



Inclusion of waste pickers in the reverse logistics of Waste Electrical and Electronic Equipment (WEEE) – the case study of Projeto Eco Eletro

Inclusão de catadores na logística reversa de Resíduos de Equipamentos Elétricos e Eletrônicos (WEEE) – o estudo de caso do Projeto Eco Electro

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ABSTRACT: This paper aims to understand the insertion of cooperatives of recyclable waste pickers in the market of Waste Electrical and Electronic Equipment (WEEE) in Brazil based on the National Policy on Solid Waste (PNRS). To that end, a case study of the Projeto Eco Eletro was undertaken. The policy is first described in general terms and then explored in specific topics. Six interviews with different actors in the field of electronics were also carried out. The main results were the summarization of four critical points present in the PNRS for the inclusion of waste pickers into the WEEE market, and opportunities and challenges faced by the Projeto Eco Eletro, which are the same as those faced by cooperatives in their day-to-day work within the WEEE market. It was concluded that there is a clear barrier in the access of the waste pickers' cooperatives in sectoral negotiations and in the market. Furthermore, there is a contradiction by the government, which envisioned the inclusion of collectors without promoting concrete actions for such inclusion to occur, especially given the existent economic interests in the sector.

Keywords: Waste Electrical and Electronic Equipment (WEEE); National Solid Waste Policy; waste pickers.

RESUMO: Este trabalho visa compreender a inserção de cooperativas de catadores recicláveis no mercado de Resíduos de Equipamentos Elétricos e Eletrônicos no Brasil (REEE) com base na Política Nacional de Resíduos Sólidos (PNRS). Para isso foi feito um estudo de caso do Projeto Eco Eletro. A política é descrita primeiramente em termos gerais e depois explorada em tópicos específicos. Além disso, foram realizadas seis entrevistas com diferentes atores no campo dos eletrônicos. Os principais resultados foram a síntese dos quatro pontos

críticos presentes na PNRS para a inclusão dos catadores no mercado de REEE e as oportunidades e desafios enfrentados pelo Projeto Eco Eletro, que são os mesmos enfrentados pelas cooperativas em seus cotidianos no mercado REEE. Concluiu-se que existe uma clara barreira de acesso às cooperativas de catadores nas negociações do Acordo Setorial e também no mercado. Além disso, há uma contradição do Estado que ao contemplar por lei a inclusão de catadores não realiza ações para que tal inclusão aconteça, especialmente diante dos interesses econômicos que existem no setor.

Palavras-chave: Resíduos de Equipamentos Eletroeletrônicos (REEE); Política Nacional de Resíduos Sólidos; catadores.

1. Introduction

Waste electrical and electronic equipment (WEEE) is a new type of waste that has been rapidly growing around the world due to technological innovation and the short life span of electronics and electrical equipment. WEEE management is a challenge in both developed and developing countries due to the rapid exchange of equipment (Baldé *et al.*, 2015). In this context, the volume of WEEE increases three times faster than the volume of common waste (World Bank, 2012). It is estimated that the amount of this type of waste in Brazil is approximately one million tons per year (ABDI, 2013).

According to the Brazilian Agency for Industrial Development (ABDI), “electronic equipment are all those products whose operation depends on the use of electrical current or electromagnetic fields.” They can be divided into four categories: white line (refrigerators and freezers, stoves, clothes and dishwashers, dryers, air conditioners); brown line (tube, plasma, LCD and LED monitors and televisions, DVD and VHS players, audio equipment, camcorders); blue line (blenders, electric irons, drills, hairdryers, fruit juicers, vacuum cleaners, coffee makers) and; green line (desktop computers and laptops, computer accessories, tablets and cell

phones) (ABDI 2013). The focus of this study is the green line.

Since 1991, there have been discussions for the creation of a National Solid Waste Policy (*Política Nacional de Resíduos Sólidos - PNRS*) in Brazil, but it was only effectively approved in 2010 (Brasil, 2010). It is important to emphasize that the PNRS relies on the principle of shared responsibility for the product life cycle: manufacturers, importers, distributors, traders and consumers are responsible for the final destination of WEEE. This means that all related parties bear product liability. In other words, the waste must be collected and reinserted into industrial production, avoiding it ending up in landfills or dumps. Under the law, there would be a period of four years for adaptation by companies, traders, distributors, manufacturers and others (ABDI, 2013).

