Extended Abstract


Technological waste, or Waste Electrical and Electronic Equipment – WEEE - (REEE in Portuguese), when disposed improperly represents a huge risk for the environment, and consequently, for human beings. United Nations studies point out a critical scenario regarding the handling of these wastes in developing countries such as China and African countries. This occurs because European countries, the United States of America and even Brazil export tons of WEEE to these countries claiming a lower cost to recycle and supposedly and allegedly jobs being created in these waste receiving countries.

Not long ago in Brazil, the electronic recycling waste chain did not exist in a structured form. Nowadays, some initiatives are found, but rather punctual, disperse and normally it becomes an onerous to those who wants to get rid of a post consumption product.

On December of 2010, the law numbered 12.305 was introduced, that creates the Solid Waste National Policy (PNRS in Portuguese) in Brazil, which attributes shared responsibility the life cycle of determined products and packaging materials. However, the strengthening of WEEE reverse logistic is jeopardized due to the high lack of information, to a small articulation among the initiatives and low involvement of private and public sectors. Some NGO’s and private companies offer council and specific collecting services, benefiting the WEEE destination. Also, some effort is being made by local and state administrative authorities, improving their practical and sustainable methodology regarding waste sorting and landfill management to deal with this type of residue.

In Rio de Janeiro the situation doesn’t seem different, the municipality still lacks a reverse integrated logistics among the waste collecting service companies, the waste cooperatives and the benefaction and destination waste companies. As for society, it is not quite clear what to do with such special treatment waste residue; those are thrown away as regular domestic litter, or sometimes put to lie
on the streets. However, international recommendations and methodologies are available, along with applied successful policies and many others examples to be followed.

This study intends to answer two questions: 1) Is the final destination of WEEE in Rio de Janeiro environmentally adequate? 2) What are the deadlocks, conflicts and opportunities for the effective implementation for the WEEE reverse logistics in the city of Rio de Janeiro? This study is organized in sessions including: introduction of WEEE scenario in Brazil and in the world; the purpose of this study; introduction to a product's lifetime period and the challenges to a circular economy; and the WEEE recycle chain in Rio de Janeiro.

The information that will be presented suggests a moment, like a picture. Something such as a complex and dynamic view is complex do capture, hence it does not intend to be an accurate representation of reality.

For the product's life cycle concept adopted in this study, Manzini and Vezzoli's (2005) definition was used, which says, “The product's lifetime cycle concept refers to the exchange amongst the environment and the combined processes followed by them, taken as a raw matter, energy and emission, considering from the beginning of a product's necessary components extraction, up to the treatment to these same materials, their use and disposal”.

The same concept was defined by the ISO 14.040 regarding a product's life cycle as “consecutive stages interconnected of a product, from its raw material acquisition or creation of a natural resource available to the end of nature's product”. This concept corresponds to a greater view about the process of industrial production, allowing an improvement to its performance, economically and environmentally speaking.

In Brazil, until the approval of the Solid Waste National Policy (PNRS) in 2010, the ownership transfer to the final consumer made the responsibility to the post-consumption residue became diffused. From the PNRS law approval some manufacturers, importers, distributers and traders had to implement the reverse logistics system by themselves or in partnership with the public urban cleaning service. Thus, they are obligated to implement a reverse logistics in a shared way with manufacturers, suppliers, and traders, of some products, including some electronic products. At the same time, there are lots of environmental regulations based on industrial polluting emission, while the diffuses post-consumption
residue policy remains far from the necessary control, even after two years passed from the PNRS law approval. Despite the effort to regulate the residue, official data about the affluence of this residue is unclear in Brazil and mainly about its export. On the other hand, during the field research to this matter, there were some clues that a few companies were exporting printed circuit board to European countries, the United States and Japan.

The implement of the principles and goals of the PNRS undoubtedly won’t be an easy task, whereas it will definitely demand the interaction among the authorities and a wide range of social representatives in a few years horizon. This interaction involving the main characters from all WEEE life cycle chain started on May fifth, 2011, when the first meeting of the Electronic Thematic Working Group (GTT-REEE, in Portuguese) took place. This group is a counseling group to the implementation of the reverse logistics. As the WEEE’s management is a worrying subject due to its likely contamination of aggregated value compounds disposal, many initiatives are being promoted around the world looking for the reintegration of these discarded materials in the manufacturing process of the companies, generating less environmental effects and ensuring maximum financial return.

