BARRIERS AND DRIVERS ON PRODUCT RETURN: A CASE STUDY IN A REVERSE LOGISTICS SERVICE PROVIDER IN BRAZIL

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Abstract
Academic and corporate interest in reverse logistics (RL) has risen considerably in recent years. More industries are adopting it as a strategic tool to achieve sustainable profitability, to avoid wastage, to benefit the customer relationship, and to improve their image by greening the supply chain. However, mostly, RL is a complex process. For that reason, many companies decide to outsource its implementation and management in order to avoid dealing with its barriers and impediments. In this sense, the objective of this paper is to identify the most important drivers and barriers that enable or impede RL development in Brazil. For that, a systematic content analysis approach was adopted in order to find the most cited drivers for RL. Secondly, a case-based research was conducted in a Reverse Logistics Service Provider (RLSP) located in Southern Brazil. This aimed at determining the main RL barriers in order to compare them to the data gathered from the literature. Multiple sources of evidence have been used, enabling triangulation data analysis and improving data validity. The prime source of data used was semi-structured interviews, backed up by unstructured interviews, personal observations, and document analysis of company archival sources. The empirical results indicate that five significant barriers hinder the RL development: (1) high taxation on recyclable materials; (2) dispersion of collecting points for end oflifeproducts and the lack of Brazilian consumer awareness of environmentally friendly disposal options; (3) lack of shared responsibility in the reverse supply chain; (4) presence of many parties in the return flow increases its costs; and (5) high RL costs. Both practitioners and academics might find this study useful, as it outlines the Brazilian barriers for RL, the largest Latin America economy. In addition, this work is built on the recent research in RL. The paper closes with a discussion onthe RL barriers and by suggesting future research in the area.
Keywords:
Reverse logistics; case study; reverse logistic service provider;Brazil.

1 INTRODUCTION

In the past fifteen years, the interest in closed-loop supply chains, product recovery and reverse logistics (RL) has attracted the attention not only of companies and professionals but also of academia [1-5]. In addition, RL has become a key competence in modern supply chains [6]. Despite RL's apparent current relevance, the available literature on the field is relatively scant[7] and little research has been conducted on the subject[8].

In fact, reverse supply chains (RSC) have not been broadly researched or developed[9]. Therefore, there is great opportunity for the advancement of RL[10]. Although RL is strategically important[11] and the RL concept is gaining popularity in practice, the available literature and theory on the strategic sphere are limited[12].

Many authors have recognized RL's strategic value [13-15]. Although the RL literature has been growing over the past years, limited empirical research has been undertaken to define the management aspects involved [16].

Interestingly most existing research on the drivers and barriers of RL implementation are focused on developed countries, with relatively little attention being paid to developing countries[17], such as Brazil. Moreover, researchers[18, 19] have stated that the scarcity of RL studies for developing countries is hardly surprising because while RL is a mandatory component of the supply chain in developed countries, RL is still in a state of infancy in emerging economies.

Given the current RL scenario, this paper aims to contribute to the RL literature and RL practice by means of a RL case study on a Brazilian Reverse Logistics Service Provider (RLSP). By drawing on the RL literature and the insights obtained from the case study, the present paper aims to identify the most important drivers and barriers that enable or impede RL development in Brazil.

This paper is structured as follows. Section 2 provides the research methods.Section 3 reviews the literature on the concept and processes of RL, RL drivers and the development of a RL environment framework.Section 4 presents the case study and its empirical results. In the final section, final remarks and conclusions are drawn, as well as future work is discussed.

2 RESEARCH METHODS

The objective of this research was to identify the most important drivers and barriers that enable or impede RL development in Brazil. To fulfill this purpose, this investigation is twofold. Firstly, international peer-reviewed publication on RL was considered in order to develop a RL environment framework. Secondly, a field research was conducted in a Reverse Logistics Service Provider (RLSP) located in Southern Brazil. A summary of the research design is presented in Figure 1.

