with a theoretical review about the residues arising from the process of the manufacture of footwear and about the reverse logistics in the footwear industry. In the following is detailed the set of methodological procedures, used in the collection and analysis of empirical data. The results can be found in the following topic, in which, in addition to presenting empirical data, the level of their convergence with the theoretical grounding can be evidenced. The work concludes with the topic of final considerations and references.

2 THEORETICAL GROUNDS

This topic begins with a presentation of structuring concepts about waste from the footwear manufacturing process. Next, in a separate subtopic, we explore the concepts of reverse logistics in the footwear industry. For the construction of a theoretical revision of the two themes, works by seminal authors were consulted, and also by contemporary authors. This theoretical review is considered essential to support both the construction of the tools for collecting empirical data and their analysis.

2.1 Wastes Arising from the Manufacturing Process of Footwear

The footwear industry generates a large amount of solid waste. According to Soares and Araujo (2016), solid waste is everything that is not used along the production chain; and that in most cases is a result of the waste of raw material, coming from failures in the production process. The authors also state that this waste can generate serious environmental impacts, due to the large volume generated by the sector. Therefore, it is of paramount importance to analyze all the stages of the footwear manufacturing process, since each one of them has distinct characteristics in relation to the type and quantity of waste generated.

The main steps in the footwear production process involve modeling, cutting, beveling, sewing/preparation, pre-fabrication, assembly and finishing. These steps are necessary, as each involves different characteristics, and are responsible for different parts of the footwear. The parts that make up the footwear vary according to the model, but in general they have the upper part, called leather, and the lower part, the sole. The leather, as well as the sole, is formed by several other parts, (Zorn, Possa & Scherer, 2007) some of them represented in Figure 01.
Modeling involves first the development of the model, which is the creation of the design of the footwear, considering the fashion trends and the demands of the market. It is also at this stage that the materials to be used are defined, the type of sewing, the ornaments, the quantity to be produced, the capacity of the machines, besides the costs involved. After developing the footwear, samples are made to be tested and approved, before being forwarded to the production line (CTCCA, 2002). The waste generated in the modeling is the same generated in the course of the manufacturing process, however, in a smaller quantity (Viegas & Fracasso, 1998).

Cutting is the sector where the cuts of the different parts of the footwear are carried out, which can be done manually, with molds; with the use of hydraulic cutters and the use of razors; or even by means of computerized systems. The leather, synthetic material and other materials used in leather are cut according to the definitions of the modeling industry. At this stage there is a lot of waste generation, such as unused razors, leather trimmings and remains of synthetic materials (CTCCA, 2002; Viegas & Facasso, 1998).

The chamfering consists of reducing the thickness of the leather, mainly at the edges where there will be the overlapping of parts, thus facilitating the gluing, sewing and assembly processes. In this stage there is the generation of waste of leather powder and other alternative materials to leather. The thickness to be reduced varies according to the model and the determinations of the modeling industry (Zorn, Possa & Scherer, 2007; Viegas & Facasso, 1998).

The preparation and sewing sector aims to unite the previously cut pieces, thus completing the leather. First, the pieces are prepared with the application of adhesives, and then sewn with the use of specific sewing machines. The main residues generated in this stage are needles, line and adhesive remains, brushes, leather trimmings and synthetic materials, as well as lining flaps (CTCCA, 2002; Zorn, Possa & Scherer, 2007; Viegas & Facasso, 1998).

In the pre-fabricated form all the components of the lower part of the footwear are produced, including the sole, the insole, the buttress and the cuirass. In the quest for greater flexibility and comfort, many soles are injected. Many companies choose to outsource this stage.
by buying the soles ready. Leather shavings and other synthetic materials, as well as foams and rubber remains, are the main residues of this stage (Zorn, Possa & Scherer, 2007; Viegas & Fracasso, 1998).

The assembly consists of the process of joining the leather and the underside of the footwear. While finishing includes the process of finishing the footwear; it includes cleaning, painting, applying creams and subsequent brushing. Finally, before being packaged and sent for shipment, there is also a review of the footwear, to detect possible defects in the production process. The main residues generated in these processes are remains of nails, tacks, brushes, solvent cans, paints, cloths and tow, cardboard boxes, among others (Zorn; Possa & Scherer, 2007; Viegas & Fracasso, 1998).

