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## Solid waste recovery and insert your input as in industry: case study on the das Calçadas Street, the Recife commercial area

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### ABSTRACT

The article deals with the problems of solid waste generated by the Das Calçadas Street in Recife, bustling street commercials. Solid waste every day are becoming an increasing problem a real environmental chaos. Recycling is environmentally and economically most appropriate to deal with the solid waste of the commercial areas of all kinds. The problems generated by solid waste need to be made in a sustainable and socially inclusive. The introduction of collectors in the product lifecycle acting as selective collection tool and recycling brings great benefits for collectors and their associations for the waste generators and the environment. The National Solid Waste Policy is the instrument that enables all product lifecycle agents assume their responsibilities within the production process, in addition to fulfilling its social role inclusion of collectors, their associations and cooperatives. In the region of Das Calçadas Street to City Hall collection by EMLURB about 11 tons per day of waste the amount would be much higher if there was action of scavengers. Awareness and public policy actions are needed to optimize recycling and disposal for collection, application of the polluter pays principle is a necessity, as a way to force the companies to implement collection processes and selection of waste.

**Keywords:** solid waste, recycling, collectors

### INTRODUCTION

From the Industrial Revolution occurred in the nineteenth century, the improvement of economic conditions, the process of urbanization and the pace of population growth accounted by both the large

consumption of natural resources, and by increased generation of solid waste.

The growing production of waste and the high levels of consumption are among the biggest environmental problems facing society. Of course the problem is exacerbated by the large expansion and

densification of urban areas, as the infrastructure of most Brazilian cities do not keep pace with population growth.

The resolution garbage problem in society is still a challenge, but that should pervade invariably through social awareness, environmental conservation, education consumption as well as the proper disposal of waste, or even reuse from recycling (SOUZA et al., 2012).

Recycling according to the National Solid Waste Policy is the transformation aiming its use in inputs and new products, and this residue a social and economic value, generating employment and income and promoting citizenship.

According to this premise is that recyclable waste become raw material industries and this circuit ends up being composed of collectors and intermediaries seeking to accumulate more material to resell the recycling industries.

Soon the collector activity material for recycling and their associations have great relevance in the reverse logistics of solid waste of the Pavements Street, should the government encourage collectors associations, as provided in the National Policy on Solid Waste (BRAZIL, 2010).

Solid waste and its recovery as input, we call recycling allows to occur preservation of natural resources, for the exploitation of this raw material in nature is not required.

The Calçadas Street essentially commercial is located in the district of San José, Recife, residential area in the 1930s, where they lived the merchants of the time, which over the decades has been transformed into a strictly commercial area in Recife, the neighborhood of San Jose, has rich cultural heritage with beautiful churches and historical buildings (GASPAR, 2009).

The Calçadas Street has great movement of pedestrians, that this shift to make purchases generate solid, directly or indirectly waste, directly due to the generation of solid waste by pedestrians themselves and indirectly resulting from the execution of purchases, which is generated from waste of original product packaging.

Solid waste from commercial activity can have the following destinations: donation for recycling or sale for recycling, third party gives bound for solid waste collection and public cleaning by the company and directed to landfill (STEINER, 2010).

Preserving the environment begins with small everyday actions that gradually start to make a difference and one of the most important is the recycling of waste. Each 50 kg of recycled paper avoids cutting a tree. Every ton of recycled paper allowed to use 3 m<sup>3</sup> landfill. This little attitude to collect paper for recycling is the way collectors contribute to preserving the environment and should become a way of including these, as the government make its role as a regulator, supporter and funder, allowing that the minimum conditions are met for the collection to proceed safely.

Therefore, the growing concern about a model of local and sustainable development has raised the importance of studies on the management of solid waste, their instruments, among them environmental education and its operators as recyclable material collectors. But do these people have the exact notion of the importance of their work to society (FERREIRA et al, 2016).

The aim of the paper was to investigate the action of scavengers and their importance in the recycling of solid waste in the Calçadas Street, Recife-PE.

## MATERIALS AND METHODS

The research is observational and field, whose authors were for the "street of Pavements" in the city of Recife, Pernambuco. The choice of location was given for this and that this is a busy area of local shops. Data collection occurred through photographic record of solid waste produced by local businesses (Lakatos, MARCONI, 2010).

images were produced which were observed aspects of packaging, form of disposal, waste pickers operations and disposal of solid waste. In addition, we used secondary data of EMLURB (Empresa de Manutenção e Limpeza Urbana da Prefeitura do Recife).

