Transformare Conference ISC Paris March 2014

POST-CONSUMER REVERSE LOGISTIC: the case of Association of Collectors of Paper, Cardboard and Recyclable Material[1] (Asmare), from Belo Horizonte, Brazil

Edenilson Luiz Gomes[2] - edenilsonl@yahoo.com.br
Aleixina Maria Lopes Andalécio[3] - aleixina.andalecio@unihorizontes.br

ABSTRACT

To investigate the role of Association of Collectors of Paper, Cardboard and Recyclable Material (Asmare), from Belo Horizonte, Brazil, in the reverse logistics of post-consumer, we conducted a case study of a qualitative nature on this association. The set of research subjects was composed of an administrative manager, two production coordinators and two production assistants. The data obtained by interviews and observation show that Asmare practices activities of reverse logistics through the collection of various types of waste in the streets of the city. It still reuses some of these residues and recycles part of them. We concluded that the process of post-consumption reverse logistics performed by Asmare contributes to the cleanliness of the city, to the social inclusion of the gatherers and to the protection of the environment by means of reusing and recycling waste, and by offering the secondary raw material for processing firms.

Key Words: Reverse Logistics of Post-Consumer. Environment. Recycling. Sustainability.

1 INTRODUCTION

Over the last decades, Earth's natural resources have shown signs of scarcity, because the industries are greatly increasing the exploitation of virgin materials in the environment, in order to continue to produce on a large scale and attend the desires and needs of an increasing number of consumers (Donato, 2008).

Given this scenario, different organizations are directing their attention to an alternative way to insure the raw material necessary for their production by reusing the waste discarded in the environment, associated with post-consumer reverse logistics procedures. Such actions may contribute to the availability of secondary raw material for organizations, by means of garbage recycling and reuse of materials in good condition (Leite, 2003).

In such a picture, an organization that collects and forwards reusable trash for recycling, enabling their return to the productive chain as secondary raw materials, assumes a

[1] In Portuguese: *Associação dos Catadores de Papel, Papelão e Material Reaproveitável*.
[2] Master of Business Administration from Faculdade Novos Horizontes (Rua Alvarenga Peixoto, 1270, Belo Horizonte, MG, Brazil, CEP 30180-121).
[3] Doctor of Information Science. Researcher Professor of the Master's Degree in Business Administration of Faculdade Novos Horizontes.

prominent role in the post-consumer reverse logistics process. This is the case of Asmare, in Belo Horizonte, Minas Gerais, Brazil, which collects monthly on the streets and avenues of the center of the State capital, about 450 tons of garbage, which is separated according to its characteristics, from which a part is recycled by the group itself and the rest is sent to other recycling industries (Asmare, 2011).

The research reported here sought to investigate the role of Asmare in post-consumer reverse logistics process. This study is justified because it aims at contributing to the construction of knowledge about post-consumer reverse logistics and the ability to collaborate so that companies envisage this process as an opportunity to increase profitability and reduce operational costs. From a social viewpoint, the study will contribute to make society aware that it is possible to improve the quality of life for the preservation of the environment, when applying the reverse post-consumer logistics process. In economic perspective, the study shows that the reverse logistics process stimulates other market sectors, in addition to industry, generating more jobs and income, and that it is possible to reduce the amount of garbage discarded in the environment and to reduce the environmental degradation.

2 THE PROCESS OF REVERSE LOGISTICS

The process of reverse logistics appears as an effective alternative for solving the arising of the complex relationship between development, consumption and environmental protection problems. At this conjuncture, which includes macro and micro analytical visions of the environmental problems as well as its perception as a strategic factor of organizational management, reverse logistics definitions differ a lot.

The term *supply chain* means finished products or supplies that flow along the chain, in the following order: suppliers, manufacturers, distributors, retailers and customers (Chopra & Meindl, 2003). The term *reverse supply chain* means the reverse channel of post-consumer goods, which participants are inserted in the following order: consumers, collectors of post-consumer goods (trash), scrap yards, recycling plants, manufacturing industries, and the products commercialization (Leite, 2003).

