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# **REVERSE LOGISTICS: SYSTEMATIC LITERATURE REVIEW VS COMPANIES' PERSPECTIVE**

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**Abstract:** The Reverse Logistic is actual and very attractive field of research due to potentials of value recovery from the used products, legislations and directives about environmental and consumer laws and social responsibilities (Varadinov, 2013; Pokharel and Mutha, 2009). This is a research area that has received special attention by academic community (researchers, students and teachers) along the years spotlighting the importance of use different strategies to manage the reverse flows of products and their environmental impact.

The aim of this paper is, on first stage, to describe and analyze the research articles on Reverse Logistic, published during the last decade and, on second stage, to analyze and characterize the Portuguese companies' perspective, based on three aspects: the concept, the returns and the environmental impact of Reverse Logistic strategies.

A total of 89 papers published between January 2004 and April 2014 are selected and reviewed from Elsevier database. The papers are then analyzed on different issues: the methodology, the origin of the papers and others relevant aspects of the research. Furthermore, and based on the previous literature review, this paper presents and describes the methodology used to study the perspectives of different Portuguese companies – case study using semi-structured interviews.

**Key-words:** Reverse Logistics; Literature Review; Study Evolution and Case-Study Methodology.

## 1. Introduction

The concept of Reverse Logistic has evolved over the years, passing through varying stages until becoming consolidated (Rubio, Chamorro and Miranda, 2008 apud Brito and Dekker, 2005 and Fernandez, 2005).

Many authors have been suggested many definitions for this concept and the proposal of the European Working Group on Reverse Logistics, REVLOG appears to be the most complete definition. This research group defines Reverse Logistic as “the process of planning, implementing and controlling backward flows of raw materials, in process inventory, packaging and finished goods, from a manufacturing, distribution or use point, to a point of recovery or point of proper disposal always with the purpose of capturing value” (Rubio, Chamorro and Miranda, 2008).

Reverse Logistic refers to the distribution activities involved in product returns, source reduction/conservation, recycling, substitution, reuse, disposal, refurbishment, repair and remanufacturing. As today's consumers are more and more concerned with the environmental impacts of products and services they buy, enterprises have been more and more concerned with "green operations" because the rapid increase of the industrial activities and uncontrolled consumption of natural resources cause environmental problems (Alfonso-Lizarazo, et al. 2013, Akdoğan and Coşkun, 2012).

Rubio, Chamorro and Miranda (2008), Lambert, Riopel and Abdul-Kader (2011) and Reddy (2011) are some examples of relevant publications on Reverse Logistics with emphasis to determine the areas of research on reverse logistics: concept, product returns and environmental impact.

The aim of this paper is, on first stage, to analyze the evolution of this topic, what, how, where and whom it has been carried out are the questions we want to find answers. The answers will help us to understand which step the Reverse Logistic is and to support who begin the development of this topic. It's noteworthy that literature review was very large and for that reason it must be appropriately delimited (define some rules) our sample, so this don't prevent us achieving the objectives we have set ourselves. About this rules, we are only interested in those papers that can be essential in the Reverse Logistic field and we have select too those papers published in the scientific journals.

Based on the above studies, the second goal of this paper, is to understand the concept of Reverse Logistics and its role in the manufacturing industry, focuses on learning different aspects of the reverse logistics and how these aspects affect the decisions made by manufacturing firms.

## 2. Literature Review

Effective reverse logistics focuses on the backward flow of materials from customer to supplier (or alternate disposition) with the goals of maximizing value from the returned item and/or assuring its proper disposal (Rogers and Tibben-Lembke, 1999; Stock, 1998 apud Autry, 2005).

This may include product returns, source reduction, recycling, materials substitution, reuse of materials, waste disposal, refurbishing, repair and remanufacturing (Stock, 1998 apud Autry, 2005).

Reverse logistics processes—and reverse logistics research—has traditionally emphasized green logistics, i.e., the use of environmentally conscious logistics strategies (Carter and Ellram, 1998; Green, Morton, and New, 1998; Murray, 2000; Stock, 1998; van Hoek, 1999 apud Autry, 2005). While environmental aspects of reverse logistics are critically important, many firms are also recognizing the economic impact of reverse logistics (Klausner and Hendrickson, 2000; Ritchie, Burnes, Whittle and Hey, 2000).