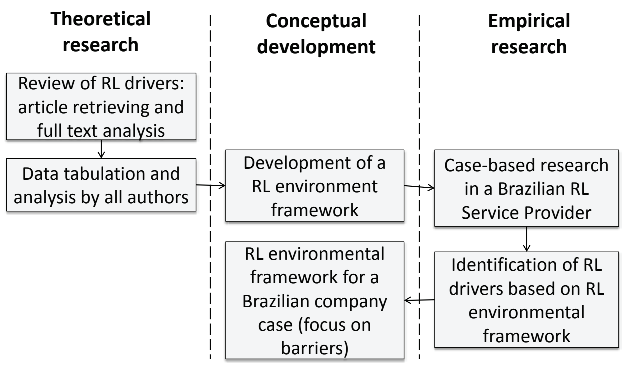

Figure 1: Research design.

2.1 Literature review process

This work firstly required methods that would uncover the drivers considered in existing RL literature. For that, it was necessary to obtain meaningful contents to address this particular research purpose from a large amount of literature. Thus, a content analysis method was adopted in this study. It encompasses a wide variety of procedures and techniques, although there is no one systematic checklist to follow when conducting content analysis [20].

In order to prepare the groundwork for the literature review, some key terms were defined. The most cited RL definition by [14]was adopted: "Reverse Logistics (RL) is the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal". In line with this RL definition, relevant publications were selected using the term "reverse logistics" combined with one of the following terms (and variations of these terms): "trigger", "pressure", "incentive", "stakeholder", "driver" or "barrier". These terms were searched for in titles, key-words and abstracts to retrieve publications in the materials collection phase.

To find articles that met the criteria of this work, the literature review focuses upon articles in peer-reviewed international journals. Papers were retrieved from major library services such as Ebsco (www.ebsco.com), Scopus (www.scopus.com) and Compendex (www.engineeringvillage2.org).

The literature review encompassed the past five years, from 2007 to 2012. The rationale for this time span was that because RL is a relatively new concept, publications should be relatively recent. Nevertheless, a random search for years prior to 2007 was also carried out. The purpose of the random search was to determine which factors were being updated in the current literature. Thus, the review needed to reach back far enough to afford an appropriate amount of papers, but not so far back as to lose contemporary relevance.

The research process yielded 182 articles that were analyzed for adherence to the established criteria. After examining the titles and abstracts of these articles, 37 articles were read in full. Out of these articles, 14 were chosen for content analysis, along with 3 other papers from the random search.

A total of 17 articles were analyzed by adapting procedures for problem-driven content analysis from[21]. The process was carefully chosen and thoroughly performed to extract the meaning of the textual content while enhancing the reliability and validity of the data to the greatest possible extent.

In this study, the unit of analysis was the drivers used in previous publications. One of the authors was in charge of recording the drivers that were extracted from the selected literature and tabulating the issues addressed in the articles. Each driver and the article of origin were recorded on a worksheet. A main list of the findings was created as a spreadsheet document, which was further analyzed by all the authors. The articles considered had as few as three and as many as seven drivers each.

2.2 Case study method

For the field analysis, case-based research was used as the methodological approach. Guidelines from the existing literature were considered (e.g.[22, 23]). This case study was descriptive and did not postulate a causal relationship between the variables because the variables are still not well-established. The data gathered were predominantly qualitative and were obtained from many sources, as will be described later.

The unit of analysis was selected based on criteria for improving the data quality and reliability, which are as follows: (i) the plant should be located in Brazil; (ii) a large RL Service Provider company (with considerable resources)should be selected; (iii) company with a RL program older than 15 years (corresponding to a structured and mature RL practice), and (iv) the company should agree to participate in the study and provide access to its data.

The prime data were gathered through semi-structured interviews, which were backed up by unstructured interviews, personal observations, informational conversations and an analysis of the company archival sources (including internal documents such as historical production, sales and recovery data). These sources of evidence were previous planned on a research protocol, in order to enhance reliability and validity of the case research, as recommended by[23]. Data validity was improved by applying triangulation among the various sources of evidence (field observation, interviews, company documents, etc.).