Leite (2003) defines reverse logistics as a set of procedures that allow post-consumer goods returning to the supply chain, which begin with the collection of the waste that would be rejected in the environment, include its recycling, and go up to their reuse in industries as secondary raw material. Important part of this process is the sorting of the material to be recycled, an activity that, according to Ferrer and Whybark (2000), requires skill in handling waste, agility and attention to the separation criteria. Separation of the waste can be

performed during the collection or at a future time; can be made at the place of collection or on the premises of the remanufacturer (Ferrer & Whybark, 2000). The initial separation makes unnecessary to do it later, streamlining the processing of waste (Leite, 2003).

According to Pereira, Boechat and Tadeu (2011), reverse logistics is seen as one of the logistics business processes and brings a set of linked activities and actions, from the decrease of primary raw materials to the proper disposal of post-consumer goods, materials and packages, in a continuous process of reuse and recycling.

To Stock (1998), the reverse logistics process, seen as a business, can contribute with the return of post-consumer goods for recycling plants, the decreasing use of primary raw materials, the use of recycled raw material, the reuse of products, the correct packaging of waste, and the repair and the remanufacturing of products.

Miguez (2010) states that reverse logistics has a direct impact on improving the environment conditions because it reduces the amount of hazardous materials dumped in landfills and dumping sites and even in open streams. Another effect of reverse logistics on the environment is the collection and reuse of products, leading to less use of virgin material, saving energy and mineral resources.

Lambert, Stock and Ellram (1998) reinforce the idea that the concept of reverse logistics is involved in the decrease of virgin materials and of the use of energy consumed during the production cycle. Reverse logistics also provides conditions for the implementation of recycling, reuse of packages and products, and the appropriate accommodation of post-consumer waste.

An important topic in post-consumer reverse logistics concerns with technological waste. Gomes and Ribeiro (2004) assert that a broken or outdated electronic device may go through the procedure of removing its parts which can be reused in other devices. Noble residues, for example, copper and aluminum, may be sold to recycling plants.

To Mollenkopf and Closs (2005), organizations need to understand the importance of reverse logistics in their operating procedures and should direct their attention to this area in order to understand the economic impacts resulting from the strategic process of reverse logistics.

Therefore, the process of post-consumer reverse logistics can be viewed both as a business and as a solution to environmental problems arising from the exploration of primary raw materials, the generation of energy used in the production process and the disposal of post-consumer waste in the environment. One indication of this finding is the actions to regulate and ensure progress of the services of collection and disposal of solid waste in Brazil.

One such action is the approval of the National Solid Waste (PNRS[4]), which seems to make it clear that the reverse logistics represents new business opportunities for companies, to the most diverse segments of society and a clear path to environmental sustainability.

3 SOLID WASTE POLICY IN BRAZIL

The Brazilian National Solid Waste (PNRS) was defined by Law nº 12.305 of August 2, 2010 (Brazil, 2010b) and is in force since December, 2010. It establishes standards for solid waste management in Brazil. For Bartholomeu, Branco and Caixeta-Filho (2011), this policy

> meets a set of principles, objectives, instruments, guidelines, goals and actions aiming at integrated management and environmentally proper management of solid waste. In the administration and management of solid waste, it must be observed the following order of priority: no generation, reduction, reuse, recycling, treatment of solid waste and environmentally appropriate final destination of residues (Bartholomeu, Branco & Caixeta-Filho, 2011, p. 23).

The PNRS gives the general guidelines to govern the management of approximately 150 thousand tons of trash and waste generated daily in Brazilian municipalities and represents an attempt to modify the habits of the people, businesses and the public sector in relation to waste, to the recycling processes and to the reuse of post-consumer waste (Brazil, 2010b). The PNRS represented a breakthrough because, among other reasons, provides a broad range of actions based on the procedures of reverse logistics and positions waste collectors as key parts of its implementation.