The results were discussed in the light of the National Solid Waste and the Municipal Plan of Integrated Solid Waste Management Policy.

## RESULTS AND DISCUSSION

The production of solid waste should be treated with great attention by the public and private power, focusing on the environmental and economic, must first be observed, as the incorrect disposal of waste can have penalties, generating fines that may adversely affect the company or status and the economic side in order to adequately allocate the waste can ensure real gains. All this as part of an efficient environmental management system can be deployed in any enterprise.

### 1. Related legislation to Solid Waste

The National Policy on Solid Waste, large demand advances in relation to disposal of municipal solid waste, defines sending waste to landfill and no other places like garbage dump or landfill, and to promote the use in different production lines with the use of possible technologies for reuse, so it is

necessary the training of collectors and collectors' associations to take them out of hiding and lead them to greater efficiency in the selection of materials (BRAZIL, 2010).

The principle of receiving protection, introduced the National Policy on Solid Waste, brings economic benefits to municipalities, as in the state of Pernambuco, with the law n0 11,899, which resets the distribution criteria of part of the ICMS that it is for municipalities, treatment is an economic advantage for municipalities that implement the National Policy on Solid Waste and other requirements (copola, 2011; SILVA JR; SOBRAL, 2014).

The National Solid Waste Policy has in its scope various instruments, including: plans of solid waste, waste sorting, encourage the development of cooperatives and associations of collectors among others (BRAZIL, 2010).

Thus recycling of paper, in its different compositions (printing paper, toilet paper, corrugated and folding carton) and recycling of plastics (polyethylene, polystyrene, polyurethane, Policloropeno and polyethylene terephthalate) through the instrument selective collection and works developed by collectors and cooperative associations allows recovery of large quantities of raw material reducing the need for natural resources (BARROS, 2012).

The city of Recife in its Law n° 14.903 of October 3, 1986 provides for penalties to be charged to merchants who do not deposit the waste (garbage) conveniently packaged for collecting a fine, although there the law is not what happens in the Calçadas Street. Another factor is the amount of waste that each establishment has the right to have to collect daily, by law the volume should not exceed 300 liters.

It is found that the larger establishments produce a much higher volume stipulated and deposit them for collection without an appropriate type of packaging. Figure 1 shows the residue deposited in front of one of the shops of the Calçadas street.

**Figure 1** - Waste deposited for collection. Source: Authors, 2016.



It can be seen in Figure 1 about 20 bags with an estimated volume of about 50 liters each corresponding to 1,000 liters in front of this property.

## 2. Environmental Management of Solid Waste

Environmental management of municipal solid waste involves different entities with different responsibilities, the manufacturer has the responsibility to reverse its waste management, municipal government responsible for household and commercial waste in to a certain volume provided for in the Municipal Plan Management Integrated Waste solid and it should be noted that the constitution provides for the responsibility of local governments in relation to solid waste (BRAZIL, 1988; BRAZIL, 2010).

Soon the Environmental Waste Management also requires a waste management, covering all stages: collection, transport, transshipment, treatment and disposal environmentally friendly.

So the management as municipal solid waste generated by the company in its various activities

result in a risk to public health is important, cause environmental degradation, as well as social, economic and administrative aspects involved in the issue (SIQUEIRA; MORAES, 2008).

## 3. Generation, Recovery and Solid Waste Disposal

The solid waste generation is linked to population growth, purchasing power, selective collection practices, application of reverse logistics and other factors. In Brazil in 2014, there was a production of 215 297 t / day consisting of about 1.062 kg per capita daily (ABRELPE, 2014).

Soon the need for increased recovery of input towards sustainability is provided for in the National Solid Waste Policy, encouraging recycling and application of reverse logistics in Brazil only 65% of municipalities have selective collection initiatives (ABRELPE, 2014).

Consequently the disposal of waste not recovered by selective collection processes are; landfill, landfill and garbage dumps, the first was the destination for 58.3% of the waste produced followed by 24.3% and 17.4% respectively landfill and dumps (ABRELPE, 2014).