Since factors that impede or enable RL practice may have different interpretations or viewpoints, multiple respondents were used to mitigate bias. The interviews lasted between 30 minutes and 2 hours. The prime informants were as follows: sales specialist, costs and budget specialist and reverse manufacture technician.

3 THEORETICAL BASIS

The primary purpose of this review is to present an overview of the RL concept and RL processes. Next RL drivers are discussed, in terms of the many different points of view in the literature. The RL environment framework developed by the authors is also presented.

3.1 Reverse Logistics overview

One of the operational goals of modern logistics in a broader concept is the idea of supporting product lifecycle regarding to the extension of the concept beyond the forward flow of materials and the need to consider the product reverse flows in general[24]. A concept of material cycles progressively replaces a 'one way' perception of economy[3].

Although over the past years RL received a lot of attention it is still a relative new concept[8]. Terms such as Reverse Channels or Reverse Flow were already used in the scientific literature of the 1970s but were consistently related to recycling[6]. The Council of Logistics Management (CLM, which is currently known as the Council of Supply Chain Management Professionals - CSCMP) published its first definition of RL at the beginning of the 1990s. This definition and other definitions are shown in Table 1.

In summary, RL is concerned with issues such as reclaiming, recycling, remanufacturing, reuse, take back, and disposal needs to be available for adequate service requirements [25]. The many RL definitions and citations thus far show that the concept is still evolving and that interest from business and academia has been growing over the last decade [26].

Table 1: RL definitions over the years. Source: Adapted fromBrito and Dekker[6].

Author/Organization and Year	Reverse Logistics definition
Council of Logistics Management (CLM); early 1990s.	"...the term often used to refer to the role of logistics in recycling, waste disposal, and management of hazardous materials; a broader perspective includes all relating to logistics activities carried out in source reduction, recycling, substitution, reuse of materials and disposal."
Pohlen and Farris (1992)	"...the movement of goods from a consumer towards a producer in a channel of distribution."
Kopicky et al. (1993); Stock (1992)	"RL is a broad term referring to the logistics management and disposing of hazardous or non-hazardous waste from packaging and products. It includes reverse distribution which causes goods and information to flow in the opposite direction of normal logistics activities."
European Working Group on Reverse Logistics - RevLog (1998)	"The process of planning, implementing and controlling flows of raw materials, in process inventory, and finished goods, from a manufacturing, distribution or use point, to a point of recovery or point of proper disposal".
Rogers and Tibben-Lembke (1999); El Saadany; Jaber, 2011; Govindan et al., 2012)	"Reverse logistics is the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal"

Reverse logistics (RL) operates in the process of materials/products handling primarily in the field of recycling and reuse, closing materials cycle, as shown in Figure 2.

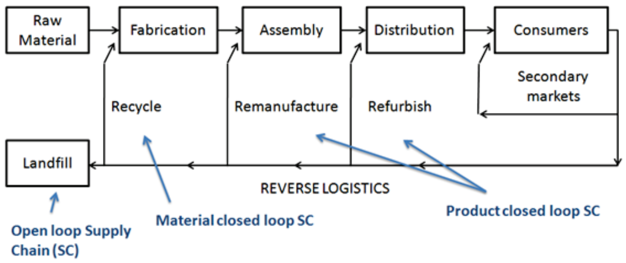

Figure 2: Reverse Logistics inremanufacturing, recycling e repairing. Source: AdaptedfromKumar and Putnam[9].

As seen in Figure 2, RL plays an important role in the reverse flow of closed loop supply chains, focusing on product take back and value recovery, by means of product reuse as a whole, its parts or modules[13]. Thereunto, RL plans reverse networks and corresponding information and operates the flow from product collection, through logistics process of consolidation, segregation and sorting, up to reintegration in the cycle[26].

3.2 RL drivers and environmental framework

RL concept has received growing attention in the past decades, due to a number of factors[27], such as: legislative, environmental, and economic reasons[28]. This section lists and discusses the various stakeholders and drivers for RL that are found in the literature.