In Chapter II of the law, which deals with Municipal Plans on Integrated Management of Solid Waste, it is defined that the procedure of selective collection of solid waste and post-consumer reverse logistics shall prioritize the effective participation of cooperatives or associations of collectors of recyclable and reusable materials, formed by low-income people (Brazil, 2010b).

In Chapter V, PNRS determines that Municipal Plans on Integrated Management of Solid Waste define actions and programs for the involvement of groups of collectors of recyclable and reusable waste. These groups also should have facilities for financing and lower interest rates from financial institutions (Brazil, 2010b).

Decree nº 7404, which regulates Law nº 12.305, provides the establishment of the Interministerial Committee of the National Solid Waste Policy and the Steering Committee to implement the Reverse Logistics Process (Brazil, 2010a). As per the Decree, post-consumer reverse logistics is the unit of economic and social development marked by actions and methods to enable and facilitate the collection of post-consumer solid waste and its recovery

[4] In Portuguese: *Política Nacional de Resíduos Sólidos.*

for the suitable organizational sector to reuse it in the production cycle, or for its environmentally appropriate final disposal (Brazil, 2010a).

To Miguez (2010), PNRS highlights reverse logistics, ensuring that it has as finality to generate actions to assure that the solid waste flow is redirected to its supply chain. Moreover, reverse logistics can reduce pollution and waste of materials, encourage the use of materials that do not damage the environment, and contribute to the development of sustainability strategies that join economic, social, cultural, environmental, and political interests. Asmare's work has features that allow its fitting within this process.

4 RESEARCH METHODOLOGY

The aim of the study was to analyze Asmare's role in post-consumer reverse logistics process. The choice of this association is justified because it is one of the most prominent associations of waste collectors in Brazil. The research is qualitative in nature, of the descriptive kind, and was performed by means of a case study.

Asmare is an association created as the result of a partnership between the Catholic Church's Street Pastoral Action and waste collectors, and aims to provide work and income for the homeless and their families. It was established on May, 1, 1990, after intense mobilization of waste pickers through public acts, occupation of places of selecting recyclable garbage, and protests directed to the City council of Belo Horizonte (Asmare, 2011). In 1992, the City Hall of Belo Horizonte began the construction of a shed for use by the association. In 1995, Asmare expanded its operations by directing its attention to the social recovery of waste pickers and their social integration (Asmare, 2011).

Nowadays, Asmare has approximately 350 members and over 1,500 indirectly benefited people. Its associates collect different types of post-consumer waste, such as newspapers, magazines, cardboard, paper, aluminum cans, and plastic bottles, among others. The association has a small recycling plant, but most of this waste is sent to other recycling plants. These actions contribute to the return of the waste to the production chain and to the preservation of the environment (Asmare, 2011).

The subjects of this research were a business manager (GA), two production coordinators (CP1 and CP2) and two production assistants (AP1 and AP2) of the association. The administrative manager, hired by Asmare, has a university degree and the other respondents have elementary level of schooling.

The data collection for the survey was carried out in two phases. At first, semi-structured interviews were conducted with members of Asmare in order to know the role of

Asmare in the post-consumption reverse logistics process and how its operations are conducted. The second phase was performed by non-participant observation, which served to confirm and deepen the understanding of the data collected from the reality presented, with respect to the post-consumer reverse logistics process performed.

The analysis of the data collected in interviews used the thematic content analysis (Bardin, 2008), with categories created on the basis of the theoretical research framework.

5 ANALYSIS OF RESULTS

The data collected in the interviews are organized by the categories used, which were formed by the steps of the reverse logistics process conducted by the association (collection, selection, recycling and disposal of recycled waste), difficulties encountered and contribution of the process to the preservation of the environment.