Since all stages of footwear manufacturing generate numerous residues, it is necessary to classify them as to the risks they can cause to the environment (Soares & Araujo, 2016). According to NBR 10004/2004, in order for the waste to be managed properly, it is necessary to identify its origin, for better classification. The standard classifies waste as: (a) class I - hazardous waste; (b) class II - non-hazardous waste; among non-hazardous waste, there is also the classification of class II A - non-inert waste, and class II B - inert waste.

Much of the waste generated in the footwear sector is classified as Class I - Hazardous, which highlights the importance of the circular economy in this sector, aiming at reducing waste generation and optimizing the use of raw material. According to the latest report released by the State Environmental Protection Foundation, prepared by Silva, Sangoi and Espinoza (2003), the leather footwear sector is the largest producer of solid waste considered hazardous, accounting for 62.5% of the total generated. Sectors that are linked to the footwear industry indirectly also have representativeness in the generation of hazardous waste, according to Table 1.

<table>
<thead>
<tr>
<th>SETOR INDUSTRIAL</th>
<th>QUANTIDADE (TON)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coureiro Calçadista</td>
<td><strong>118.254</strong></td>
</tr>
<tr>
<td>Mecânico</td>
<td>20.800</td>
</tr>
<tr>
<td>Metalúrgico</td>
<td>20.624</td>
</tr>
<tr>
<td>Químico</td>
<td>18.232</td>
</tr>
<tr>
<td>Papel</td>
<td>2.291</td>
</tr>
<tr>
<td><strong>Borracha</strong></td>
<td><strong>1.504</strong></td>
</tr>
<tr>
<td>Bebida</td>
<td>1.347</td>
</tr>
<tr>
<td>Madeira</td>
<td>1.261</td>
</tr>
<tr>
<td><strong>Têxtil</strong></td>
<td><strong>1.214</strong></td>
</tr>
<tr>
<td>Diversos</td>
<td>1.027</td>
</tr>
<tr>
<td>Elétrico/Eletrônico</td>
<td>962</td>
</tr>
<tr>
<td>Plástico</td>
<td>940</td>
</tr>
<tr>
<td>Alimentar</td>
<td>490</td>
</tr>
<tr>
<td>Minerais Não Metálicos</td>
<td>123</td>
</tr>
<tr>
<td>Fumo</td>
<td>82</td>
</tr>
<tr>
<td>Gráfico</td>
<td>52</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>189.203</strong></td>
</tr>
</tbody>
</table>

**Table 1:** Distribution of the amount of hazardous industrial solid waste generated per industrial sector (in ton/year)

**Source:** adapted from SILVA, SANGOI and EZPINOSA (2003)
Considering the large amount of waste generated in the footwear sector, most of which is classified as Class I waste - Hazardous, reducing generation is not enough, alternatives are needed for not generating waste, and the circular economy is a means to achieve this objective. The non-generation of waste in the footwear sector involves not only the material used in footwear, but the whole production chain. The origin of the raw material supplied, the culture of exaggerated consumerism, the adequate disposal of the product so that it returns to the productive chain, as well as the partnership between companies and its organizational structure.

Much of the footwear market considers the low price as the main competitive factor, because most customers do not value the sustainability factor in products. Therefore, the main challenge for industries is sustainable and low-cost production. However, most entrepreneurs show no interest in sustainable production, precisely because of the low value of this factor in customer choice; which demonstrates the need for public policies and tax incentives for sustainable practices in the footwear industry (Albanio & Tatsch, 2016).

2.2 Reverse Logistics to the Brazilian Footwear Industry

According to Speranza e Moretti (2014), the publication of PNRS, which included reverse logistics as an instrument and in some cases as a requirement, has caused several companies to adopt it throughout Brazil, including other sectors of industry. However, it is important to highlight the existence of complementary actions, such as the formation of committees, sectoral agreements and more specific regulations, so that reverse logistics is actually implemented.