The return of products by reverse channels is motivated by many driving forces. Carter and Ellram[29] constructed a framework that illustrated the forces influencing RL. These authors showed that four organizational entities affect an enterprise's RL operations: suppliers, buyers, the government, and competitors. Carter and Ellram's conceptual model is widely regarded as the first comprehensive RL framework [20].

Other authors have also identified the main RL drivers. Brito and Dekker [6] indicated three drivers: economic (which refers to the reuse of product materials, product value recovery, the reduction of final disposal costs and the creation of indirect benefits, such as a green image, competitiveness and other strategic issues); legislation (which refers to the areas of product recovery or product take-back); and corporate citizenship (which encompasses a range of values or principles that stimulate an industry or organization to use RL). Toffel[30] has posited that even before the emergence of take-back laws, some firms were already engaging in voluntary returns. The author provided the following reasons for these practices: the reduction of production costs, enhancement of the brand image, meeting changing customer expectations, and the protection of aftermarkets. The advent of take-back legislation also motivated firms to prevent the scope of the legislation from broadening and to pre-empt additional legislation.

Álvarez-Gil et al. [11] argued that RL programs result from a combination of external pressures (from consumers, government, suppliers, NGOs, etc.), an organizational factor (the availability of resources), and an individual factor (the strategic stance of the decision-maker). For Lau and Wang [31], RL is driven by factors such as systems (infrastructure and technology), economics (incentives and benefits), legislation (regulations and directives), awareness (public concern and extended producer responsibility) and collaboration (supply chain partners and competitors). Mutha and Pokharel[32] argued that the implementation of legislation, social responsibility, corporate imaging, environmental concerns, economic benefits and customer awareness are forcing OEMs (original equipment manufacturers) to take back used products at the products' end oflife.

González-Torre et al. [33] conducted a study on the automotive sector, considering five external barriers (governmental reluctance, customer reluctance, reluctance of social actors, reluctance of competitors, and the perception of a poorer quality product) and four internal barriers (lack of expertise, the absence of top management commitment, the absence of information and technological systems, and the high cost in financial and human resources) that may impede or hinder the implementation of environmentally-oriented RL practices.

In an empirical study on more than a hundred Singapore-based companies, Tan and Hosie[34] identified six key barriers to the successful implementation of RL: legal issues, competitive issues, financial constraints, the absence of a proper information system, the absence of attention from management, and human resources. Achillas et al. [35] posited that authorities should establish economic and regulatory incentives for the appropriate management of waste. The authors also stated that the growing trend of ‘‘green consumerism”, which is characterized by consumer preferences for eco-products and consumer willingness to pay a premium for goods or services that place fewer burdens on the environment, is also a powerful incentive in the promotion of alternative waste management.

Eltayeb et al. [36] analyzed three organizations to identify green initiatives adopted in Malaysia, including reverse logistics. The interviews indicated that the key drivers were regulations, customer pressure, expected business benefits and social responsibility. Kannan et al. [37] considered five pressures to take back used products: government legislation, social responsibility, environmental concern, economic benefits and customer awareness.

Sarkis et al. [38] conducted research on the effects of stakeholder pressure on the adoption of environmental practices. The authors listed the following stakeholders: clients, the government, shareholders, workers and society. Hazen et al. [20] extrapolated the following seven factors: supply chain capabilities, RL costs, profit from RL, the environmental impact of RL, regulation, market considerations, and customer behavior.

Chan et al. [39] argued that the key drivers for RL are as follows: unavoidable returns, environmental and green concerns, enforced legislation, economics, and corporate citizenship. Abdulrahman et al. [17] identified key barriers for four categories (management, financial, policy and infrastructure) in Chinese manufacturing industries: a lack of RL expertise and low commitment (management category), an absence of initial capital and funds for return monitoring systems (financial category), an absence of enforceable laws and supportive governmental economic policies (policy category), and an absence of systems for return monitoring (infrastructure category).

Ho et al. [40] presented five supported hypotheses in an analysis of the major factors that may influence industries to implement RL: the number of staff in the company, the company’s financial support, the company’s human resources support, business partners in the supply chain and the perception of the benefits of RL. Van Der Wiel et al. [8] classified the multiple drivers and barriers of RL into three groups: regulatory (legislation), market (economic and strategic drivers) and societal forces (corporate social responsibility or environmental sustainability).