5.1 Collection of post-consumer waste

The collection is the first phase of the reverse logistics process developed by Asmare and consists of procedures for collection of garbage (paper, plastic, cardboard, glass and various metals) from the streets. According to Bartholomeu, Branco and Caixeta-Filho (2011), in waste management, the post-consumer waste collection process is essential to speed the recycling.

To collect this post-consumer waste, the associates use carts of wood and brass, pulled by them, and trucks. According to one of the production assistants:

> We realize the collection of the waste here in Asmare with carts [...] and also there is a collection with truck that brings the waste to the Association. The carts have a scheduled time to leave to seek this material on the street. (AP1)

The use of carts and trucks aims at making transportation adequate to the amount of post-consumer waste to be collected. In this procedure of waste collection, some proper care should be taken, since, for Queiroz, Silva, Braga, Pine and Santos (2007), the moving and handling of post-consumer waste, if not properly implemented, may cause countless damage both for people and for the environment.

5.2 Selection of post-consumer waste

After the collection, comes the process of sorting the waste, which is one of the post-consumer reverse logistics procedures (Leite, 2003). It was observed that this separation occurs in the shed and is performed according to the type of material, such as plastic, paper, PET, aluminum and cardboard. According to AP1, in Asmare the screening process of post-consumer waste starts with the manual selective collection and has continuity in the separation process by the type of waste:

> Collectors that go on the street [...] bring the residue to the selective collection screening shed and selectors (women) separate it by type of waste. (AP1)

With respect to this screening process, AP2 clarifies that the activity of waste separation is very difficult and tiring: the person responsible for screening must be agile in moving and handling of garbage and this task is arduous.

> It's painful. It is not easy to make this [...] separation, because [...] it consumes all day [...] and if the person does not have a good agility in the hands [...] it does not yield much. (AP2)

The interviewee speech coincides with the opinion of Ferrer and Whybark (2000), who state that the screening activity requires skill in handling the waste. Besides agility, they need to pay attention to the separation criteria, as described by AP1:

> The separation is made by white paper, which is A4 sheets, separately. And the other separation is the mixed, which are magazines, crepe paper, colored paper leftover in general [...] the newspaper that everyone already knows [...] the separation of colorless and colored plastic. And also there are bottles [...] PAD, which are the bottles of mineral water and cleaning material in general [...] and PET bottles. (AP2)

After screened by features and compressed into bales of about two hundred kilograms, the waste is stored for a short time in the Asmare own patio. Subsequently, these bales are sent to recycling plants or for commercialization. In this screening step, materials still capable of being reused (as is the case of electronics and computers) are also separated.

5.3 Recycling of post-consumer waste

After the screening stage, the post-consumer waste go through the recycling process, which varies according to the type of materials (glass, plastic, metal and paper), as described by AP1 and AP2:

> The residue comes in Recycling and is separated according to the type type. The paper goes to the factory [...] there they melt into a giant blender [...] make something like a pellicle [...] mixed with cellulose and remake the paper, then it turns to recycled material that may already be used in industry to make another type of product. (AP1)

> The material, mostly plastics [...] are sent to the factory [...] are cleaned, washed and crushed to be forwarded to the industry to create new objects to [...] dryer, bowls, buckets. Plastics are also sent to the factory to become bags, hoses etc. (AP2)

The reports above show that residues are separated by type and pass through the operating procedures for processing them into secondary raw material, after which they are ready to be sent to the market and used in the manufacture of new products.

Information given by production assistants demonstrate that Asmare effectively participates in the reverse supply chain, since, according to Leite (2003), this term designates the reverse channel of post-consumer goods, including consumer, post-consumer goods (trash) collectors, scrap yards, recycling plants, manufacturing industries, and trade of products.