Effective reverse logistics is believed to result in improved firm outcomes. Firms that effectively manage the reverse flow of goods benefit through decreased resource investment levels and cost reductions, i.e., storage and distribution (Andel, 1997; Giuntini and Andel, 1995a).

Once a product enters the reverse logistics flow, the logistics manager has to decide where the product has to be sent: either return to vendor, to the landfill, or to the secondary market.

There are several reasons why a product enters the reverse logistics flow. Customers return the products for several reasons, for example products once bought may be returned due to physical damage, some of them are returned because the customers are unhappy with the functionality of the product (expectations not met), sometimes customers return products because they discover an alternative product with better functionality after they have made the purchase and others reasons Reddy (2011).

Rogers and Tibben-Lembke (1998) apud Reddy (2011) mention seven channels for disposing the products that have been returned to the manufacturer. They are the return to vendor, sell as new, sell via outlet or discount, sell to secondary market, donate to charity, remanufacture/refurbish and materials reclamation/recycling/landfill.

Based on the condition of the returned product, contractual obligations with the vendor, and the demand for the product, the manufacturer has one or more of the above options to dispose the returned product

The author Autry (2005) emphasizes a quick and efficient handling of returned product can also be critical in sustaining relationships and creating repeat purchases. For this reason, firms are more willing than ever to accept returns from customers. Reverse logistics allows companies an opportunity to differentiate themselves, builds consumer confidence in the company brand, and positively influences customer satisfaction (Blumberg, 1999 apud Autry, 2005).

As a result, liberal return policies have become a standard marketing practice and a major component of the corporate image for many firms in both business-to-business and business-to-consumer markets. The complexity of managing damaged or defective merchandise, product recalls, maintenance and repairs, and recycling should make reverse logistics programs a high priority (Autry, 2005).

Concerning the environment impact, in recent years, the interest has increased for a number of reasons. Firstly, as a result of the important negative environmental impacts that company products and processes are producing (Azzone and Noci, 1998 apud González-Torre and Belarmino Adenso-Díaz, 2006). Secondly, due to the pressure that society is exerting on its institutions to address environmental issues (Murphy and Poist, 2003 apud González-Torre and Belarmino Adenso-Díaz, 2006), which translates as new legal demands (for example, European Union laws require manufacturers to collect and reuse many types of products). Thirdly, managers appreciate the benefits to their company image of adopting environmentally concerned programs (van Hoek, 1999 apud

c). Lastly, consumers have changed their preferences, which are transferred the entire value chain (Lampe and Gazda, 1995 apud González-Torre and Belarmino Adenso-Díaz), modifying the responsibilities of suppliers and manufacturers with regards to the products they place on the market (Bloemhof-Ruwaard et al., 1995 apud González-Torre and Belarmino Adenso-Díaz).

As a result of the aforementioned pressure, environmental practices have been adopted by companies that consist of both increased investment in clean technologies as well as the redesigning of processes and organization (González-Torre and Belarmino Adenso-Díaz, 2006).

Given that an impact on the environment is produced in all the phases of the life cycle of products (elaboration, transport, use or destruction), the integration of environmental questions consequently influences the choice of process technologies, the management of the supply chain or the development of new products (Angell and Klassen, 1999 apud González-Torre and Belarmino Adenso-Díaz, 2006). Accordingly, total quality environmental management, life cycle analysis, green supply chain management and ISO 14000 standards are becoming more and more widespread practices (González-Torre and Belarmino Adenso-Díaz, 2006).

The aim of environmental strategic viewpoint is to revalue products once they have been thrown away by the end consumer, thus closing/extending their life cycle. Diverse alternatives exist to do so: reutilization, repair, renovation, reprocessing, cannibalization or recycling (Thierry, Salomon, van Nunen, and Van Wassenhove, 1995 apud González-Torre and Belarmino Adenso-Díaz, 2006). To put any of these alternatives into practice, companies need to define in collaboration with their customers the changes in their relationship with the goal of returning products at the end of their life span (Azzzone and Noci, 1998 apud González-Torre and Belarmino Adenso-Díaz, 2006).