Table 2 compiles all the literature data on the drivers for and the influences on RL.

Table 2:Mentioned RL drivers per reference.

	External - General Environment			**External - Operational Environment**			**Internal**				
Authors	Environment	Government (legislation)	Society / NGO	Suppliers	Competitors / Market and Aftermarket	Clients / Consumers	Corporate Citizenship / Social Responsibility	Economic / Financial	Infrastructure and Technology	Management / Individual factor	Human Resources
Carter and Ellram (1998)		x		x	x	x					
Brito and Dekker (2003)		x					x	x			
Toffel (2004)		x			x	x		x			
Alvarez-Gil et al. (2007)		x	x	x		x		x		x	
Lau and Wang (2009)		x	x	x	x	x		x	x		
Mutha and Pokharel (2009)	x	x			x	x	x	x			
González-Torre et al. (2010)		x	x		x	x		x	x	x	
Tan and Hosie (2010)		x			x			x	x	x	x
Achillas et al. (2010)		x				x		x			
Eltayeb et al. (2010)		x				x	x	x			
Kannan et al. (2010)	x	x				x	x	x			
Sarkis et al. (2010)		x	x			x		x			x
Hazen et al. (2012)	x	x		x	x	x		x			
Chan et al. (2012)	x	x					x	x			
Abdulrahman et al. (2012)		x						x	x	x	x
Ho et al. (2012)				x				x	x		x
Van Der Wiel et al. (2012)	x	x			x		x				

Most references include the following three drivers: (i) the government (in terms of legislation on regulations and directives), (ii) economic or financial issues, and (iii) client or consumer requirements/concerns. The tabulated information from the articles was used to perform an environmental analysis of RL, which resulted in the conceptual framework.

The stakeholder theory posits that stakeholder pressures greatly motivate organizations to adopt various environmental practices[38, 41, 42].An RL environment framework was built based on the information in Table 2 and on the stakeholder concept (Figure 3).

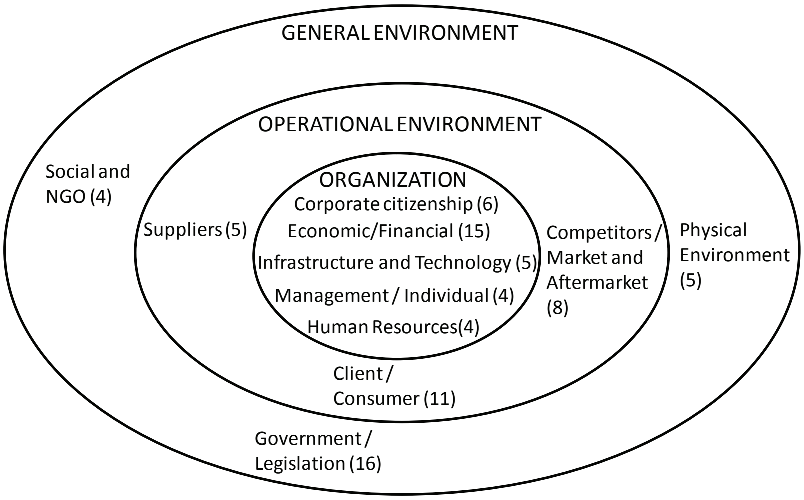

Figure 3: RL environment framework. Source: Adapted from Certo and Peter [43].

The RL environment framework in Figure 3 is based on a systematic review of the papers. A total of 11 drivers was detected from the content analysis. The number associated with each driver in Figure 3 represents how many times the driver appeared in the papers. The least cited drivers were as follows: shareholders, human resources (HR), and management and individual factors (for example, a manager's posture in favor of RL), and society and nongovernmental organizations (NGOs).