This process of returning the waste to the factories of origin is called “reverse-logistics”, the objective of which is to reinsert the waste into the production chain to create new products or to reuse components as a raw material in by-products (Brasil, 2010). Through this system, recyclable materials from a discarded electrical or electronic product can return to productive use as a raw material in its own right (ABDI, 2013). Given that most WEEE is not collected and treated, WEEE

tends to not be disposed of correctly. In addition, these devices often travel thousands of kilometers to reach developing countries where rudimentary and inefficient techniques are used to extract materials and components, endangering vulnerable populations and environments, such as Guiyu in China and Agbogbloshie in Ghana (Baldé *et al.*, 2015).

In Brazil, because WEEE is often mixed in with recyclable materials, they are usually picked up by waste picker cooperatives and can even be a source of significant financial income for these workers, who depend on the waste found in the garbage to survive. This category of workers (collectors of recyclable material) is generally composed of people looking for alternatives for survival because they are generally excluded from society. Their job is to collect, sort, transport, package and sell to companies that recycle the recyclable material they collect. In this process, waste pickers transform what might otherwise be considered worthless or useless into valuable commodities. Thus, waste pickers add value to this waste stream (IPEA, 2013; Gonçalves-Dias *et al.*, 2014). They are capable of transforming waste into revenue by reinserting materials into the production cycle and providing financial benefits to the waste pickers themselves, as well as providing environmental benefits since they avoid the pollution created from the discarded material and save disposal space (Magalhães, 2012).

In Brazil, since the 1930s there have been reports of people who subsist on waste picking, making the collection of materials an occupation in which waste pickers serve as the basis for the recycling industry in the country ((Teodósio *et al.*, 2014). Collectors of recyclable materials are found in various states of social vulnerability, such as the street population and ex-homeless people who find

a way to survive through the commercialization of waste (Santos, 2003). Freire (2002) shows that one-third of the street population of São Paulo uses such collection work to survive. These waste pickers, whether organized into cooperatives and associations or not, collect and separate the recyclable material they find and sell it to intermediaries, who generally accumulate these materials and sell it on to other companies so that this material is recycled (Gonçalves-Dias *et al.*, 2014).

This market, formed around the commercialization of waste, has enabled a portion of the Brazilian population to be reinserted into the market (Migueles *et al.*, 2004), generating work, income and social inclusion for them. Thus, due to this group of workers, even with national regulation developing at a slow pace, recycling has continued to grow in Brazil (Gonçalves-Dias *et al.*, 2014) and the work of waste-pickers has become the beginning of an economic chain (Teodósio *et al.*, 2014; Gonçalves-Dias, 2009).

In spite of the fundamental role they play in the recycling chain, through urban cleaning work and contributing to the more environmentally correct disposal of waste, these workers receive little recognition for their contribution (Santos *et al.*, 2014). The recycling market has tremendous potential for social inclusion for these people, for whom opportunities have been typically scarce or non-existent (Teodósio *et al.*, 2014).

This informal market helps to provide a better standard of living for these workers. In most cases, although in precarious conditions, this work provides a livelihood for them and their families (Medeiros & Macedo, 2006). Gradually, this has led some of them to organize themselves into cooperatives and associations and, together, they

have managed to improve their working conditions (Gonçalves-Dias, 2009; World Bank, 2012). Thus organized, they actively created the National Movement of Collectors of Recyclable Materials (*Movimento Nacional de Catadores de Materiais Recicláveis* - MNCR), a social movement incorporating thousands of other waste pickers to mobilize the approval of the PNRS in 2010: Law 12.305/2010 (Santos *et al.*, 2014). They also worked, in time, on the Interministerial Committee for the social inclusion of recyclable waste pickers. Such participation indicates the special role of the national movement in its insertion in solid waste management in Brazil. (Teodósio *et al.*, 2014).

In this context, with the potential to generate billions of dollars, and the economic difficulties of this segment of the population, it is necessary to understand the opportunities these people have in the WEEE market, considering the structure of the law. There are also many dangerous metals and contaminants that are difficult to break down into such waste. When combined with common garbage, materials such as mercury, cadmium, arsenic, lead, and other heavy metals and chemicals contaminate soil and groundwater, adversely impacting plants, animals and human beings. The consequences of these contaminations are diseases that compromise the nervous system and can cause cancer (Araújo *et al.*, 2012). According to the US government environmental agency (EPA), WEEE heavy metals are estimated to account for 70% of the country's river and air pollution (Aradas, 2012).

In addition, the electronics industry relies on rare earth minerals for the extraction of these metals, which are mainly concentrated in China. According to the United Nations University in Ja-

pan, the manufacture of such equipment receives the equivalent of USD 16 billion of gold and USD 5 billion of silver, and 15% of this material is being recycled, the so-called "urban mining" (Aradas, 2012). Metal mining from WEEE generated USD 1.42 billion in 2011. In this way, manufacturers and recyclers have developed techniques for collecting and treating WEEE. However, these urban mining activities in WEEE are still quite limited and most countries do not even have a system of collection and separation for these materials.