5.4 Disposal of post-consumer waste

In Asmare's shed, it was observed that the members look for taking the maximum advantage of the post-consumer goods. In the screening step, the residues that are intended to be recycled and everything still able to be reused, as is the case of electronics and computers, are separated. According to the CP1 and AP1, the post-consumer waste is also used for the following purposes:

> We also collect woods. We have a carpentry shop, which makes carts, furniture, chair [...] is to be resold. There is where the containers for events are made, to also sell, the container for selective collection. And back to the market, to reuse again. (CP1)
>
> In the case of barrels, you can send them any way that we reuse. (AP1)

It was observed, in the association's shed, that materials such as tires, PET, barrels and electronic parts are reused for other purposes, such as coffee table, toys and selective collection container, as well as replacement parts for the secondary market, confirming the speeches of CP1 and AP1.

Only waste that does not have conditions to be reused or recycled are, according to CP2, sent to landfills.

Asmare collects and gives the correct destination to electronic waste. The equipment still in use conditions are used by Asmare itself. Those which do not have these conditions pass through the dismantling process, which consists of full disassembly. About computers, printers, monitors and televisions collected by Asmare, AP1 clarifies:

> In the case of computers components [...] they bring it here and we dismantle them [...] give the correct destination for the parts that can be sold; and others we give disposal. Printers, TVs, monitors and others things arrive, and we dismantle. We have the specific location for dismantling these things. We get these parts that can be sold and the rest [...] we give the correct destination. (AP1)

The process through which the electronics pass matches the reporting by Gomes and Ribeiro (2004), with the removal of parts that can still be reused for secondary marketing and the proper disposal of other kinds of waste.

5.3 Difficulties in Asmare's work

Asmare's work finds some difficulties. In the perception of its production assistants, the lack of a waste separation routine in homes and businesses affects the residue screening activity in Asmare:

> The quality of the material, you can't imagine [...] there is a lot of leftover food, coffee grounds, food leftovers [...] standing up from eight in the morning until five in the afternoon [...] to separate this material is not easy. (AP2)

This speech shows that the post-consumer waste comes very mixed, i.e., in the same container one can find recyclable waste, organic material and refuse. Thus, the separation of this material is very time-consuming and very tiring. If the material was separated from the

collection, as described by Ferrer and Whybark (2000), it would become unnecessary to do it later, streamlining the processing of waste, as presented by Leite (2003). If people were aware of the importance of separating waste, this would facilitate the work of Asmare's production assistants when processing the waste and increase the return of the residue to the productive chain.

However, the awareness process is slow. Even the City Hall of Belo Horizonte, which performs selective collection of waste, delivers this material to Asmare still mixed:

> The residue comes very mixed, broken glass comes in the middle [...] the selective collection that even the City Hall makes [...] it is very mixed. (AP1)

This procedure goes against the basic principle of selective collection of solid waste, which, as Bartholomeu, Branco and Caixeta-Filho (2011) show, implies the residue is screened in advance, facilitating its handling, separation and selling by recycling associations.

Thus, it is necessary to invest in community awareness regarding the separation of the post-consumer waste. This is perceived by AP1, for whom

> The population could help separating the material, not putting wet things in the middle of the paper. Even if you don't have large amount of material, if a collector passes on the street, come, separate and donate to that specific person, which is running on the street, not specifically a person of Asmare, but rather the entire category. (AP1) (AP1)

According to Asmare's Administrative Manager, the solution is to invest in educational campaigns, and in the efficiency of selective collection held by the City Hall, in joint actions, since according to him,

> No use in educating if there is no plan of gathering and disposing of this material. (GA)

Regarding the consumer participation in waste separation, Miguez (2010) indicates that the PNRS provides that consumers must perform the appropriate separation of their garbage, dropping it in containers for selective collection. They also need to correctly pack the waste for its gathering, implemented by city officials, through appropriate vehicles.

Another difficulty present in the work of Asmare's members, observed by non-participant observation, and not reported by them, refers to the conditions of health and hygiene of the place where the sorting of waste is made. It was observed that there is a lot of cockroaches, mosquitoes and, to a lesser extent, rats at this place. This happens due to the nature of the work of Asmare, which makes its workplace a very dirty one.