However, HR can also be an external driver in the operational environment, in terms of the availability of competent labor for executing RL. This is an important factor in many communities, particularly when HR is related to RL activities that require the availability of skilled manpower. Thus, RL is a complex process and many companies cannot handle the complex networking necessary to produce an efficient RL process[25].

4 CASE STUDY

This section presents the case study developed in a company located in Southern Brazil.The company is a Brazilian reverse logistics service provider (RLSP)which has offered environmental solutions since 1994. For confidentiality, the company is referred to as "ABC Company". First, the ABC Company is presented. Next, the reverse process of refrigerators is described. Finally, barriers and results from the case study are presented and discussed.

4.1 Presentation

The case study was performed in a company thatworksmainly with endoflife (EOL) products, such as: electronic devices in general, refrigerators, air conditioners and printers. The ABC Company also receives production rejects from industries as well. The ABC Company is certificated by the norms OHSAS 18001, ISO 9001 and ISO 14001. It operates in the following areas:

•Treatment and destination: thecompany unit that deals with costumers for solid and liquidresidues disposal.

•Reverse Manufacturing: a business unit that has a “waste less and preserve more”principle, including the recovery of materials from products e.g. refrigerators, computers and electronics devices in general. It uses thereverse flow process: productseparation, primarily manual dismantling, shredder activities and segregation of materials by type (ferrous and non-ferrousmetals, plastics, polyurethane, etc.).

•Engineering and consultancy: the ABC Company operates in three segments: water, soil and air in partnership with industrial clients to implement customized projects.

•Recovering and “revalorization”: driven by the New Brazilian Policy of Solid Residues (*PolíticaNacional dos ResíduosSólidos – PNRS*), the ABC Company performs recovery ofmetal materials from manufacturing industries.

•Gas and oil: this business unit contemplates some activities such as diagnostic, investigation and remediation of soils and underground waters that havebeenaffectedfrom oil companies' activities, dealing with emergency situations, environmental consultancy, etc.

For the purpose of this study, the investigation was performed in the reverse manufacturing unit of the ABC Company. The case study focused on the reverse flow of end oflife (EOL) refrigerators as well as on the reverse flow of production rejects, which are the most significant flows for the company in terms of return volume. These flows can be divided in three stages: product disposal by the consumer/client, reverse logistics and reverse manufacturing. The reverse process is described in full in the following section.

4.2 Reverse Process

The ABC Company receives 15 to 18 tonsper month of non-serviceable refrigerators (EOL or production rejects).As already mentioned, there are two main product return flows: (i) some refrigerators return from industries that have established a partnership with the ABC Company for the final destination of non-serviceable refrigerators. These products are not proper for retail sale and, therefore suited for dismantling and material recovery in the ABC Company. Usual problems found in these products are: the production batch did not attain the expected quality or the shipment suffered some kind of damage during transportation. (ii) The second type of return flow is related to a Brazilian energy efficiency project (EEP).The main objective of this project is to reduce the energy consumptionin a specific area in Rio de Janeiro, named “Favela da Rocinha”, the largest Favela community in Brazil. At the same time, this project aims at reducing the amount of illegal energy connections. For this purpose, the Brazilian government has created a partnership with the ABC Company. Houses in the “favela” are visited in order to replace the used and high energy consumption refrigerators with new low energy ones. Simultaneously, illegal energy connections are undone. The ABC Companycollects those used refrigerators and transports them to its reverse manufacturing plant.

The ABC Company outsources the transportation of all the returned refrigerators. For the specific case of non-serviceable refrigerators from industries, the producer is responsible for sending those products to the ABC Company.

The average stock level of non-serviceable refrigerators from industries is two days and for EOL refrigerators from the EEP is three to four days. The process stages for each type of returned refrigerator are different. Products brought from industries go directly to shredderprocessing and segregation. Products brought from the EEP need to pass through the primary manual dismantling, in order to remove the compressor.

Figure 4.a) shows the automatic process of the treatment line, containing a back conveyor that supplies the shredder machine. Figure 4.b) presents an upper view of the shredder machine.

