Australian Journal of Basic and Applied Sciences, 9(11) May 2015, Pages: 832-839

ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com

Waste Management: The Reverse Logistic Implanted by a Brazilian City

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ARTICLE INFO

Article history:
Received 16 March 2015
Accepted 28 May 2015
Available online 22 June 2015

Keywords:
Reverse Logistics, Waste Management, Recycling, Sustainability, Public Politics, Solid Waste

ABSTRACT

Background: The adoption of environmentally correct preservation practices are getting stronger inside public management and are starting to be implemented in public municipal politics. This Project would not happen if it was not through the support of a co-op management company, specialized in solid residue and the support of the local government. To accomplish our established goal a study based on our Reverse Logistic method took place to measure the volume of residues collected, separated and sold. **Objective:** With that in perspective the objective of this research project is to evaluate the results generated by the implementation of our reverse logistic method in one of the Brazilian city of the Sao Paulo State, Brazil. **Results:** As a result, It was observed that lack of knowledge in administration, is a factor that affects in the poor coordination of the cooperative, hindering the growth of the same. **Conclusion:** The analysis of the data showed an increase not only in the quality of life of those who work, but also quality in the community where the cooperative operates. With the simple act of separating the material used, it generates much more than just economic factors, reduces air and water pollution, and saves the environment.

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To Cite This Article: Maisa Benito Pimentel, Sergio Silva Braga Junior and Priscila Rezende da Costa., Waste Management: The Reverse Logistic Implanted by a Brazilian City. ***Aust. J. Basic & Appl. Sci.,*** *9(11): 832-839, 2015*

INTRODUCTION

Environmental preservation is trending topic in the political scene., also shared by the public and companies. Companies and politicians are well aware that preservation of natural resources today is considered more important than brand appreciation and customer loyalty, its a major concern amongst all in our society. (Tibben-Lembke & Rogers, 2002).

According to Carrieri (2000) pro environment actions are taken by companies to minimize costs and risks associated with sanctions that results in large amounts of compensations to repair the environmental damages caused by themselves. On the other hand local governments main focus is to reduce the amount of residues disposed in city landfills. The existence of stringent laws and a demanding society propelled the use of eco-friendly practices when it comes to post consumed garbage disposal.

Public and private organizations are dealing with strategic aspects and even operational conditions that has a negative effect on the environment, pointed by Bertaglia (2009). With that said Dias (2006) adds that they should consider a benefit by implementing the importance of recycling in their new concept, by using the Reverse Logistic method companies can use this to promote and add value to their company. It is a fact today that many have chosen this path, prioritizing this method they allowed themselves to generate real and important financial gains and a potential impact with the local communities relationship. (Skinner & Richey, 2008). In that sense the fact that many products are being remanufactured by the use of this method this became an important topic for this research. (Tibben-Lembke & Rogers, 2002).

The reverse logistic is being recognized as the area of business logistics that plans, operates, controls the flux and logistic information that corresponds to the return of post sale and post consumed goods to the production cycle, by means of reverse distribution channels, adding value in different categories such as: economic, ecological, legal, logistic, corporate image. (Leite, 2003).

Incorrectly disposed garbage has a strong impact in the environment generating big sanitary landfill. In respect to that, the main priority of city governments is to collect garbage from the cities instead of using the reverse logistic method. When this method is put in practice it allows the residues that would be occupying the cities landfills to be reprocessed and

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reintroduced through a productive process and reducing the impact in the environment.

Therefore, the main goal of this research can be expressed through one question: how the reverse logistic method can be implemented in a Brazilian city and can generate economic and environmental benefits to our society?

Our research was implemented in a city of Tupa, country side of Sao Paulo State, Brazil, in order to evaluate the methods results. With a population of 65,000, the results found qualifies this city, one of the few, to have a selective collection of garbage in the nation. (IBGE, 2008). Consequently this process generates a formal income and a better management of the city's landfill.

Public Institutions and Public Politics:

According to Rua (1997), a life within a society, involves conflicts of opinion, values, interests and different aspirations and different roles in the course of its existence, and in order to a society survival and be able to continue, it is necessary that a conflict exist and must be kept within manageable limits.