The recyclable waste pickers in Brazil have found a new opportunity to increase income in the electronics market, but their entry into this market is hampered by uncertainties relating to the structure of this market in Brazil. This paper aims to structure the insertion of cooperatives of recyclable waste pickers into the market for waste electrical and electronic equipment in Brazil based on the National Policy on Solid Waste. To illustrate their insertion into this market, the paper first describes the Projeto Eco Eletro¹ and brings to the fore some key reflections and questions for future research on the subject. This paper depicts the reality of the waste picker cooperatives, particularly their strength and influence in the creation of PNRS. The policy is outlined and then explored by topic.

2. Methodological procedures

This research was based on a qualitative-exploratory approach and adopted the unique case study method (Yin, 2015). The studied case was the Projeto Eco Eletro developed by the GEA Institute and LAS-

¹ We chose to keep the original name of the project in Portuguese. In English it could be translated as Eco Electro Project.

SU – Sustainability Laboratory of the Department of Computer Engineering and Digital Systems of the Polytechnic School of the University of São Paulo - USP. The direct participation of one of the researchers in the project was crucial to their choice. Due to this involvement, the researcher was able to map the main actors of the network. Furthermore, the Projeto Eco Eletro focuses on the insertion of cooperatives into the WEEE market, contributing to greater security in the process of sorting materials and increasing the income of these cooperatives. For this reason, the program was qualified as a relevant experience and met the objectives of this research.

Thematic dimensions were identified in the text of the PNRS for subsequent analysis and discussion of which space the cooperatives are inserted when it comes to the WEEE market. Consequently, this work is divided into two parts. The first focuses on the analysis of the legislation and the second focuses on the interviews. Finally, the Projeto Eco Eletro is used as a case study from which to draw our findings. Firstly, four critical points of the PNRS were considered relevant to understand the relationship between the PNRS and the insertion of waste pickers in the WEEE market.

Three waste pickers from three different cooperatives were interviewed, one of them being from the MNCR. Also interviewed was a representative of the Brazilian Association of Electrical and Electronics Industry (ABINEE), a representative of the Environmental Company of the State of São Paulo (CETESB) of the department of Public Policies of Solid Waste and Efficiency of Natural Resources and a professor of Projeto Eco Eletro, who leads a professional training course for waste pickers which is described in more detail further on. The interviews were conducted from May to November of 2017. All interviews were con-

ducted in person and recorded, averaging 40 minutes in length. The interviewees signed a consent form and allowed the publication of the collected data.

The interviews were semi-structured, based on a pre-established script, which sought to understand how the cooperatives are inserted in the WEEE market, from the perspective of different actors. There were two questionnaires for the interviews (table 1). Both scripts contained six questions to guide the interview, although other issues arose as the interview progressed. As these interviews served to further research, the questions that contributed to this research were as follows:

Script 1 was intended for the general group. Group 1, in general, was composed of a representative of the Brazilian Association of Electrical and Electronics Industry (ABINEE), here named as R-ASS; a representative of Environmental Company of the State of São Paulo (CETESB), named as R-GOV and a professor of the Projeto Eco Eletro, WAG named as R-ACAD.

In script 2, the questions were addressed to the waste pickers. Group 2, comprised of recyclable waste pickers, was divided into Waste Picker 1, who works with WEEE in the city of São Paulo, and Waste Picker 2, who also works with WEEE in the city of Cotia, both of whom participated in the Projeto Eco Eletro. Waste Picker 3 – MNCR, belongs to the national movement of recyclable materials collectors and did not participate in the Projeto Eco Eletro.

3. Presentation and discussion of results

Working with the law itself, it was necessary to separate the relevant topics of the law for the study, determining the provisions that are relevant

TABLE 1 – Script for the Interviews.

Script 1

- I) Who do you see as the main players in the WEEE market?
 - II) Do you see cooperatives of waste pickers as actors as well? How do you see their participation in this market?
 - III) Do you participate in the industry agreement? What do you expect from the sectoral agreement for WEEE?
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Script 2

- I) Who do you think is in this WEEE business besides you and your buyers?
 - II) Do you think the government is part of this business too, helping with some policies, providing some rules, fines, incentives?
 - III) Do you know what a sectoral agreement is? What do you think you can expect from it? Have you ever been invited to attend negotiations?
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SOURCE: own elaboration.

to waste pickers and to understand how (or whether) this insertion is occurring in the context of WEEE. Thus, four critical points involving the PNRS and the inclusion of the waste pickers in the WEEE reverse-logistics chain were highlighted. The four points are described below:

(I) The inclusive nature of the PNRS. The law makes provisions for social inclusion, specifically regarding waste pickers with the express aim of inserting waste pickers into the WEEE market.