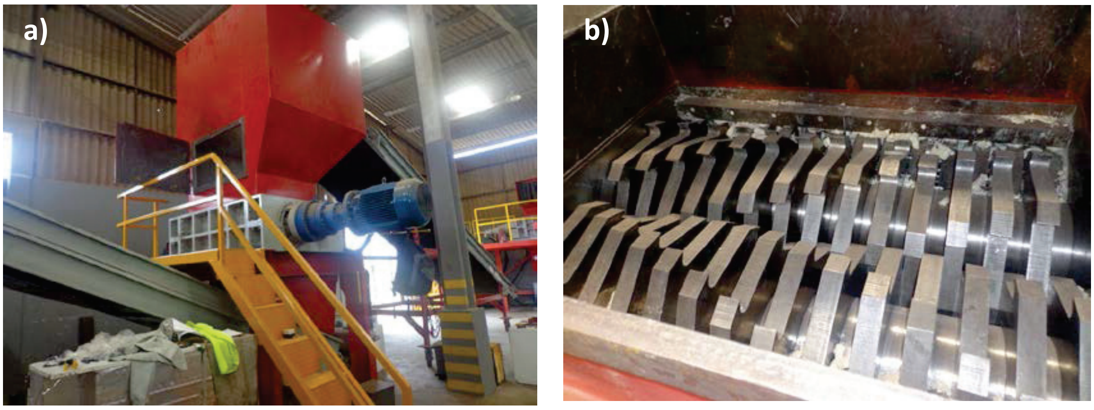

Figure 4: Treatment line with conveyors and shredder machine and a shredder machine upper view.

The final stock, after trituration and segregation, is divided in: plastic, ferrous metal, copper and aluminum. All these scrap materials are sold to recycling companies. Plastics are sent to recycling companies once a week (one truck per week). Ferrous metals aresent two or three times a week, whilecopper and the aluminum materials are sentonce or twicea month.

The process lead time of the treatment line (shredder and segregation of materials) is approximately five minutes. This line operates in one shift and handles, in average,2.500 refrigerators per month. The ABCCompany usually works in batches for this treatment line, although the batch size is not fixed. The batch size mostly depends on the volume of products that arrives for reverse operations. This is why reverse production systemsare commonlyclassified as “supply-driven flows”, rather than “demand-driven flows” as seen in the forward production system, as already stated by some authors[44, 45].

Figure 5 summarizes the whole reverse process for production reject and EOL refrigerators as well.

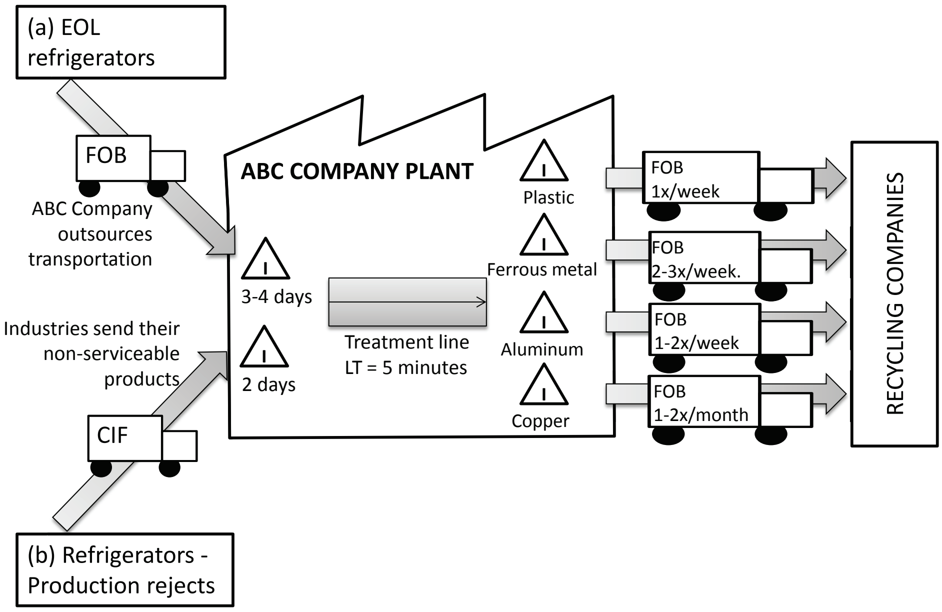

Figure 5: Return flow for ABC Company.