Modern societies have, as its main feature, the social differentiation. This means that its members not only have different attributes (age, sex, religion, marital status, education, income, professional activity sector, etc.), but also have ideas, values, interests and different aspirations and different roles during of its existence. (Rua, 1997, p. 01)

So there are two ways to keep the limit: the mere coercion, and politics.

In this research, we seek to understand the Public Institution. Therefore, it is necessary to define what is political. Rua (1997) found that the policy is in formal and informal procedures, in the form of power, pacifying conflicts over public goods.

Public policies have not given their size only by the dimension of their respective society. One of its main characteristics is that they are coated decisions and actions of the sovereign authority of the government. Porting, public policies involving public activity.

Quite simply, we can consider that much of the political activity of governments is designed to attempt to satisfy the demands addressed to them by public opinion or those made by the agents of the political system, while articulating the necessary support. (Rua, 1997).

"According to Easton, the inputs and with-inputs can express demands and support." (Rua, 1997, p. 02). Rua (1997) states that the demands may be, all the way from claims of goods and services (health, education, roads, transportation, public safety, social security, etc.), or demand for participation in the political system (recognition of the right voting of illiterate, access to public office for foreigners, organization of political associations, strike rights, etc.), or can be demand for control of corruption, environmental preservation, political information, standard institutions to control public and private officials.

Only in the attempt of generating demand that the development of formal and informal procedures for peaceful resolution of conflicts can characterize this policy. A political system in which the formulation and implementation are separated, either by the Legislature and the Executive, or division between levels of government (federal, state and municipal.), provides opportunity for symbolic adoption of policies. Therefore, an instance can be assumed that the defendant took decision by the public, knowing that the cost of implementation will fall on another instance, even if the resources necessary to make possible action have not been provided.

This implementation is a process of decision-making by numerous small groups involved with politics, presenting actual or potential reactions to the decision. The implementation needs to be understood through interaction, where individual actions at strategic points reach considerably the results obtained.

Therefore is understood that there is a need for a public institution, established as regulatory space of Public Policy. The adoption or implementation of programs that meet these policies will define the profile of government and decision-making based on current demands. In this study, the reverse logistic method has a strategy to quantify the volume of waste collected, identify the results of this research, mapping the possible benefits that can be generated, with population assessment that acts directly on the processing of selective collection of waste with the "Recycling is Cool" project made in a city in the country side of the State of Sao Paulo.

Reverse Logistic:

Since the Industrial Revolution large-scale production has made the volume and diversity of waste generated in urban areas increase. Humans are experiencing the era of disposability (Fehr, 2014). Most products used are thrown away or incinerated, causing considerable damage to the environment. Currently, more stringent legislation and growing consumer awareness are driving companies to think about their responsibility for their products after use (Veiga, 2013).

There are many definitions that formed the basis of reverse logistics, such as Rogers and Tibben-Lembke (1998) in which are also reaffirmed by other recent studies of authors such as de Oliveira and Silva (2011) who claimed that Reverse Logistics is a planning process, implementation and control of raw materials flow, there is work in process and finished products (and its information flux) the consumption point to the point of origin, in order to acquire the value that could be lost or performed an appropriate disposal. The reverse logistics process generates

reused materials that return to the traditional process of supply, production, and distribution.

To Oliveira and Silva (2011) that aggregates the previous concepts, Reverse Logistics emerged as the relocation of materials and waste function, one of the main objectives is the collection and the replacement through distribution channels and can therefore enhance considerable economic gains, less environmental wear and add greater value to the product.

Still for the same author, reverse logistics is found to have great representation in the face of actions aimed at preserving the environment to promote the sustainable development. The efficient planning of this process became essential not only for companies but also for society as a whole. This reverse process is closely linked to recycling, which is largely responsible for a significant part of the waste that become raw materials again.

Freitas, Scheffer and Days (2013) add another complement in which reverse logistics comprises the management of reverse flow of materials, from the consumption point all the way to the point of origin, disposal, or recycling.

Therefore, the same relates to all logistic activities to collect, process, and disassembling products. Using part of products and / or materials in order to ensure a sustainable recovery from an environmental point of view (REVLOG, 2009).

Leite (2009) adds that the Reverse Logistics delivers value of various kinds to the business cycle or the production cycle, for example: economic, ecological, Legal, logistics, corporate image, among others. In addition, there is another important factor, the social factor, which is first exposed through the professionalization of the partnerships involved in this processes, such as recycling companies.