There is also a high risk of fire due to the accumulation of paper, cardboard, plastic and wood. These types of wastes are easily combustible and quickly spread the fire. To reduce the chances of this happening, it is necessary to periodically perform reviews in electrical installations in Asmare's shed and advise its members to take care when handling stoves such as those used to heat pans and prepare coffee.

5.7 The contribution of Asmare for the preservation of the environment

In interviewees' perception, one of the main contributions of Asmare is the conservation of the environment, as can be seen in the statements below:

> My job [...] has a strong appeal to conserve the environment. I know my importance in what I do before the environment [...] is a little bit but it helps [...] because there ahead of us we will see the people's children harvest that little bit we helped in recycling. (AP2)

> We have this environmental vision, we know that fifty kilogram of recycled paper replaces the cut of a tree, we know that glass is cheap [...] In the future, we win a lot for our environment, there those coming from our generation, my grandchildren, my great-grandchildren and my children will enjoy this healthy environment. Our environment is sick and needs an injection. (CP1)

We note that respondents are aware of the importance of Asmare's role of in what concerns environmental protection, which will enable future generations to enjoy better environmental conditions than those that exist today

Although Asmare has been created with the purpose of providing work and income for the homeless and their families, the collection of post-consumer waste and the application of the procedures of post-consumer reverse logistics in their operating procedures make it stand out with regard to environmental protection. Both the associates and the administrative manager are aware of it. The manager states that

> Asmare found in recycling one of the solutions to reduce the destruction of natural resources, and reusing materials that degrade the environment. The role of recycling is still much broader because, in addition to contributing to environmental preservation, is an income-generating business, integrating people into the labor market, providing a balance between the environment and human survival needs. (GA)

From the interviewees' reports, it is possible to realize the importance given by Asmare's members to their work regarding the maintenance of the environment. This awareness of the associates finds support in the literature on reverse logistics. According to Miguez (2010), the reverse logistics process contributes to the improvement of the environment because it reduces the volume of waste disposed of in landfills, garbage dumps and watercourses, and results in economy of mineral and energy resources.

As stated earlier, PNRS, which is in force since December 2010, represents new business opportunities for companies and for different segments of society. Regarding the probable opportunities that Asmare can achieve with the implementation of this policy, GA reported that in addition to preserving the environment, PNRS will also contribute to the promotion and social inclusion of Asmare's members.

> The so expected PNRS is an important opportunity not only to Asmare, but for all pickers, as is premised, in addition to environmental issues, promotion and social inclusion, and the incentive to grant the collector a job category as services provider. (GA)

That speech meets what Miguez (2010) exposes when he shows that PNRS will help to reduce pollution and waste materials, to encourage the use of materials that do not

jeopardize the environment preservation, and the development of sustainability strategies that bind the economic, social, cultural, environmental and political interests.

6 CONCLUSIONS

The research described here was performed in order to check Asmare's role in the post-consumer reverse logistics process. To accomplish it, a qualitative case study was conducted through interviews and non-participant observation.

Using reverse logistics references and the methodological framework adopted, it was possible to gather data that would allow us to state that the work done by Asmare is as much about the social inclusion of its members as to environmental protection. With regard to the difficulties experienced and perceived by the respondents, the lacking habit of a pre-separation of garbage in homes and businesses is what most undermines the work of the members, especially the screening of materials. One way to solve the problem, as perceived by the members themselves, would be to invest in educational campaigns about the need to make a prior separation.

Although the work of members means to themselves an alternative income and the belonging to an internationally prominent association confers dignity to such an arduous and undervalued work, the unsanitary conditions they face are undeniable. In the shed where the work is done, there is a large amount of post-consumer waste, including some types that may compromise the health and physical integrity of the associates. For instance, there can be found pieces of broken glass, rusted metal, toilet paper, disposable diapers and even used syringes. However, these conditions do not seem to be perceived by them as a problem.

