

## **REVERSE LOGISTICS PROCESSES AND TEXTILE WASTE: STUDY IN A CLOTHING CLUSTER**

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### **ABSTRACT**

The research on reverse logistics indicates the possibility of recovery of industrial waste. Reverse logistics processes and textiles solid waste were explored in a clothing cluster, and it was identified a gap in the literature. Studies have addressed the benefits provided by the reverse logistics processes for the disposal of industrial waste, besides supplying approaches and including applications in different industries that can be used as parameters for the development of proposals directed to clothing industries. This study has as objectives to develop a tool based on reverse logistics processes to enable recovery of textile solid waste and to identify opportunities for companies reformulate the destination of these materials collaboratively. The tool was proposed based on the literature review of reverse logistics processes and textile industrial waste with the corroboration of a survey. The study emphasizes the importance of clothing local productive arrangement in Brazil and the appreciation of textile solid waste from production processes in this sector. The developed tool illustrates the processes and opportunities for recovery of textile materials that may be developed by industry of a local cluster. Data from the study contribute to literature on reverse logistics, waste management and the benefits of micro, small and medium size enterprises are met in a local productive arrangement.

**Key words:** Reverse logistics; Textiles solid waste; Clothing cluster.

### **INTRODUCTION**

Companies that aim to stand out in the market are interested in the activities that support for a sustainable environment. Therefore, the responsibility of companies is to avoid deterioration of the environment, including the reduction of raw material sources, depletion of landfills lifespan and increasing pollution levels (Akdoğan and Cingöz, 2012).

In the face of the waste disposal problem, organizations remain competitive and strong by planning solutions to this activity, either by internal or external forces (Seadon, 2010). In this scenario, reverse logistics (RL) is encouraged to be used in the sectors for the return of after-sale and post-consumer goods including industrial waste (Srivastava, 2007; Akdoğan and Cingöz, 2012).

The local production arrangements (LPA), also called clothing cluster in this case, are made up of these companies, which is the motivation and interest in these agents for this study. Industrial waste consist of similarities, being generated in a cluster, and thus can be directed to the same destination,

enabling the reduction of uncertainty and small volume, considered critical to reverse logistics and small businesses, because of the difficulty in achieving scale economies (Liu and Zhang, 2008).

There have been few investigations related to the concern of textile waste destination from the production processes within clothing industries. To contribute to this gap, the main objective is to develop a tool based on reverse logistics processes to the appreciation of textile solid waste, favoring the process of reformulation of activities in order to minimize the environmental impacts of the industry, agents of a clothing cluster. This paper is organized into several sections. In the next section, a literature review of relevant basic concepts for this study is presented. Then the way the study was conducted and how the data were collected and analyzed. Finally, a discussion of the contribution of the study and its conclusion.

### **REVERSE LOGISTIC PROCESSES: FOCUS ON INDUSTRIAL WASTE**

The market requires a high level of competition and suggests that companies optimize the use of resources and intensify the modernization of management and production techniques, developing activities that support for sustainable environment (Seadon, 2010; Akdoğan and Cingöz, 2012).

Thus, it is seen that with the rapid economic development and globalization, the generation of a large amount of solid waste result from industrial production processes; a fact that has attracted worldwide focus, because of potential environmental impacts. Nowadays, the disposal of waste is constituted as one of the serious problems faced by society, which presents a huge challenge for researchers seeking alternatives to its confrontation (Fujii et al., 2012; Song et al., 2014).

Given this approach, it is estimated that the Reverse Logistics Processes aimed at minimizing environmental impacts and promote sustainable production, consumption and proper disposal of waste flow (Wath et al., 2010). Many companies have recognized the reverse logistics as an important tool for promoting economic, strategic, competitive and profitability advantages through waste recovery, or the proper disposal of waste (Autry, 2005; Liu and Zhang, 2008; Rada et al., 2010; Eltayeb et al., 2011).

However, due to the great generation of industrial waste, not all of them can be collected and processed. Therefore, huge amount of industrial waste is dumped illegally, especially in developing countries, and industrial waste generators are continually faced with the problem of disposing of their waste and must choose one among several different options for disposal and treatment (Song et al., 2014; Jakhar, 2015).

Accordingly, reverse logistics has as a benefit, extending the product or residue life cycle that would be used as waste, whereas there is still possibility to use as a raw material for other products. Thus, there is the promotion and the alternative use of resources. They can increase profitability and productivity by reducing inputs and materials that possibly would be heading to landfills, besides competitive reasons as differentiation by service, cleaning of distribution channels, protection of profit margins and recapture of value (Tibben-Lembke, 2002; Dhanda and Peters, 2005; Moon et al., 2013). Still, it is noticeable that RL is considered a strategy to promote sustainable actions in the company and to design a relevant response to the requests of consumers and society (Dat et al., 2012; Lee and Lam, 2012).