According to Oliveira and Silva (2011) the activities of the reverse logistics depends on the type of material and the reason why they enter the system. The materials can be divided into two major groups: products and packaging. In the case of products, reverse logistics flows will be the need to repair, recycling, or because simply customers return them. As for the packaging, which are usually directed to the beginning of the production process turned into raw material.

There are four main reasons for carrying out the reverse logistics according to Braga Junior and Santos (2015), a) legal issues that require the establishments to position itself to the problems generated by the disposal of waste; b) environmental awareness, which brings the concept of sustainability linked to the actions of the study of logistics and the collection made by the consumer; c) strategic differentials, which interfere in the company's image, flexibility, and quality in the receiving products / residues from customers; d) cost reduction, revenue generation through materials that would be otherwise discarded.

Oliveira and Silva (2011) also states that is also possible to observe the reverse process, the materials can be identified in various ways, such as: a) return to the supplier when there is agreement; b) resold if they are in appropriate marketing conditions; c) be reconditioned, if there is economic justification; d) recycled if there is no possibility of recovery. All of these alternatives generated by reused materials that can reenter the direct logistics system. Only when there are no more options disposal is the final destination.

This return of products obeys a few steps, cited by Leite (2009), which are: collection, selection of the use of products or waste, reuse and distribution of these new products to market. However, how these steps are performed interfere with the progress of an efficient process, which would be the realization of the goal of reverse logistics. Reusing materials so that they do not harm the environment.

It is clear that reverse logistic represents reflections on the tripod of sustainability: economic, social, and environmental components. The economist refers to financial gains, such as cost reduction through reuse of waste. The social context relates to gains received by society. Finally, environmental, which relates to the minimization of the environmental problems caused by the improper disposal and utilization of waste products, thereby generating the processing of natural resources. If that was the objective of this research, the tripod was represented by the formation of a cooperative supported by the city and is responsible for receiving, sorting, and sale of all recyclable material collected in the city.

The Formation of Solid Waste Cooperative (Co-ops):

A cooperative is a private company administered collectively by joining a group of people with specific needs and problems in common. According Amodeo (1999), Rodriguez and Santos (2002) a cooperative member is both, owner, manager, consumer, and supplier. In other words he is the business owner and direct participant on equal terms in the decisions of the same, regardless of their participation in capital, setting up this kind of company with singular characteristics. The partners are not capitalists like any other private company, instead they make their contribution in the form of work and loyalty to the cooperative. In a cooperative, the members vote to choose their leaders, between the partners themselves, everything is discussed and decided in the general meeting, and the total earnings are allocated according to criteria approved by the majority.

Rodriguez and Santos (2002), claims that as an economic practice, the cooperative uses the values of autonomy, participatory democracy, equity, and solidarity.

Esteves (2013), points out that the cooperative principles are higher than the administration of government and corporate economic activities. Cooperatives fix the purposes that bring social and autonomous benefits to participate in cooperative acts, their technical and trade relations are nonprofit oriented and are almost tax free.

The concern of cooperatives can not be only with the members, but also with the community where it is inserted.

Amodeo (1999), demonstrates this by describing the seven cooperative principles.

I- voluntary and free Accession

II-democratic management by its members

III-economic participation of members

IV-autonomy and independence

V-Education, training and information

VI- Inter-cooperation

VII- Concern for Community

Adherence to enter into a cooperative is voluntary and free. Anyone able to use their services, accept its members responsibilities, may be considered a member of a cooperative. Without social, racial, political, religious, and gender discrimination; Every co-op is democratically controlled by the members, where men and women are elected as representatives and responsible to its membership; The way in which the members participate economically (control of its capital) with the cooperative are fair and democratically controlled.

If there are money leftover in the cooperative, members use for development, enabling a reserve that may or may not be divisible among the partners, or supporting other activities approved by the membership; Cooperatives are autonomous organizations, and are controlled by its members, must maintain a way to preserve their autonomy and independence, even when they get help as form of capital from external sources; A cooperative must effectively contribute to the development of its own members by providing education, training, and information to the general public. Particularly young people and opinion leaders, showing them the nature and benefits of cooperation; Another principle is cooperation between cooperatives, which help and strengthen the cooperative movement by working together through local, national, regional, and international structures; Communities where each cooperative is inserted are sustainably developed by cooperatives, always with policies approved by the members; "One man, one vote" another principle adopted by other cooperative members. Each member has one vote regardless of the number of shares and may vote and be voted; Finally, the return of the excess cash, which makes it clear that there are remains in the closing balance sheet, those will be allocated to funds provided in the bylaws of the cooperative and other destinations that are discussed in general meetings.