According to the authors, it is expected that the lessons from the experiences of implementing reverse logistics in other sectors, such as agriculture, which already practices reverse logistics, on account of the hazardousness of the products: empty packaging of agro-chemicals, may facilitate the expansion of this practice, contributing to its improvement (Speranza & Moretti, 2014).

According to the National Institute of Empty Packaging Processing (INPEV, 2022), the standards, requirements and procedures for the implementation, licensing, accreditation and operation of stations and central receiving empty packaging of agro-chemicals follow the precepts of Law No. 974/2000, which disciplined the reverse logistics of this material and established shared responsibilities between farmers, distribution channels, industry and public authorities.

Furthermore, according to Staikos and Rahimifard (2007), the rapid market change and fashion trends demanded by the consumer generate a large waste stream discarded at the end of the product's useful life. In this way, the new environmental legislation, the demand from a new public and a conscious consumer, and the very responsibility of the manufacturers challenge the footwear industry to solve the problem of the generation of solid waste (that can be reused) and of the waste (not amenable to reuse).

The generations of solid waste from the footwear industries are directly related to the amount of production and the type of footwear produced. Another relevant factor is that the search for alternatives of materials with better prices increases the range of types of waste produced, and it is important to point out that this type of industry accompanies the fashion market, so, every season, there are variations in the types of waste generated (Viegas & Fracasso, 1998).

In view of the aforementioned aspects, the residues of the footwear sector are mainly composed of leather trimmings, synthetic fabric trimmings, rubber trimmings, cardboard, plastic, paper, metal waste, tow contaminated with chemicals, latex, PU and EVA foam trimmings, fabric trimmings, buttress and cuirass trimmings, remnants of lines and adhesives, nail fees and dirty brushes (Viegas & Fracasso, 1998).
According to the research conducted by Staikos et al. (2006), solid waste management activities in the footwear industry, as well as the substitution of non-biodegradable materials, will not solve in the short term the problems related to the generation of waste at the end of product life. In this way, it is important to highlight the importance of directing considerable efforts in the treatment of generated waste, especially those aimed at recycling, reuse and energy recovery of products from the footwear industry (Staikos et al., 2006).

As a result of what has been mentioned, according to information made available by Abicalçada (2022), Brazilian environmental laws and norms determine that manufacturers, importers, distributors and traders must ensure the collection of packaging of their products, after use by the consumer. This obligation must be fulfilled by means of the reverse logistics system. Failure to comply with this obligation can lead to fines being imposed by the supervisory bodies if companies are forced to bring legal actions for compensation for any damage caused (ABICALÇADOS, 2022).

In support of the sector, Abicalçada (2022) developed the Reverse Packaging Logistics System for the Footwear Sector, creating a practice where companies do not necessarily have to collect their own packaging, nor have it returned to the establishment of the company, which would be technically and economically unfeasible. The reverse logistics system proposed by Abicaladas is based on the method of environmental compensation of packaging that are placed on the market, where it is proven to recycle by larger of the equivalent quantity, in mass and type of material (ABICALÇADOS, 2022).

In Brazil, the publication of Federal Decree No. 9,177, on October 23, 2017, determined that from that date, the obligations assumed in the Sector Agreement for Reverse Logistics of Packaging in General be extended to all companies that supply products with packaging. Accordingly, various environmental bodies, amongst them, the Public Prosecutor's Office (MP) and the Ministry of the Environment (MMA), were empowered to charge companies for carrying out the reverse logistics of packaging in the country. The Public Prosecutor's Office of the State of Mato Grosso do Sul (MP/MS) was one of the first to charge companies from all over the country for implementing systems of reverse packaging logistics.

The reverse packaging logistics program, developed by Abicalçada (2022), offers companies the option to carry out environmental compensation for packaging placed on the market between one or more states. The coverage covers twelve host cities and metropolitan regions provided for in the sectoral agreement, as well as the state of Mato Grosso do Sul.

The 2015 Sector Agreement for the Deployment of the Reverse Packaging Logistics System in General sets the recycling target of 22% of the total mass of packaging placed on the market, through reverse logistics. It is important to point out that the PNRS defines that each state has the responsibility to regulate and monitor compliance with obligations on reverse packaging logistics.