## MATERIAL AND METHODS

This study focuses on the perspective of industries, agents of a clothing cluster, and it was based on the literature and it was grounded in the application of a questionnaire. The study employs qualitative and quantitative methods and it can be classified as a survey, which aims to gain insights and understanding of the problem and the systematic search of data that remains to be learned. Following the principles of qualitative research, theoretical analyzes that resulted in deductions were made. In this study, the questionnaire was used to identify the generation actions, control of textile solid waste, and map the possible reverse logistics processes used, besides the benefits provided by these actions, with a view to the aspects that involve the reduction of environmental impact, costs and compliance with the law.

Therefore, it is understood that the results and conclusions can present some about the general attitudes towards the recovery of textile waste through reverse logistic processes. For this reason, a tool based on reverse logistics was proposed, aiming sustainable attitudes in the clothing industries, through the recovery of textile solid waste. The questionnaire was applied in person and respondents were the managers of industries. The survey was conducted over a period of four months.

This questionnaire with closed questions was applied to thirty-two companies classified as micro, small and medium sized, chosen according to the criteria of accessibility. In addition, this region was constituted in important clothing cluster, bringing the biggest occupied manpower number operating in the sector in Parana State - Brazil (IPARDES, 2006).

## DISCUSSION

The clothing industries produce considerable amounts of waste and compounds of similarities, because they are generated in a local productive arrangement and develop products with fashion trends.

In this sense, it is considered relevant to know what the current model of return of textile waste in clothing industries, agents of this LPA. These industries have a low return of textile solid waste through reuse in their internal processes, only 19% reported that reuse textile waste in an internal process such as for making gifts, details and/or accessories for the products made by the company, as shown in Table 1.

*Table 1: Practices adopted by the surveyed companies regarding the return of textile solid waste*

Questions	[%]
1. The textile solid waste is reused by the company	19
2. The textile solid waste is sold by entrepreneurs from other sectors	22
3. The textile solid waste is disposed of by companies specializing in waste	75
4. There are partnerships with other companies to eliminate the textile solid waste	16

It was found, therefore, that the marketing of this waste to entrepreneurs from other sectors is rarely used and only specialized companies carry out the destination. Six respondents reported donating waste to women who manufacture carpets (household) and "wipes" to be sold in gas

stations and car repair shops.

The surveyed industries have physical proximity and consume similar compositions of textile materials. In this regard, an important aspect of partnership among them refers to the economies of scale that are achieved through agreements among industries that allow cargo transportation consolidation, resource management and logistics operation cooperatives (Barnes and Dhanda, 2007). However, whereas playing similar activities for the disposal of waste, 16% of respondents reported having partnership with other entrepreneurs for the disposal of textile waste, which represents a low partnership among clothing manufacturers.

The waste control action results and favors an adequate destination policy and its possible enhancement. However, in the surveyed enterprises, it was found that there is a low control through spreadsheets of the amount of generated waste. The separation of waste is the initial process of reverse logistics.

Table 2 shows that, in the researched industries, the textile materials are not separated according to their composition (41%) and a further representative percentage (94%) reports that no waste is separated in accordance with its color.

*Table 2: Controlling the generation of textile waste in clothing industries*

Questions	[%]
1. Control of generated waste through spreadsheets	19
2. The textile solid waste is separated according to the material composition	41
3. The textile solid waste is separated according to the material color	9
4. The fabric scraps are stored in a dry and airy place before collection	94

However, the controlling actions in companies can promote waste through marketing and reuse. For this, the material must have good conservation (clean, dry and intact properties), achieved through correct storage and, ultimately, the waste should be disposal environmentally correctly (Xanthopoulos and Iakovou, 2009).

The recovery of textile waste is an important factor to prevent the early disposal of these materials. The recovery and/or recycling are ways of optimizing their life cycle. However, only eleven respondents (34%) state that there are actions in the company for recovery of the fabric scraps, such as the manufacturing of details in clothing, accessories and other practices that recover and avoid waste disposal.

Regarding the final disposal of textile waste, they reported they are aware of the content of contracts among industries and specialized company, which is responsible for the waste disposal. Data show that most respondents do not know the final disposal of solid waste collected in their companies; and 41% claimed they are aware.

On the practices adopted by the respondents for final waste disposal, it was found that these practices do not represent advantages in the economic growth and cost reduction. It is assumed that this data is related to the fact that the waste is intended as residues. Costs for disposal of textile solid waste are considered moderate to high and companies reported that they do not disclose the

information concerning the practices with the society, customers and suppliers.