According to Deccache (2012 p. 15), there are several types of cooperative, such as consumption, agricultural, credit, educational, housing, work, mineral, production, health, service, and special. The work cooperative is one that stands out the most among the others, because in addition to generating and distributing income, it also works in the social area, giving job opportunities that goes beyond income, but also as a form of personal, professional, and cultural growth.

A work cooperative or services does not have a leader or a boss, but a coordination or direction. It is born by the will of its own members, which are autonomous and that split the winnings in proportion to the effort of each one of them. (Carrion, 2012)

According to Vieira and Ricci (2008) the principles of the cooperative movement is related to the fundamental principles of cooperation, which enables the elimination of social differences, giving fundamentals to the Popular Cooperatives.

The People's Cooperative follows the fundamental principles of cooperation, self-management, and the pursuit of social inclusion and an end to poverty. (Vieira and Ricci, 2012)

The unequal distribution of wealth in Brazil implies a search for survival of people in the collection of recyclable materials. This exposes the collectors to the risk of accidents and diseases, and exclude them from society. Therefore when autonomous waste pickers are organized into cooperatives or associations, the collectors can become partners of these institutional programs of selective collection, changing the stigmatized profile. (Esteves, 2013)

The cooperative studied in this research, was established in 2001, with the Project "Recycling is Cool" from the Prefeitura da estancia turística of Tupa, through the Office of Environment. According to Maria Teresa, Mabel Bastos, and Helma, recycling cooperatives began in the 90s, where enabled the possibility of better relationship with local government and collectors groups. Also mentioned by the same authors, these cooperatives have benefits for collectors as recovery and the professionalization of the collector's work, social inclusion, and the recovery of citizenship.

There are several studies that indicate that the difficulty of these types of cooperatives have are due to low education level of collectors. There is a social exclusion information and the difficulty of establishing commitment with the cooperative, since working as self-employed, they are not subjected to regulations. (Maria Tereza, Mabel Bastos, Helma, 2012)

When a field survey was performed, it was realized that there was a lack of organization, down time, stopped or broken machinery, insecurity in the workplace and a lack of commitment of collectors within the cooperative. There are several studies that indicate that the difficulty of these types of

cooperatives is due to low education of its members, the history of social exclusion and the difficulty of establishing commitment to the cooperative, since, working as self-employed, are not subject to regulated labor laws. (Maria Tereza, Mabel Bastos, Helma, 2012).

MATERIALS AND METHOD

For the verification of the objectives proposed by this work, an exploratory qualitative research will be made going through literature review of public policies, national waste policy, reverse logistics, and recycling. All in order to substantiate and justify the formulation of a semi-structured questionnaire and participant observation in the data collection process.

To measure and achieve the research objective, the method of analysis of the environmental advantages developed by the Wuppertal Institute, allows the assessment of environmental changes associated with the extraction of resources from their natural ecosystems. Thus, to supply the material flow of a system, a greater amount of material was previously processed in various environmental compartments. The compartments are classified as: abiotic, biotic, water, and air (Ritthoff, Rohn & Liedtke, 2002)

For conversion of the volumes of data through the Wuppertal method, Table 1 shows the means by which the results were obtained and exposed in the survey, where the monthly volume of solid waste generated in kilograms (kg) are multiplied by the corresponding value in the table. The resulted data was used for analysis.

Table 1: Conversion Table.

	Abiotic Material	Biotic Material	Water	Air
Plastic (g/g) [a]	6.45		294.20	3.72
Paperboard (g/g)[b]	1.86	0.75	93.60	0.33

Note. Adapted from "Calculating MIPS: Resource productivity of products and services", by Ritthoff, Rohn, & Liedtke (2002)

The abiotic and biotic fields are the materials that the company did not let it generate in the environment, in (kg). Water and air fields, are representing the volume that did not pollute the environment with the practice of Reverse Logistic Method (in kg).