After this analysis of the different strategies adopted in the product returns and environmental impact, it is important to understand the connection between the literature and the real life, and understand if the companies follow some of these strategies. With this objective it was adopted the case-study's methodology using a semi-structured interview. The interview is one of the most important sources of information and essential in the case studies (Yin, 2005 apud Meirinhos and Osorio, 2010). Also, Fontana and Frey (1994) apud Meirinhos and Osorio (2010) focus the interview as one of the most powerful way to understand the others perspectives and it's a powerful tool to capture the diversity of descriptions and interpretations about what the people know on the field (Meirinhos and Osorio, 2010).

The previous literature review gave us the support to understand and analyze the strategies applied in each area: Products returns and Environment.

### 3. Methodology

#### 3.1 Characterization of the Research on Reverse Logistics (2004-2014)

The sources of information began by the selection which database we wanted to work. All the members chose database Elsevier Science because we believe in their quality. Our idea was to analyse the Reverse Logistic evolution during a specified period. Therefore, we used the follow term for the research: Reverse Logistic, in the title, abstract or keywords of the papers during the period of analysis. Other terms could be used to perform this research but it was decided to focus the object of this research, we want to investigate which is related and focused with this specific term. We excluded reference work and books, in that way we selected only journals. In our understanding, all the qualities papers are published in journals.

In the next step, the period 2004 – 2014 was selected and a total 93 papers were obtained. After each article to be analyzed we removed 4 of them (Letter to the editor, Erratum, Corrigendum and Forward) because they didn't add any value for the study. So, our database were completed with 89 articles and from each paper the following topics were analyzed: Year of publication; Type of journal; Origin; The number of authors; The methodology; Areas of research and the Local of the research.

The research team considered two fundamental areas of research on Reverse Logistic: Supply Chain Management or Environmental issues. Each member classified each paper in one of this areas and all the decisions were taken mutually by the research team. All the articles were examined by the title, abstract, keywords and main body of the paper and none software was used to support these decisions, only EXCEL was used to organize the data. It is important to emphasize that, not all articles on reverse logistics published during the period of analysis have been published in impact factor journals. There are other prestigious scientific publications, not included in Elsevier Science database, however in future work it should be considered the access to others databases and others terms of research.

#### 3.2 Companies' Perspective

The bibliographic research, made earlier, given to us a connection between the literature and all the elements that must be taken in field research (Real Oliveira and Ferreira, 2014).

After getting somewhat of a fair idea about Reverse Logistics, a preliminary set of questions were formulated for the case study. Most of the questions were either taken directly or inspired by the methodology developed by Reddy (2011), for its master thesis work "A study on Reverse Logistics."

The methodology adopted was the case study, as proposed by Yin (1994) apud Silva et al (2013). This case study will be applied in different business sector (for example: transportation, automotive, retail, textile and others) and dimensions (multinational and small and medium) Portuguese enterprises and it pretend to analyze and characterize these companies' perspectives, based on three aspects: the concept, the returns and the environment.

"Case study" means a close analysis of the practice, together with the circumstances and its characteristics leading to an understanding of the situation within its own context (Stake, 1995 apud Brito, 2004). Yin (2003) apud Subramoniam et al (2009) proposed an exploratory case study aimed at defining the questions and hypotheses of a subsequent study or defining the feasibility of the detailed research procedure.

This methodology was chosen because the case study is used to assess the strategic factors from the literature review and to clarify the questions that require further research (Subramoniam et al, 2009).

These exploratory case studies started in the systematic literature review and then, we delineated all the important questions that we want to get answers from the different business sectors companies. For example: What do they know about reverse logistics? What do they do with returned products? How do the returns affect the decisions made in manufacturing firms? How do environmental issues affect the reverse logistics decisions?

The population of this study consists of supply chains managers in Portuguese companies of different business sectors and dimensions. Twenty seven Portuguese companies of different business sectors were selected and a formal email to explain the project and to request their collaboration were sent.

So now, the way forward by the research team is calling for each company to boost the importance of their collaboration. We pretend to collect interviews from eight different sectors: transportation, automotive, textile, retail, aluminum, cutlery, food and drinks companies. This information will allow us to understand if different companies use different strategies on each business sector.