Given the foregoing, it can be concluded that the process of post-consumption reverse logistics practiced by the Asmare, besides the inclusion of its members, has an important role in protecting the environment, because the Association collects, separates, reuses and recycles much of the waste removed from the streets of Belo Horizonte. The management of post-consumer solid waste carried out by Asmare represents an environmental, social and economic gain for all involved in the reverse supply chain.

For future studies, we propose a research on the changes that Asmare will suffer with the mandatory adoption of the process of post-consumer reverse logistics and the shared responsibility determined by PNRS. It is also suggested to conduct studies on the implementation and results the reverse logistics process provides to the productive cycle of companies in the processing industry.

7 REFERENCES

Associação dos Catadores de Papel, Papelão e Material Reaproveitável. Corporate website. Available in: http://www.asmare.org.br [Accessed 25 July 2011].

Bardin, L. (2008). *Análise de conteúdo.* Lisboa: Edições 70.

Bartholomeu, D. B., Branco, J. E. H. & Caixeta-Filho, J. V. (2011). A logística de transporte dos resíduos sólidos domiciliares (RSD). In Bartholomeu, D. B. & Caixeta-Filho, J. V. (Orgs.). *Logística ambiental de resíduos sólidos* (pp.16-43). São Paulo: Atlas.

Brasil. (2010a). Câmara Federal. *Decreto nº 7.404*, December 23, 2010. Regulates Law No. 12.305, of August 2, 2010. Available in: http://www.camara.gov.br [Accessed 19 April 2011].

Brasil (2010b). Câmara Federal. *Lei Nº 12.305*, of August 2, 2010. Establishing the National Policy on Solid Wastes. Available in: http://www.camara.gov.br [Accessed 19 April 2011].

Carter, C. R. & Ellram, L. M. (1998). Reverse logistics: A review of the literature and framework for future investigation. *International Journal of Business Logistics*, 19(1), 85–102.

Chopra, S. & Meindl, P. (2003). *Gerenciamento da cadeia de suprimentos*. São Paulo: Pearson Prentice Hall.

Donato, V. (2008). *Logística verde.* Rio de Janeiro: Ciência Moderna.

Ferrer, G. & Whybark, D. C. (2000). From garbage to goods: successful remanufacturing systems and skills. *Business Horizons*, 43(6), 55-64.

Gomes, C. F. S. & Ribeiro, P. C. C. (2004). *Gestão de suprimentos integrada à tecnologia da informação.* São Paulo: Pioneira Thomson Learning.

Lambert, D. M., Stock, J. R. & Ellram, L. M. **(**1998). *Fundamentals of logistics management.* Boston: Irwin/McGraw-Hill.

Leite, P. R. (2003). *Logística reversa:* meio ambiente e competitividade. São Paulo: Pearson Prentice Hall.

Miguez, E. C. (2010). *Logística reversa como solução para o problema do lixo eletrônico:* benefícios ambientais e financeiros. Rio de Janeiro: Qualitymark.

Mollenkopf, D. A. & Closs, D. J. (2005). The hidden value in reverse logistics. *Supply Chain Management Review*, 9 (5), 34-43.

Pereira, A. L., Boechat, C. B. & Tadeu, H. F. B. (2011). *Logística reversa e sustentabilidade*. São Paulo: Cengage Learning.

Queiroz, A. P., Silva, A. L., Braga, C., Pinho, D. R. & Santos, T. M. S. (2007). Gestão Ambiental e Desenvolvimento Sustentável. In Braga, C. (org.) *Contabilidade ambiental:* ferramenta para a gestão da sustentabilidade (11-25). São Paulo: Atlas.

Stock, J. R. (1998). *Development and Implementation of Reverse Logistics Programs*. Council of Logistics Management.