## 4. Waste generation in the Calçadas Street

It is a commercial predominant Calçadas is located in the neighborhood of San José, the architecture dates from the early twentieth century, with a few older buildings at first you can not see this architectural miscegenation due to mischaracterization of facades for commercial use.

During the day the intense trade in and out of the various shops, the buzz of the street, in their attempt to attract clientele, hides what is happening behind the scenes. Hundreds waste are being generated, packaging of products used to transport large amounts are not re-used in the retail trade, are replaced by bags and plastic bags, which have



become waste in other parts of the city. With the end of the day the staff are quick to put on the street to be collected by the public waste generated in the day. Calçadas Street is located at coordinates: Latitude: -8.069547 and longitude: -34.87922,716 m.

Commercial establishments produce a large amount of recyclable materials such as paper, cardboard and plastic waste from commercial areas have in your food waste composition resulting from bars and restaurants that can be reused in compost (BARROS, 2012).

**Table 1** – Percentage of business establishments by type. Source: Authors, 2016.

main mode	percentage
Children's party	20,3
Haberdashery	15,6
Mega Store	4,7
perfumery	1,6
Fashion Children	12,5
Fashion Adult	14,1
Food	3,1
Jewelry and semi jewelry	3,1
Construction Material	1,6
Other (Gifts, Bazaars, Costume and Textiles)	23,4

In addition to the formal the other informal working with the same products of formal and among these we highlight the sellers of green coconuts and a snack of sugar cane juice as a major waste generator.

According to data provided by EMLURB, the solid waste produced in the Calçadas Street consist primarily of plastic, cardboard and paper and other waste in smaller volumes, sweeping occurs 4 times a day and the sector to which the street sidewalks is inserted collects about 11 tons per day.

Recife has one of the most advanced selective collection of the Northeast program, covering 45 districts, 107 voluntary surrender of deposits and has actions to regulate the activities of collectors helping the creation of associations and cooperatives, currently having six screening centers supported by EMLURB counting with about 150 collectors (EMLURB, 2015).

**5. Performance of Collectors in the Calçadas Street**

Before the waste disposed to the collection comes to the figure of scavengers present are not properly prepared for the collection of waste and their carts human-powered gathering with great turmoil the most valuable waste and greater volume, cardboards, there is a method , a care the issue is just getting enough to survive another day. After the first wave reaches a slower second in order to pick up what was left behind and that were deposited after the passage, those vying for space with the official sweeping team starts its service agglomerating waste in places where already there are disposed a greater amount, as shown in figure 2 and figure 3.

**Figure 2** - Photo of waste disposal in the street. Source: Authors, 2016.



**Figure 3** - Photo of waste collector. Source: Authors, 2016.

In the Calçadas Street, they were interviewed 4 collectors aged between 18-45 years of age, which, when questioned about the service in the grooming, the elder said that is more than eight (8) years and the youngest 2 to 4 years; It was found that most collectors are men. The working conditions are poor, living daily with the stench arising from solid waste, are susceptible to contracting diseases with the presence of animals (cockroaches, flies, mice) and in work accidents with sharps material, because they work without equipments for individual safety.

The main recyclable materials collected by scavengers are plastics and cardboards. The monthly income of the collectors is lower than the minimum wage, ranging from R \$ 100.00 and R \$ 600.00 reais, depending on the amount of waste that is collected. The materials collected in the street are sold to the cooperative, which is the separation of waste to be directed recycling industries.

Most of the materials collected in the Calçadas Street are the cardboards, the recycling generates relevant social, economic and environmental contributions. The production of paper consumption enormous amount of water and energy, as well as trees, recycling can provide a great savings of these inputs. According to the EPA (2013), paper recycling

can generate contributions to society and may include: saving space in landfills, reducing the need for disposal and reduce emissions of greenhouse gases.

The paper is among the products that have higher recycling rate in Brazil. Among the types of paper used, the cardboard material is found most municipal solid waste. The cardboard comes to properly baled factory, it is mixed with water to form a pulp, this pulp is led to a sieve which is intended to remove unwanted materials such as pieces of plastic and wires. After sieving is added chemicals for the removal of paints. Finally, it is done following bleaching of pulp for paper manufacturing process, which will be manufactured according to customer's specification (BRACELPA, 2010).