The case study will be conducted through semi-structured interviews with open-ended questions. This type of interview doesn't follow any previously established order about the questions designed and allow more flexibility because it is possible to put the questions in the appropriate time according to the interviewee's answers (Meirinhos and Osorio, 2010).

The interviews will be record, on audio format, and always with the agreement of the interviewees. It's very important to respect their space and if they want to remain anonymous or confidentiality of their information.

#### **4. Results of Systematic Literature Review**

The analyzed database has 89 articles in 33 journals. The Figure 1 shows



the relation between the journals and the number of publication each journal. the ten most important journals were select and the first of the top with eleven publications is the *International Journal of Production Economics* (I.J.P.E: this journal has very recent publications in the last four years and the almost of them are from USA and China); after, with seven publication are *Computers and Industrial Engineering*(C.I.E) and *Journal of Cleaner Production* (J.C.P); with six publications are *Resources, Conservation and Recycling* (R.C.R) and *Transportation Research Part E* (T.R.P.L.T.R); with five publications is *Computers and Operations Research* (C.O.R), *Expert Systems with Applications* (E.S.A) and *European Journal of Operational Research* (E.J.O.R) and finally with four publications are *Applied Mathematical Modelling* (A.M.M), *Industrial Marketing Management* (I.M.M) and *Procedia Social and Behavioral Sciences* (P.S.B.S).

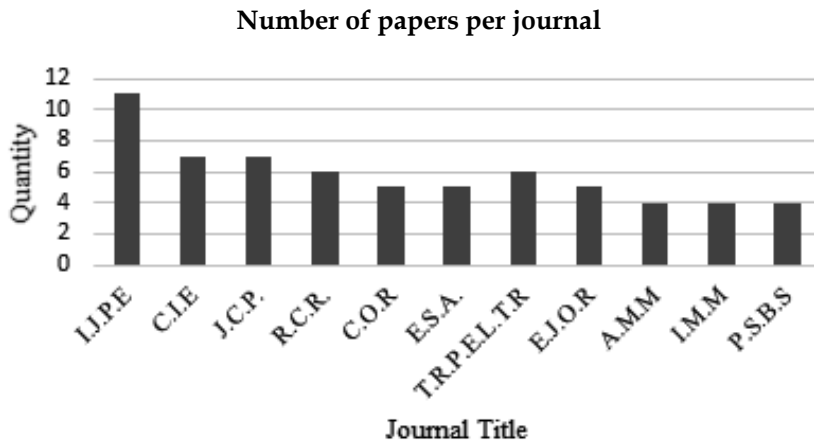


Figure 1. Number of papers per Journal.

It is observed that Reverse Logistic, as a research area, is very directed for environmental issues (recycling industry/products, environmental laws, waste management, sustainability, end-of-life products and others) and the supply chain management (return products, cash flows, supply planning, production planning, remanufacturing and others). Over the years it could be observed an increase of the papers published in the journals, more precisely since 2010 until 2013.

This peak is due to the fact the companies need to be more competitive minimizing costs, improving their image in the consumer and export market, more the legal, social pressure to recycle materials, green directives and liberal return policies is constantly increasing (González-Torre and Adenso-Díaz, 2006; Trappey and Ru Wu, 2010 and Baenas et. al, 2011). It's important to note that the year 2014 was not yet finished when this study was made, however in 4 months it has already 7 papers so, perhaps that could be a good way for to reach another peak (Figure 2).

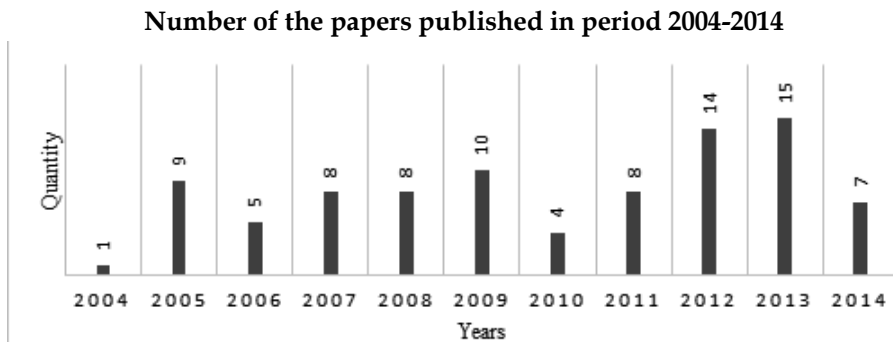


Figure 2. The number of the papers published in period 2004-2014.