With regard to the Brazilian footwear segment, reverse logistics is still not a practice with 100% adherence, however, in some cases, there is the practice of isolated sustainable actions, such as the socio-environmental program involving the productive chain and the community of the Paranhana Valley, located in the region of Vale dos Sinos, in Rio Grande do Sul, whose purpose is to reduce and correctly target the generation of waste from the footwear industry of the region (Wallauer, Martins & Schreiber, 2016).

In addition to this example, it is opportune to highlight the creation of the certification "Sustainable Origin", in 2013 and reformulated in 2019, by the Brazilian Association of Shoe Industries (Abicalçada) and by the Brazilian Association of Leather, Footwear and Artifact Components Companies (ABICALÇADOS), which implies the obtaining of a seal (bronze, silver, gold or diamond) for Brazilian footwear industries and components that present sustainability initiatives in their production processes (ABICALÇADOS, 2022).
3 METHODOLOGY

To achieve the objective of the study, the authors opted for the case study strategy, qualitative approach, collection of empirical data through semi-structured interviews with the organizational managers directly involved with the investigated phenomenon, documentary survey, consulting internal records of the organization, and systematic non-participant observation.

The choice of a single case study strategy, in one of the largest footwear industries in Brazil, is justified by the size of the company, large in size, with a high degree of complexity of the organizational universe, due to the significant quantity of existing and consolidated organizational processes. This strategic option finds support in authors who talk about alternatives to conduct scientific research in applied social sciences, with particular emphasis on Yin (2010), Gil (2002) and Minayo (2002).

The choice of approach, in this case qualitative, occurred in line with the strategic option, in so far as that approach provides evidence of the details of the organizational environment analyzed, allowing to explore it in depth, which is the specific characteristic of this choice, as Gerhardt and Silveira (2009) and Minayo (2002) point out. To achieve the objective of the study it was necessary to understand the organizational context, the internal infrastructure, how to arrange the organizational resources, as well as the set of criteria that guided the decision making.

With the similar purpose, of adherence to methodological procedures, of collecting empirical data, with the objective of the study, the three techniques of collection were selected, namely (i) semi-structured interviews, with the managers of the investigated organization; (ii) documentary survey, based on consultation with internal records of the operational areas of the company and (iii) systematic non-participating observation, of one of the authors of the research. These techniques for collecting empirical data are the most frequently cited in the scientific literature consulted, which deals with scientific methodology (Fonseca, 2002; Gil, 2002; Deslandes, Cruz Neto & Gomes, 2002; Gerhardt & Silveira, 2009; Minayo, 2010).

The empirical data obtained were submitted to content analysis, following the recommendations and guidelines of Bardin (2011). Content analysis is a set of methodological tools that apply to the analysis of extremely diverse discourses, seeking to classify them by means of a thematic categorization. Content analysis, according to Bardin (2011), allows the aggregation of a significant number of organized information, starting with the inventory of data, where the common elements are isolated and then with the classification, where the elements are divided and structure their organization, favoring the last stage of the research, which is the interpretation of the data.

The company participating in this case study operates in the footwear sector of the state of Rio Grande do Sul, possessing eleven branches and eight brands, which deliver quality, comfort and fashion for all styles. With innovation and effective management, it is a leader in the footwear segment, being one of the largest Brazilian manufacturers, taking its products to more than 95 countries in the world and throughout the national territory. For the purpose of this study, it will be named as an Alpha company.

Three of the eleven subsidiaries of Alfa were chosen randomly to contribute to the study, each of which produces a particular brand:

a) subsidiary 1, which manufactures women’s sandals;

b) subsidiary 30, which manufactures men’s children’s sneakers;

c) branch 16, which manufactures injected women's shoes.

Interviews were held between 11 March and 25 April 2022 with employees of these subsidiaries and with the Legal Manager of Alfa. Also, the CEO of the recycling company, which carries out the waste recycling processes of the company Alfa, participated in the interviews. Nine interviews had their audio recorded and transcribed in full, carried out via
telephone call, using the Whatsapp application; two were answered in the format of a questionnaire, that is, two respondents opted to type their answers. The interview with the CEO of the recycling company was conducted in person and also had its audio recorded and transcribed.