It is important to note that studies of intensity of material developed at the Wuppertal Institute are based on the energy headquarters in Europe but this fact does not preclude the implementation of this methodological tool in Brazil, according to the institute the quantitative data are very close.

Based on the research problem and the overall goal, this survey was conducted on the theoretical review of the issues. Following, a field research aiming at understanding the process was done. The process implemented during a course of ten months by the cooperative that receives all recyclable solid waste of the city, thus collecting all the data needed from their reverse logistics process. With the collected data they were analyzed, based on quality and quantity, thus measuring the environmental gains generated by the process.

The quantitative nature, measures the environmental advantage of the reverse logistics implementation in the city, allowing the development of the case study. Qualitative research, characterized as an attempt to a detailed understanding of the meanings through situational characteristics presented by the interviewees and the analyzed cases (Yin, 2003), provided the research with observation depth of the deployment process of reverse logistics.

Analysis and Results:

The research objective was based on the waste recycling cooperative which was established in the city in 2001 from the project "Recycling is cool" by the City of Tupa's environmental office. In other to assist in the reduction of environmental impact, recyclable material was placed in an appropriate and safe area, this also helped improving the quality of life of families who would leave the "dump" for a more decent work within the cooperative.

In 2009, The COORETUP (Work Cooperative of Recyclers from Tupa) went through financial problems, because it had to be structured in a moment of falling prices of material. To make matters worst the cooperative could not even count on the funds from BNDES, which was intended for infrastructure. Few years later, the cooperative had local government help from Tupa, and in 2012 along with the liberated funding from BNDES, contributed to the cooperative providing a new and bigger space, with trucks, scales to measure volume of the collected material, new presses, new mats to sort recyclable materials faster, dining room, bathroom and an area to provide training courses, so the task could flow easily. Safety was also increased in the work environment and higher monthly income for members. The COORETUP's structure is in a strategic location near the landfill and near the debris recycling plant.

The City of Tupa, along with the secretary of environment, has conducted several awareness campaigns, delivering pamphlets and explanatory booklets, in order to show the importance of recycling, the difference between organic and recyclable materials and how it should be separated.

Even with these various awareness campaigns, and being such an important subject, many people still find it difficult to adapt and start separating garbage in their own home, generating obstacles for

the cooperative workers when they separate what can be sold or not.

The COOPERTUP and the Municipality of Tupa do work together, since one complements the other. The cooperative suffers, having a low cash flow, but the city helps with more trucks paving the way for waste pick up throughout the whole city, and that way benefitting both. The city because it has the cooperative to make the collection of recyclable waste, which makes the city more sustainable, and the cooperative will also benefit because they use city trucks and do not have to compete with others in the same business.

The "Recycling is cool" opened many doors for both, community and for the city. A more sustainable city promotes improvement in the environment, which in turn improves the lives of people living in it, with less pollution. This opens doors to improve population living conditions increasing wages, putting less lives at risk (because they leave the landfills), and creating opportunities. Reinforcing the issue of sustainability since it is so important topic to the world.

The city government, along with the cooperative and this project made the city of Tupa turn into a reference in this matter, because it is one of the few cities that rely on recycling and has its own landfill.

It is noteworthy that, despite this progress over the years, the community still does not see or understand all the benefits of recycling, and they do not treated as a priority.

Throughout the data collection process, it was possible to realize how important it is to start the separation of waste in the people's homes, this procedure would accelerate the process, on the conveyor belt and decrease the amount of waste that goes into the landfill. The period of study was from March 2014 to December 2014. It was identified the (kg) in the amount of waste that was collected. It was separated in the amount of recycled in (kg), percentage, and the amount that goes to the landfill because it is not possible to recycle, one example is the amount of papers which were used for physiological functions (toilet paper), cardboard, greasy paper, and organic waste. shown in Table 2.

Table 2: Estimated overall amount of material collected, recycled, and sent to landfill.