Analyzing the articles by areas of research, we can clearly say that the topic “Supply Chain Management” issues have attracted more attention than “Environmental” issues over the years. However, it is notable the increase evolution that the topic “Environmental” issues in recent years. In 2013, the almost works published fall within this research topic and it’s normal to increase the number of publications in the next years, because the business world is increasingly more and more competitive and the environmental concerns are increasingly taken into attention by everyone (Figure 3).

The analysis works employ different methodologies (Figure 4.) that are quantitative (basically using mathematical models) or qualitative (case study, literature review or theoretical). Only 6% of the papers use two different research methodologies, with Mathematical Model and after applies in the case study. Mathematical model is the methodology more used (61%) by the researcher.

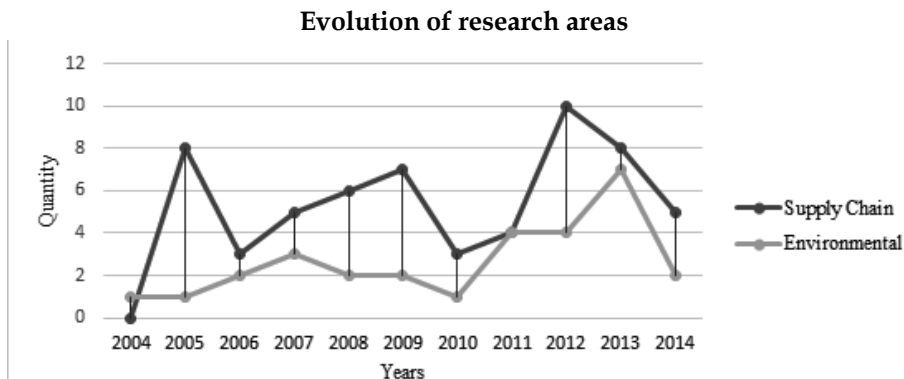


Figure 3. Evolution of research areas.

It can be observed that mathematical programming, and more specifically linear programming is used to solve problems like allocation and localization,

and simulation is used when the problem needs to analyze various scenarios to resolve the problem. 14% of the studies use only the case study methodology.



Figure 4. Research methodology.

The next results show the origin of the papers, the number of the authors per article and research localization. As far as the number of authors (Figure 5.) of each article is concerned, it was observed that collaboration between researchers is clearly, since 92% of the works have two or more authors and the almost of them the works have authors of different origins: more specifically 34% of the papers are signed by two, 38% by three, 17% by four and 3% by five or more.

However, 8% of the papers are signed by only one author (Autry 2005, Sheu 2007, Srivastava 2008, Sheu 2008, Genchev 2009, Chan 2011, Ramírez 2012) and we observe that some authors try to keep current and they publish some papers over the following years (Pilar L. González-Torre published in 2004 and 2006; Juih-Bing Sheu published in 2005, 2007 and 2008 and others authors).

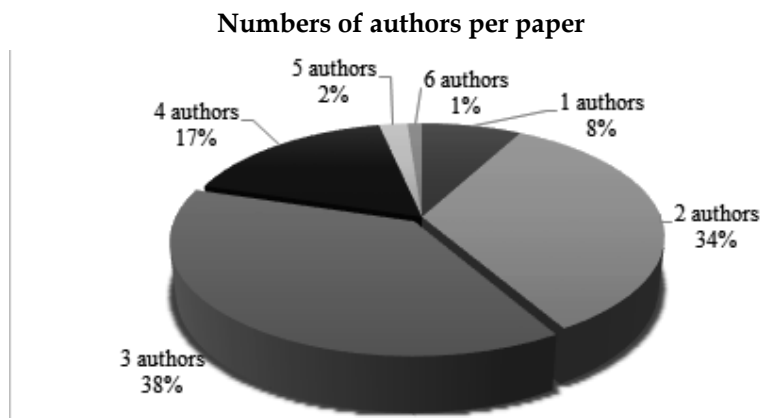


Figure 5. Numbers of authors per paper

Regarding the origin of the publications analyzed (Figure 6), these are mostly concentrated in three countries: USA (18 publications), India (12 publications) and China (10 publications). USA is a developed country and it's always seeking to increase their competitiveness in the market, their image, and quality and to find different ways to minimize their cost, pollution and others factors.