Among the eleven interviewees, five women and six men participated, with ages ranging from 25 to 54. The interviewees will be identified by the acronyms E1, E2, E3, E4, E5, E6, E7, E8, E9, E10 and E11. Respondents E2, E5 and E6 belong to Branch 1, where the women's sandal is manufactured; respondents E3, E4 and E8 belong to Branch 3, where the men's children's sneakers are manufactured, while respondents E1 and E7 belong to Branch 16, where the injected women's shoe is manufactured, all interviewees chosen have a relationship with the theme addressed, based on previous experience and professional trajectory.

Respondents E9 and E10 are, respectively, Alfa Company's Legal Process and Quality Manager and its intern. Respondent E11 is the entrepreneur and CEO of the third-party company that supplies raw materials, and the unit where he works is a recycling company partner of Alfa.

The academic background and current position of the interviewees are presented in the Table 2.

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Academic training</th>
<th>Current Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Financial Management</td>
<td>Administrative Supervisor</td>
</tr>
<tr>
<td>E2</td>
<td>Management Process Management</td>
<td>Administrative Supervisor</td>
</tr>
<tr>
<td>E3</td>
<td>Production Engineering</td>
<td>Industrial Manager</td>
</tr>
<tr>
<td>E4</td>
<td>Business Administration</td>
<td>Administrative Supervisor</td>
</tr>
<tr>
<td>E5</td>
<td>Advertising and Advertising</td>
<td>Footwear Designer</td>
</tr>
<tr>
<td>E6</td>
<td>Business Administration</td>
<td>Administrative Supervisor</td>
</tr>
<tr>
<td>E7</td>
<td>Product Design</td>
<td>Designer</td>
</tr>
<tr>
<td>E8</td>
<td>Technician in Design of Shoes</td>
<td>Designer</td>
</tr>
<tr>
<td>E9</td>
<td>Process Management</td>
<td>Process and Quality Manager</td>
</tr>
<tr>
<td>E10</td>
<td>Mechanical Engineer and Master in Generalist Engineering</td>
<td>Trainee</td>
</tr>
<tr>
<td>E11</td>
<td>Economics with an Emphasis on Projects and Business Psychology</td>
<td>Business manager and CEO</td>
</tr>
</tbody>
</table>

Source: drafted by the authors (2022)

In relation to the total time of experience of employees in the labor market, only one of them is with less than one year, four employees have up to ten years of work and the others have more time, reaching 20, 35 and up to 42 years of total work time.

As for the time they work at the company Alfa, two interviewees have been working for less than a year, six collaborators for ten years, while the others have accumulated an average of fourteen years of experience in the company.

4 ANALYSIS AND DISCUSSION OF RESULTS

Initially, in the company's organizational environment, what would be necessary to allow the return of used footwear to the original industry was investigated. To this end, E1 points out that, in order to resolve situations of exchange and return of orders, this process already exists in the company and is operated by the company representative to the shopkeeper; therefore believes that the bottleneck exists in the relationship between the consumer and the shopkeeper and, therefore, should be considered to create a direct channel with the final consumer for the return of used shoes. Thus, the consumer himself would resend the product
back to industry. They share the same opinion with the interviewees E2 and E4, who are thinking of creating points of receipt in the general trade, for used shoes and without conditions of use.

E3 admits that today there is already a clear return system for the defective product, but for the post-consumer product, with a sell-out shelf life, no work is done to rescue this product by the industry. He believes that the first point to allow this is to raise awareness of the end customer, to make the post-consumer footwear return to the industry. Have at the customer's disposal a system where he knows how to proceed to carry out the return, possibly a computerized system. E6 believes it is necessary to have a pick-up point for the end consumer, as shown in Figure 2.

![Flow for reverse logistics operations](image)

**Figure 2** - Flow for reverse logistics operations  
**Source:** interviewee E6 (2022)

In the opinion of the interviewees E5, E7 and E8, to operationalize the return of the footwear, a specific structure would be needed for the separation and correct destination of this waste. Investing in marketing campaigns for the return of shoes would also be a smart option. Today, this marketing incentive already exists for some brands: the person, when going to buy a new item, takes its used one and gets a discount, a *cashback*, at the time of purchase. Among these points, the shared responsibility for the disposal of waste is emphasized, the concept of the life cycle of a product and the obligation to structure and institute reverse logistics systems (BRAZIL, 2010).