In the city of Rio de Janeiro, the municipal law number 4.969 regarding the Solid Residue Integrated Management, assures that electronics considered harmful to human health and to the environment are not mixed together with domestic waste, being up to electronic device customers to send them back to those who produced them or imported them, giving the electronic device a proper environmentally-friendly ending.

There are also actions being taken by the Rio de Janeiro Environmental Secretariat towards receiving donations of WEEE, such as the ‘‘Fábrica Verde’’ (green factory), a place that transforms obsolete computers into new ones by the hands of youngsters enabled by this social program. In 2010, 2011 and 2012 a campaign for electric electronic recycling was made and helped to educate the population of how important it is to recycle, at the same time collecting and sending tons of electric electronic equipment to have a proper disposal or reuse.

WEEE management is a complex activity, especially for its long course through legal channels. When the Solid Waste National Policy (PNRS in Portuguese) was approved at the Brazilian national congress, many states and
cities had already developed their own legislation and mechanisms focused on WEEE management, as it happened to the city and the state of Rio de Janeiro. The Brazilian recycling market needs a huge increase on its capacity, although there's not an organized structure to receive the WEEE in Rio de Janeiro, some recycling companies are demanding WEEE on the market. There are only a few initiatives that seek to recycle part of WEEE, but they aren’t enough to supply the necessity from these companies, therefore formal and informal practices blend in and are often done into these cities and their surroundings recycling markets. Studies made to this research point to the intense relation between formal and informal recycling chain. Interviews were made with the main characters of the recycling segment, including representatives from the Urban Cleaning Municipal Company (Comlurb, in Portuguese) of Rio de Janeiro, cooperative companies, private companies, NGOs and many other groups. It became clear that there are four main stages for the WEEE recycling process in the city of Rio de Janeiro: The Receiving (1), The Selection (2), The Processing (3), and The Destination (4); The receiving is considered to be part of the formal recycling chain that is made by the NGO's, the Cooperatives or by the private sector start up initiatives projects. But an informal part of the receiving stage can also be made by the street scavengers (street garbage pickers) and by the waste landfill scavengers. After that, the WEEE are sent to the selection stage, where they'll have a proper care done by the specialized cooperatives, NGO's, private companies and informal agents. At this stage, the toxic components are separated and sent to the following stage, the processing, where they crush and compact materials with similar characteristics first, so they can be brought later to the recycling industry companies. This proven process, is made by a few specific companies, most of them situated in the state of São Paulo.

Informal protagonists are found at all stages of the recycling process in the district of Rio de Janeiro and they're characterized by the selling or the processing of the WEEE without environmental licensing, invoice slip, etc. In addition, it is believed that there are people who mediate the protagonist's connection to a low infiltrated recycling chain area. In relation to the final destination which the WEEE components receive, they might end up at the landfills of COMLURB (Urban cleaning municipal company), they might as well fall in the hands of the private sector or even to some illegal landfills. Another possibility for WEEE
components is their usage by domestic industries looking to incorporate on their productive process and reuse the most valuable materials to export or resell them. The reuse process, as for precious metals for instance, does not exist in Brazil yet; nonetheless, some national initiatives have started and some are in the implementation process, others in the planning process, showing the market's willingness to encompass all the recycling chain within Brazil.

Formal protagonists conduct a structured recycling chain that may take different forms and are supported into a logistic chain, whereas the WEEE are normally forwarded to Sao Paulo, home to a lot of companies specialized on WEEE processing, and after the processing, they're sent abroad. Members of the formal recycling chain protagonists from Rio de Janeiro's district are: COMLURB, Cooperatives, Auctioneers, Technical Assistance, Private initiative, NGOs and Processing companies. What’s being called the recycling informal market in this study represents the number of actions made by the ones involved in the recycle chain in the district of Rio de Janeiro that somehow are not legalized, either by being unregistered or by not having a proper license to work, engendering a considerable harm to the environment and to human health.

What can be analyzed from this scenario involving many informal protagonists into the recycling chain is that there is a mismatch between the demand from the WEEE recycling companies and the capacity of the formal market to attend this demand. As there's a great demand for the companies located in Rio de Janeiro's district, Sao Paulo, Minas Gerais and other countries also, it's basically motivated in a way by the high costs from the materials found in WEEE. The need for informal protagonists is a must due to the lack of enough electric electronic residues available through formal legal channels. Besides, the residue found in electric electronic equipment, when selected may reach the highest sale value amongst the recycle products; and as demanded, this kind of residue can be extracted in many different forms, what motivates even more informal agents to get into the recycling chain.