The others countries, India and China are a developing countries and they show an interest in the several areas like recycling, sustainability, minimize cost, end-of-life products and others topics.

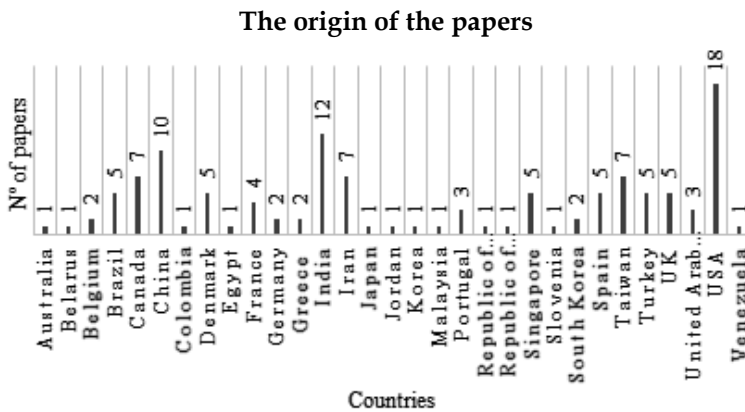


Figure 6. The origin of the papers

Analyzing the local of research (Figure 7) we can say that research on reverse logistics is concentrated in Universities with 70%, 21% in partnerships between Universities and Centers, 8% only centers and 1% in partnerships between company and university.

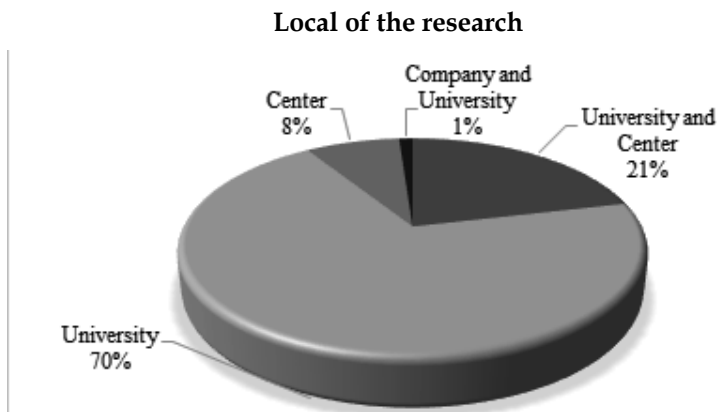


Figure 7. Local of the research

## 5. Conclusion

Throughout the first stage of the work, the development of research on reverse logistics over the recent years was analyzed, by examining the scientific articles appearing in the international journals. Our principal goal was to analyze the evolution of the papers on Reverse Logistic published in 2004 until the present time, describe the current situation of the research and provide the support for those who begin the development of this topic.

In accordance with our findings, we can point out the following conclusions: although, there were some earlier works focusing on the Reverse Logistic, this research is recent and over the next years everything points to an incredibly interest by the researchers. This increasingly interested in the field, as demonstrated the last four years the progressive growth in the number of the papers (the peak was reached in 2013).

Concerning the research areas, the topic "Supply Chain Management" has received more attention; however it was observed an increase on the topic "Environmental" issues in recent years. This issue has more and more interest by companies and it has been a concern for the whole community.

The analysis of the research on reverse logistics should now be directed at analyzing others research topics, to consider other important papers and directed at analyzing strategic aspects and developing organizational theories, allowing us to establish an appropriate framework of reference within which the tactical and operational aspects can be developed efficiently as mentioned on Rubio, Chamorro and Miranda work (2008).

Regarding the second stage of this paper, it is presented the methodology selected to explore the perspective of different companies about the concept of reverse logistic, the strategies adopted by that companies and the value aided by this strategies. It is also pretends to analyze their reality and how the multinationals and small and medium enterprises manage their product returns and the environmental issues. This is a working paper and at this moment we have already four companies that have accepted collaborate on this study and some of the interviews are pointed out.

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