Respondents E9 and E10 argue that it would be necessary to create a return chain for these products, through partnerships with recycling companies or local retailers, where footwear would be separated and destined to specialized locations for their recycling, because, according to Chaves, Balista and Comper (2019), what motivates manufacturers to adopt return processes for products is the possibility of remanufacturing and recycling.

The recycling of conventional footwear, however, after its useful life, faces several difficulties, since the footwear presents a mixture of various materials. In addition, the material recovery system depends on the reverse logistics system, which currently lacks viable infrastructure for its operation (Rahimifard, Staikos & Coates, 2007; Rensburg, Nkomo & Mkhiize, 2020; Zavodna, Trejtnarova & Pospisil, 2020).

The E11, which works in the recycling company, comments that a specific structure would have to be mounted for the collection of the used footwear, since in the recycling process of his company, for example, there can be no metal included, necessarily the leather of buckles, rivets, steel core, jumping pin, etc. The interviewee also points out that it is necessary to manage the cost of logistics, including for some customers located in the states of Minas Gerais, São Paulo, Santa Catarina and some regions of Rio Grande do Sul, and they are already collecting the inputs for recycling in their company. In this way, companies will make it possible to return footwear when they are obliged by the legislation. This is because, according to Wastling,
Charnley and Moreno (2018), the great challenge encountered in the management of reverse logistics is the capital needed to cover the operating costs of the system. As can be seen in the successful experience of the agricultural sector in relation to the recycling of empty packaging of agro-chemicals, the shared responsibility between distribution channels, industry, public authority and farmers is the main precept for carrying out the reverse logistics of this sector. However, for the footwear sector, even if the environmental law determines that manufacturers, importers, distributors and traders must guarantee the collection of the packaging of their products, after the use by the consumer this process is economically unfeasible, for this reason the modality of environmental compensation has been one of the legal procedures adopted by the companies. This process considers the recycling of the equivalent amount, by mass and type of material as a form of environmental compensation of packaging placed on the market (BICALÇADOS, 2022, INPEV 2022).

Wallauer, Martins and Schreiber (2016) argue that, in the Brazilian footwear sector, reverse logistics does not yet have 100% adherence, but there are examples of isolated sustainable actions practices, such as the socio-environmental program that involves the productive chain and the community of the Paranhana Valley, located in the region of Vale dos Sinos/RS, which performs the correct disposal of the waste from the footwear industry of the region. There is also the certification "Sustainable Origin", created by the Brazilian Association of Footwear Industries (Abicalçada), in conjunction with the Brazilian Association of Leather, Footwear and Artifact Components Companies (Asintecal), for Brazilian footwear industries and components that present sustainability initiatives in their production processes.

<table>
<thead>
<tr>
<th>Source</th>
<th>Empirical evidence</th>
<th>Theoretical basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviews E1, E2, E4</td>
<td>The consumer himself should send the product back to industry, so receiving points in the general trade should be created for post-consumer footwear.</td>
<td>Wastling, Charnley and Moreno (2018)</td>
</tr>
<tr>
<td>Interview E3 + Production sector records</td>
<td>There is already a clear return system for the defective product, but for the post-consumer product, which has a shelf life, there is no kind of redemption work.</td>
<td>Wastling, Charnley and Moreno (2018)</td>
</tr>
<tr>
<td>Interview E6</td>
<td>The point of collection of the footwear after use shall be made available to the final consumer.</td>
<td>Wastling, Charnley and Moreno (2018)</td>
</tr>
<tr>
<td>Interviews E5, E7, E8 + Production sector records</td>
<td>It would be necessary to create a specific structure for the separation and correct disposal of this waste. Invest in marketing campaigns for the return of footwear.</td>
<td>Abicalçada (2022); Brasil (2010); INPEV (2022)</td>
</tr>
<tr>
<td>Interviews E9, E10 + Production sector records</td>
<td>Creation of a return chain, through partnerships with recycling companies or local retailers, where footwear would be separated and destined to specialized locations for their recycling.</td>
<td>Abicalçada (2022); Chaves, Balista e Comper (2019); INPEV (2022); Wallauer, Martins e Schreiber (2016)</td>
</tr>
<tr>
<td>Interview E11</td>
<td>In general, the recycling process cannot have metal included, necessarily one must separate the leather from buckles, rivets, steel core, jumping pin, etc.</td>
<td>Rahimifard, Staikos and Coates (2007); Rensburg, Nkomo and Mkhize (2020); Zavodna, Tretjaranova and Pospisil (2020)</td>
</tr>
</tbody>
</table>