Difficulties were found while investigating the recycling waste management due to the historically known organized crime participation, as mentioned in the article by Andre Trigueiro, published by the news website g1.com.br. Also Mr. Trigueiro is the creator of the blog called "Mafia do Lixo" which translates to "Mafia Trash". As predicted, many difficulties were found to get accurate
information and data. Many agents, who'd been contacted, wouldn't allow themselves to provide information and the ones who did, only did it after they were sure no shame was being played upon them by their competitors tying to have access to privileged information. Still, mapping the informal recycling market was harmed by two reasons: first, because of the great geographic diversity of the protagonists, making it impossible to give a more complete sampling. Second, by the fact that most of the interviewed regarded the city of Duque de Caxias as being a illegal WEEE processing center. Because this study's focus is in the city of Rio de Janeiro, it was unable to deepen on that matter. A determined agent was asked about the possibility to investigate Duque de Caxias, and warned saying: "If you go there asking too many questions, wondering who's selling, who's buying, you may not come back".

The WEEE management is a worldwide concern and awakens a regulation need in many countries. The WEEE cross-border flux, toxic but valuable, are moving a big international formal and informal chain. From the start to the end, the WEEE recycling has the potential to be highly risky, not worth the benefits. However it can also be safe and profitable, depending on how it's operated. The biggest challenge to the formulators of the WEEE reverse logistics is indeed to incorporate the informal market, to regulate and monitor these agents, something that isn't being looked after nowadays.

In addition, no definition, study or debate regarding the limits on the monitoring criteria that is supposed to exist to avoid illegal WEEE exportation to developing countries without the proper structure to recycle is in progress. This is a problem being debated seriously in many countries, while Brazil is far beyond debating this issue. There's another topic receiving no proper attention in Brazil regarding WEEE: the WEEE recycling certification programs.

From that, it's possible to guess that by being in a developed structured recycling formal market many relevant subjects lose their ideas in agendas of debate since there are no measures for this specific area. It should be a priority, but it’s not, and also Brazil lacks the latest technologies to process certain WEEE’s components. While the needed technology is not a reality, foreign companies will keep establishing themselves in Brazil, therefore, reducing exportation costs and creating a bigger market expansion to their business. The goal to find a common solution to WEEE reverse logistics in Brazil that gathers
all the involved protagonists in this recycling chain has been a task for the electric-electronic thematic working group (GTT-REE, in Portuguese, 2012) which also the PNRS counseling board got involved on doing since May 2011. In order to be successful, the WEEE reverse logistics group counts on the support from the private sector, civil society and from the public authorities. With the support from these different groups, the GTT-REEE is able to work on different platforms, looking after its own interests. Many challenges, especially those found in Rio de Janeiro, seem to have spread out countrywide and actions were taken so that the implementation of the WEEE reverse logistics could be achieved, that is being one of the many goals established by the PNRS.

A new methodology is being developed by the GTT to give a different distinction for WEEE based upon its dimension and characteristics, and from that perspective, each manufacturer would be responsible to recycle its own product. Other issues considered as obstacles to WEEE reverse logistics implementation in Brazil were also mentioned by the GTT, such as: transportation, legislation, simplified fiscal policy, differing state and municipal laws, among many other things. The full potential to implement the PNRS in Brazil and in Rio de Janeiro was acknowledged, however, Brazilian entrepreneurs need to act rapidly and seek new opportunities alongside the public authorities in order to enhance present legislation and inspection with the intention of understanding the current reality and all the present difficulties including highly tax rates and bureaucracies. Major efforts would be needed, no doubt, to bring formal ways of labor to a specific group of people working on society’s shine less side.

In short, many questions were brought up by this study which deserves deeper investigations. One of the questions is regarding tips received pointing to an WEEE illegal scheme on processing and dismantling these types of residues in the city of Duque de Caxias and according to some reports coming from all over Brazil, illegal activities are being done by some companies regarding WEEE’s components. Some of the people interviewed in this study confirmed that these same companies are exporting WEEE components to Asia and to the Middle East in order for them to be recycled at their informal and illegal recycling market.

For a better understanding and mapping of all the WEEE recycling chain in the city of Rio de Janeiro, quantification studies would have to be made about the
whole WEEE destination process, from the beginning to the end, along with different studies not only in Rio’s district, but its surrounding cities as well.

**Keywords**

Waste Electrical and Electronic Equipment (WEEE) Management; Solid Waste National Policy; Reverse Logistics; Recycling; Rio de Janeiro.