In an enlightened society, it is expected that consumers themselves cover, through its power of choice, the products are becoming less impact to the environment. (Mendonça Filho, 2013)

This may even happen to retail consumers the because the retail packaging those are not ruled out in the driveways Street, but the wholesale of the consumer, commercial establishments, are not being informed about their duties in the cycle life of the product.

Selective collection in the current form and the informal selective collection, in which predominates the total irresponsibility of manufacturers in the life cycle of the product, do not correspond with the new system adopted by the National Policy on Solid Waste. Responsibility for product life cycle covers the government and consumers, but must also involve the business sector. (SON Mendonca, 2013).

Recycling enters this cycle informally, without the support of the government and without the slightest knowledge of the risks involved in the

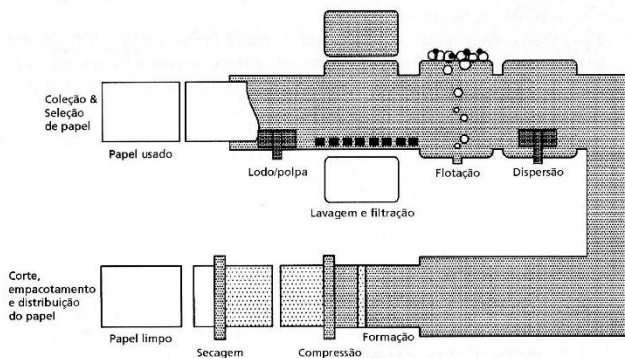
activity of the paper and cardboard collector takes on an obligation that would be the manufacturer and commercial consumers. With the help of cooperatives materials collected by scavengers return to the productive sector.

**6. Paper production and recycled plastic**

The production of paper having as raw materials, recycled paper, which is inserted in the production line as figure 4, although inferior quality due to impurities that may possess due to the use intended for the paper prior to recycling, however it is not possible to use the total diversity of paper, for example waxed paper, can be used as biomass for burning (BARROS, 2012).

The use of paper for burning may be an option when the reuse of this material for recycling is not possible especially when they have a large amount of impurities that does not allow the use as a feedstock in the production of paper, it is interesting to note that depending on the amount impurities in the paper will have a high ash production (Nasrullah M; VAINIKKA P; Hannula, J; Hurme M; karki, J., 2014).

**Figure 4** - Conventional Process Recycling. Source: BARROS, 2012.

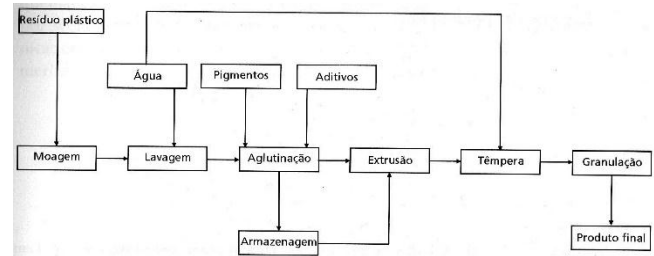


The plastics recycling process mainly polietilenotereftalado is consolidated in the industry, but there is a variety of polymers used, and there are several ways to reuse them as primary recycling (reextrusão), secondary (mechanical), tertiary

(chemical) and Quaternary ( energy recovery) (AGO, KIM, cited BARROS, 2012).

In figure 5 we have the stage of mechanical recycling of plastics waste.

**Figure 5** - Mechanical recycling. Source: BARROS, 2012.



**CONCLUSION**

Recycling is the best way to reduce the volume of waste, and in some areas the waste generated are virtually all their recyclable. Residues of establishments in the "Street of Pavements" fall into this category and if handled the right way there will be a substantial reduction of waste generated by these, summing up the sweeping store and generated by employees.

There by the retail business of "Rua das Pavements" concern with recycling, there is total disregard for local laws and the National Policy on Solid Waste.

It is necessary that the city can create procedures for waste collection and the light of current legislation to enforce. Applying where possible the polluter pays principle.

It is also necessary that the government enforce the law, and to coordinate the actions of selective collection, encouraging cooperatives and demanding that these comply with the safety standards in waste collection work.

Social inclusion of the scavengers with fair remuneration for their valuable work and the reduction of environmental impacts will be the

culmination of one of the objectives of the National Policy on Solid Waste.

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