Period	Collected	Recycled	Forwarded to the Landfill (ton)	Forwarded to the Landfill (%)
March/14	197169,00	118299,00	78870,00	40%
April/14	207027,45	122145,00	84882,45	41%
May/14	195197,31	117117,00	78080,31	40%
June/14	194802,97	120776,00	74026,97	38%
July/14	210970,83	122362,00	88608,83	42%
August/14	197169,00	120271,00	76898,00	39%
September/14	214914,21	118202,00	96712,21	45%
October/14	226744,35	126975,00	99769,35	44%
November/14	195197,31	126877,00	68320,31	35%
Total	1839192,43	1093024,00	746168,43	41%

Also in table 2 it shows that an average of 41% of the waste collected is sent to the landfill, therefore the cooperative which is responsible for garbage collection for recycling, accumulates a high percentage of non recyclable waste. These amounts do not generate economic value. In other to separate this garbage that does not fit recycling causes, delays the practice of separation, performed by the cooperative workers, thus stressing the importance of proper sorting of waste collected.

Table 3 shows the amount of material that is submitted for recycling, thus contributing to the decrease of material generated on the environment. With the collected data, it was detected that the amount of cardboard and plastic that goes to recycling is superior to other products.

Table 3: Estimated amount of separated material for recycling.

Period	Paperboard	Plastic	Others	Total
March/14	86,922.00	14,511.00	16,866.00	118,299.00
April/14	97,896.00	20,111.00	4,138.00	122,145.00
May/14	96,891.00	19,210.00	1,016.00	117,117.00
June/14	74,343.00	19,373.00	27,060.00	120,776.00
July/14	102,433.00	17,861.00	2,068.00	122,362.00
August/14	87,262.00	17,742.00	15,267.00	120,271.00
September/14	112,512.00	4,829.00	861.00	118,202.00
October/14	119,253.00	7,027.00	695.00	126,975.00
November/14	117,388.00	9,303.00	186.00	126,877.00
Total	894,900.00	129,967.00	68,157.00	1,093,024.00

Table 4 demonstrates that the practice of recycling, failed to generate 2483.31 tons of abiotic material, this is not transformed in the environment over time, and 671.18 tons of biotic materials (which can be transformed into environment). Leaving 289,553.84 tons of water and 750.20 tons of air, that are no longer polluting the environment.

With this analysis, it is possible to identify the importance of recycling cooperatives, it was possible to measure their contribution to the environment. By recycling waste it is possible to save natural resources, help in reducing pollution of air and water, and contribute to creation of jobs.

Table 4: Amount of Material Generated by the Cold Cuts Sector.

	Abiotic Material (Ton)	Biotic Material (Ton)	Water (Ton)	Air (Ton)
Paperboard*	1,664.51	671.18	83,726.84	295.32
Plastic (PET)*	818.79		205,827.00	454.88
Total	2,483.31	671.18	289,553.84	750.20

* Data calculated based on quantitative estimate for Europe.

Conclusion:

It was observed that lack of knowledge in administration, is a factor that affects in the poor coordination of the cooperative, hindering the growth of the same.

Also analyzed, that the lack of knowledge starts from the homes where the garbage was collected. The current president of Working Cooperative of Recyclers Tupa (COORETUP) explained that the way that recyclable waste is separated in the community, has a potential affect on the work of members, making them work twice to separate all the waste on the mats, that way leaving the non-recyclable waste occupying a very large area inside the cooperative.

A lot of times the organic and recyclable waste ends up being directed to the same place, because the collection of recyclable waste coincides sometimes with the collection of organic waste. The organic waste, in addition to disrupting in the time of separation, also occupies inappropriate area, contaminating material that could be recycled.

Another point discussed was the lack of data control. Not every garbage truck that enters the cooperative is heavy, making it difficult to collect data. Based on this research it was proposed to the secretary of the cooperative that the use of a spreadsheet to maintain a continuous control of the trucks entering and leaving the cooperative, with the objective of helping them find the main factors that make them lose products, find out which months to collect is better, and which products give them greater profit. Therefore, aiming to help retain workers who leave the job because of little gains in a given month. This will seek a way to maintain a fixed salary, improving the knowledge in the administration area, and also leading to a better coordination and control of the cooperative, increasing the income within their company.

The analysis of the data showed an increase not only in the quality of life of those who work, but also quality in the community where the cooperative operates. With the simple act of separating the material used, it generates much more than just economic factors, reduces air and water pollution, and saves the environment.

ACKNOWLEDGEMENT

Foundation for Research of the State of Sao Paulo – FAPESP for financial support to the survey.

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