Concerning the investments in technology aiming to reduce wastage of textile materials, for example, automation of the modeling and cutting sectors, directly involved in the generation of waste, respondents report that there is no investment in this respect. According to the data, it seems that the managers of clothing industries have not noticed reflections of economic growth, increase in profits or added value in products from the actions of proper disposal.

It is found that proper disposal of waste, through the reverse logistics process, recovers the materials and, consequently, reduce environmental impacts, costs and facilitates the compliance with the legislation. It is assumed that is required to achieve these actions, such as planning, control measures and the separation of waste, which are processes that need to be reviewed and/or implemented in companies, in order to enhance the benefits for the sector.

By the relevance of the waste recovery that can be recycled through the reverse logistics chain (BRAZIL, 2010; Mendonça and Infante, 2014), a proposal to an elaborate tool will be presented according to the processes of reverse logistics for the recovery of textile solid waste.

Figure 1 shows the initial processes of RL: control, separation, storage and collection of textile waste (Xanthopoulos and Iakovou, 2009). Thus, the aspects considered fundamental for a more efficient management of waste are identified, with RL in the recovery or proper disposal of waste.

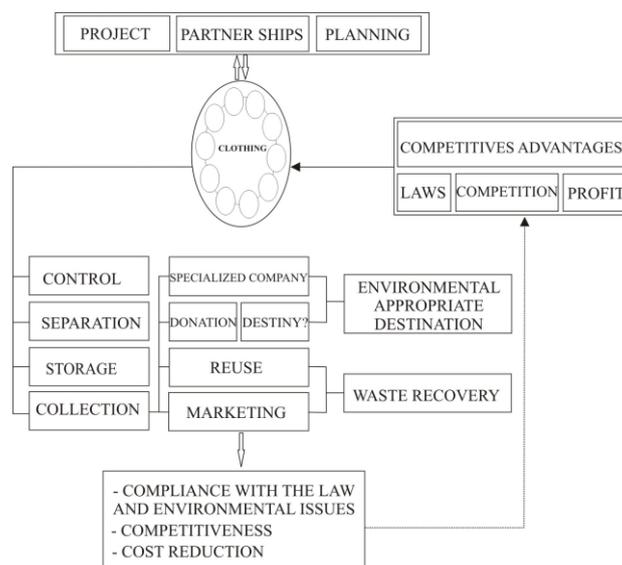


Figure 1: Processes and benefits of RL for the destination of textile waste from clothing industries

The results shown here indicate that the participants in the research does not have a structured policy for the destination of textile solid waste and therefore can readjust/implement processes for this action. In this sense, processes that must be chosen appropriately according to the characteristics of the raw material are presented: reuse (recycling), marketing or specialized company (process often used in companies) (García-Rodríguez et al., 2012).

However, it is evident the need for insertion of a policy of solid waste disposal, covering aspects such as planning, investment, preparation, prevention, recognition of reusable and recyclable solid waste as an economic asset and social value, generating employment and income, promoting the citizenship, among others (BRAZIL, 2010).

## CONCLUSIONS

This study showed a tool based on Reverse Logistics Processes for the recovery of textile solid waste of a clothing industry cluster located in Paraná State – Brazil, which could reduce environmental impacts and promote competitive advantage by reducing the disposal of textile waste generated in the sector.

The proposed processes challenge the current industrial system used by clothing companies and show new opportunities for the recovery of textile solid waste, which would occur with some changes. This tool, based on reverse logistic processes, is not ready for a radical change, because it involves economic and management issues. Yet, it presents evidence that there is viability for the use of these practices.

However, focusing on the recovery of textile waste and providing real opportunities for the company managers, these actions can start the discussion about inserting such systemically processes within industry, since the short-lived textile waste present a problem, in view of the amount of the current industrial disposal system. Moreover, in this analysis is possible to verify that the waste (scraps, trimmings) are not seen as a product (raw material) to be used in a new cycle. Therefore, the strategic objective of reverse logistics is not achieved, i.e., adding value to a made unusable product to the original owner or that still have conditions of use.

Finally, the importance of micro, small and medium enterprises are gathered in clusters is highlighted, such as the participant industries of this study. At the moment, the disposal of textile waste processes are developed in isolation, with little contact among the surveyed industries, i.e., their full potential are not optimized. It is emphasized that this study provides more knowledge for an activity often developed by the companies and poorly investigated by researchers. There are few studies in the literature that deal with this subject specifically, being a comprehensive field for research that can provide advances for companies in the market and society in general. Additional studies become necessary in the face of barriers that impose to the implementation of this tool, such as costs, territorial dimension, conflicts in the production chain and product development.

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