4.3 Results and Discussion - RL Barriers

Even considering that the company studied is specialized in product return solutions, it faces some particular barriers that were already present in literature. These barriers and the RL stakeholders identified during the investigation are presented in Figure 6.

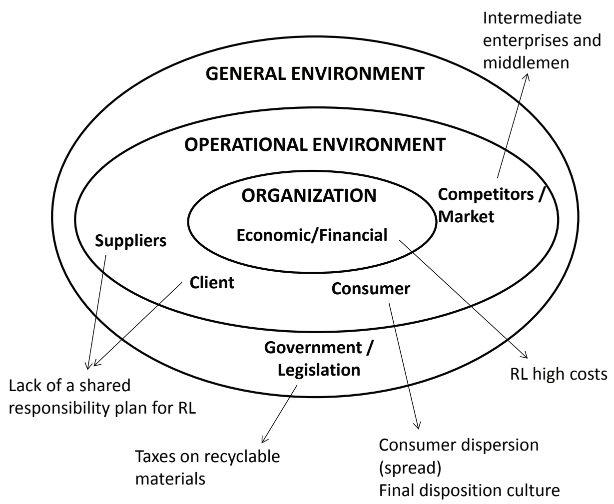

Figure 6:RL barriers for ABC Company.

According to data gathered during investigation, the most relevant barriers for the operation of RL for the ABC Company are:

• General environment - Government/Laws: in Brazil, the taxation on recyclable materials is equivalent to taxationon brand new materials. In some developed countries (UE countries or USA, for example), there are incentives for recyclable materials, reducing taxation on reusable materials or products.

• Operational environment -Consumer: the collection of EOL product is a hindrance inherent to RL operations because of the dispersion of the points of collection (consumer houses, for example). Furthermore, Brazilian consumers are not yet broadly conscious of the environmentally appropriate final disposaloptions.

• Operational environment -Suppliers and Clients: it was also mentioned during the investigation the lack of shared responsibility in the reverse supply chain (RSC) for the RL planning and operation. This barrier generates a misbalanced cost distribution in the reverse channel, hindering the RL development.

• Operational environment - Competitors and Market: the presence of many parties in the return flow increases costs of the reverse process. Each party in the reverse chain places a profit margin on products, increasing the RL overall operation cost.

• Organization - Economic/Financial: at last but not least, there is an impact on the RL costs due to barriers mentioned before (lack of shared responsibility in the RSC; parties action; high taxation on recyclable materials).

5 FINAL REMARKS AND CONCLUSIONS

Reverse Logistics, which is driven by environmental, social and legislative issues, is growing in importance and application, as stated in this paper. Thus, the aim of the present study was to identify the most important drivers and barriers that enable or impede RL development in Brazil. For this purpose, a literature review was performed in order to develop a RL environment framework. Then, a field research was conducted in a RLSP located in Southern Brazil.

The most cited drivers for RL during the literature review process were “government/laws” and “economic/financial”. Thesedrivers could be identified during the field study, as well as “suppliers”, “client”, competitors/market”, and “consumer” influences.

It might be interesting to mention that most of the barriers found in this study are related to the lack of involvement between the stakeholders. The recently approved Brazilian Policy for Solid Residues (*PolíticaNacional dos ResíduosSólidos* - PNRS) foresees the shared responsibility for the RSC members, although this is not yet in practice for most industries in Brazil. Moreover, the lack of consumer awareness hinders any product return initiative, considering that consumers are the starting point of a RSC.

Future workmay extend this research considering multiple case-based research of RLSP’s, using triangulation of cases during data analysis for better generalization of results. Another possible future line of research is to analyze whether the drivers studied can be extrapolated to other countries. Knowledge of the driving forces in their RL environment may help industries to better implement and manage reverse flows and to bridge the gap between existing and future green solutions for reverse logistics.

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