Source: drafted by the authors (2022)

Also, an attempt was made to analyze how the process of dismantling the shoes should occur, to make it feasible to segment the materials used in the manufacturing process. All the interviewees emphasized that today returns are already carried out, due to some kind of defect, with the company Alfa already having a disassembly process for the optimization of this material. The E3 respondent emphasizes that the leather is separated from the sole and insole. From the leather, the garnish is removed, when it exists, and sent to the partner company, which carries out the reprocessing and transforms it into raw material for the insole. The sole, when
the base is PVC, TR or EVA, is also separated and intended for suppliers working with this raw material, as shown in Figure 3.

Figure 3 - Parts of footwear disassembled by components
Source: organization analyzed (2022)

The E7 respondent, who works in the line of injected shoes, commented on the importance of separating into components, the soles of the synthetic or plastic leather and the metals used in the lines, in order to make the correct destination or reuse. Likewise, the E9 and E10 respondents confirmed that each type of model undergoes different processes, but that they can be summarized in macro separations, with the removal of soles, ornaments and insoles, and the dismantling of the heads, with the removal of the liners or processing of the synthetics. Another option would be to crush the footwear as a whole and use the by-product as a sole charge.

Depending on the level of disassembly and separation of components, post-consumer waste reuse options may include:

a) the repair technique, which aims to return the initial conditions of use to the footwear;

b) the remanufacturing technique, which aims to employ new and used items in the production of new footwear;

c) the technique of cannibalization, which aims at the selective salvage of some components, depending on the application required, and recycling that targets the waste generated by the footwear post-consumption, as raw material, for the production of new items, or directs it towards safe disposal (Demajorovic & Migliano, 2013).

According to Vier et al. (2020), incorrect disposal makes reuse unfeasible, so production management must include the entire life cycle of the material, even before the raw material is extracted from nature. According to the authors, recycling is important for the reduction of waste, but, in order to meet the objectives of a circular economy, the recovery of products by means of remanufacturing is more advantageous. In this sense, reverse logistics can be adopted as a tool to operate the circular economy.
Table 4 - Disassembly of footwear into components

<table>
<thead>
<tr>
<th>Source</th>
<th>Empirical evidence</th>
<th>Theoretical basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviews E1, E2,...,11 + Production sector records + Visit by participant observation</td>
<td>Company Alfa separates the leather from the sole and the insole. From the leather, the ornaments are removed, which are sent to the partner company that carries out the reprocessing and transforms it into raw material for the insole. The sole, when the base is PVC, TR or EVA, is also separated and intended for suppliers working with this raw material.</td>
<td>Demajorovic and Migliano (2013); Vier et al. (2020)</td>
</tr>
</tbody>
</table>

Source: prepared by the authors (2022)

According to Demajorovic and Migliano (2013), it is unlikely that a company will be able to act sustainably if its business model does not include environmentally and socially adequate attitudes, along its entire production chain, including valuing the human being. In the day-to-day life of the company Alfa, socio-environmental culture is a premise that is part of the routine of employees, including selective garbage collection, rainwater abstraction and use of translucent tiles, which help save electricity and consequently save natural resources.

The commitment to protect the environment has a direct relationship with one of the most important pillars of the company Alfa, which is the enhancement of human beings. The successful actions, in this sense, have already gone beyond the frontiers of Brazil and have been presented at the United Nations (UN), as an example at a global level. The company maintains the work of committees, which are groups of improvements, such as, for example, the sustainability committee. Commitment to all these practices brought the company, in 2021, the achievement of the Sustainable Origin Certification, in its maximum category, Diamond level. Through this award, the company shows its definitive alignment with the best international sustainability conducts and reaffirms its responsibility for nature and all that surrounds it.

As for the implementation of reverse logistics by Alfa, it is already in force in the state of Mato Grosso do Sul, since 2019. In the states of São Paulo, Amazonas and Rio Grande do Sul is under way, with a forecast for coming into effect in the year 2022, in São Paulo, and in the year 2023, in the states of Amazonas and Rio Grande do Sul. In the states of Rio de Janeiro, Minas Gerais, Pernambuco, Maranhão, Espírito Santo, Mato Grosso, Santa Catarina and the Federal District, they are at the stage of signing the term of accession, with a forecast of coming into force in the period of one year, as shown by the timetable for the implantation of the reverse logistics of the company Alfa, presented in Annex E to this study.

To detail the reverse logistics process adopted by Alfa, the company's Legal Manager, responsible for the management of the company's reverse logistics contracts, informs that reverse logistics in the company works by purchasing Recycling Certificates, equivalent to 22% of the waste generated. By means of a sectorial agreement, promoted by Abicalçada, the company maintains a partnership contract with the organization Eu Recicleta, which, according to Dore (2020), is a startup that works with the companies, certifying the implementation of the reverse logistics processes in them.

Each year, Alfa informs the volume of waste produced, the price per ton is calculated and the company pays. In exchange, he receives the certificates. The recycling certificates are proof of the reinsertion of the recyclable materials into the company's productive cycles, that is
to say, they are a form of proof of the results of the reverse logistics practiced by the company.

Figure demonstrates the seal of that certification.

**Figure 4** - Eu Recycling Certification Seal  
*Source:* Eurecyclo (2020)

The Packaging Recycling Certificate (CLP) purchased by the companies is the document that proves that the equivalent mass of recyclable packaging is returned to the production cycle after use by the consumer, in accordance with the parameters of the competent inspection body.

**5 FINAL CONSIDERATIONS**

The production of footwear represents one of the traditional industrial activities that is characterized by the intensive use of labor, as well as low level of on-board technology. Due to this characterization, it is one of the economic activities that requires less initial investment volume, notably in capital goods such as machinery and equipment. For this reason (low initial investment volume and significant job creation) the footwear industry has received attention, incentives and subsidies from government agents, not only from several Brazilian states, but also from other developing or underdeveloped countries, located in the Asian and African continents.

However, the footwear production chain is also characterized by the relevant environmental impact, resulting from the generation and consequent discarding of significant volumes of footwear, at increasing levels, accompanying the increase in the demand of the consumer market, at the world level, over the last few decades. Produced, in the majority of cases, from materials that are slow to decompose, footwear, even when correctly laid down, in
Reverse logistics arise, especially from the promulgation of the National Policy on Solid Waste, as an alternative to reduce the volume of solid waste from the footwear manufacturing process, as well as discarding it at the end of its life cycle. Even though reverse logistics is not yet a mandatory process for the footwear production chain, it is understood that it is recommended, given the characteristics of inputs used in its composition.

In this study, in which a deliberate choice was made for the single case study strategy, in one of the largest footwear industries in the country, with a qualitative approach and data collection through interviews, documentary survey and systematic non-participant observation, data was sought to verify the possibility of adopting the reverse logistics process.

The detailed description of footwear manufacturing operations and the operational procedures necessary to achieve this objective, namely the implementation of activities to enable reverse logistics, provided evidence that the implementation of reverse logistics in the footwear production chain would be technically feasible, but could jeopardize the existing profit margins, due to the need to restructure support operations, as well as investments in physical infrastructure, machinery and equipment, employee training and logistics system.

The limitation of the study carried out stems mainly from the methodological option, of a single case study, which restricts the possibility of generalizing the results obtained. However, in spite of the methodological limitations cited, it is understood that the research achieved its objective and evidenced elements that can subsidize the decision-making process of managers of the companies that make up the footwear production chain, to articulate actions in order to implant the reverse logistics process.

As a recommendation of future studies, it is suggested to conduct further research with the case study strategy, preferably multiple, both qualitative and quantitative approach, to deepen the discussion on the subject in question.

REFERENCES