In this sense, there was social participation in the formulation, implementation and evaluation of public policies. In Article 6 of the PNRS, the principles of the policies are: III - the systemic vision, in the management of solid waste, considering environmental, social, cultural, economic, technological and public health variables; VIII - recognition of reusable solid waste and recyclables as an economic good and of social value, generator of work and income and promoter of citizenship (Brasil, 2010); National and State Solid Waste Plans: V - targets for the disposal and recovery of dumps, associated with social inclusion and the economic emancipation of recyclable waste pickers.

(II) Shared responsibility. The concept of shared responsibility makes every individual, business and the state accountable for the entire life cycle of WEEE, including the order of priorities in solid waste management (prevention, reuse, recycling, disposal in landfill). As concerns the situation of waste pickers within this notion of shared responsibility, the law assigns responsibility to businesses (manufacturers, importers, distributors, and sellers) to ensure environmentally adequate disposal of the waste. Section II of Article 30 of the PNRS says: Shared responsibility for the product life cycle is hereby established, to be implemented in an individualized and chained manner, covering manufacturers, importers, distributors and traders, consumers and contractors of public services of urban cleaning and solid waste, depending on the duties and procedures set forth in this section (Brasil, 2010).

Article 31: Without prejudice to the obligations established in the solid waste management plan and with the purpose of strengthening shared responsibility and its objectives, manufacturers, importers, distributors and sellers bear responsibility that covers [...] III - collection of products and the remaining

waste after use, as well as their subsequent final environmentally appropriate disposal, in the case of products subject to a reverse logistics system in the form of Art. 33 (Brasil, 2010).

(III) Reverse logistics. Reverse logistics can be an essential instrument for the inclusion of waste pickers since waste pickers become actors of reverse logistics in the WEEE market. According to the PNRS:

XII - reverse logistics: an instrument of economic and social development characterized by a set of actions, procedures and means to enable the collection and restitution of solid waste to the business sector, for reuse in its cycle or in other productive cycles, or other environmentally appropriate final disposals (Brasil, 2010).

Article 3. For the purposes of this law: XII - reverse logistics: an instrument of economic and social development characterized by a set of actions, procedures and means to enable the collection and restitution of solid waste to the business sector for reuse, in its cycle or in other productive cycles, or other environmentally adequate final disposal (Brasil, 2010). Article 33. Obligated to structure and implement reverse logistics systems, upon return of the products after use by the consumer, regardless of the public urban cleaning and solid waste management services, manufacturers, importers, distributors and traders of [...] VI - electrical and electronic products and their components (Brasil, 2010).

(IV) Sectoral agreement. Particular attention is paid to WEEE since, depending on what is resolved, waste pickers may or may not work with these materials. According to the PNRS, a sectoral agreement is an “act of a contractual nature signed between the public authority and manufacturers,

importers, distributors or merchants, with the purpose of implementing shared responsibility for the product life cycle;” (Brasil, 2010).

In CHAPTER II – DEFINITIONS of PNRS, Article 3 establishes, for the purposes of this law, that the following definitions shall apply: I - sectoral agreement: an act of a contractual nature signed between the public authority and manufacturers, importers, distributors or traders, with the purpose of implementing shared responsibility for the product life cycle. Paragraph 3 of Article 20 of Decree No. 7.404/10: the proposed Sectoral Agreement may be prepared with the participation of cooperatives.

Article 33: Manufacturers, importers, distributors and traders are required to structure and implement reverse logistics systems, upon return of products after use by the consumer: [...] VI - electronics products and their components. § 3 ... the manufacturers, importers, distributors and traders of the products referred to in items [...] VI or of the products and packaging referred to in items I and IV of the head paragraph and paragraph 1, take all necessary measures to ensure the implementation and operation of the reverse logistics system under its charge, according to that established in this article, enabling, among other measures. [...] III - work in partnership with cooperatives or other forms of association of collectors of reusable and recyclable materials, in the cases dealt with in § 1. Paragraph 1: In accordance with the provisions of a regulation or sectoral agreements and terms of agreement signed between the public and the corporate sector, the systems provided for in the head paragraph shall be extended to products sold in plastic, metal or glass packaging and other products considering the degree and extent of the impact on

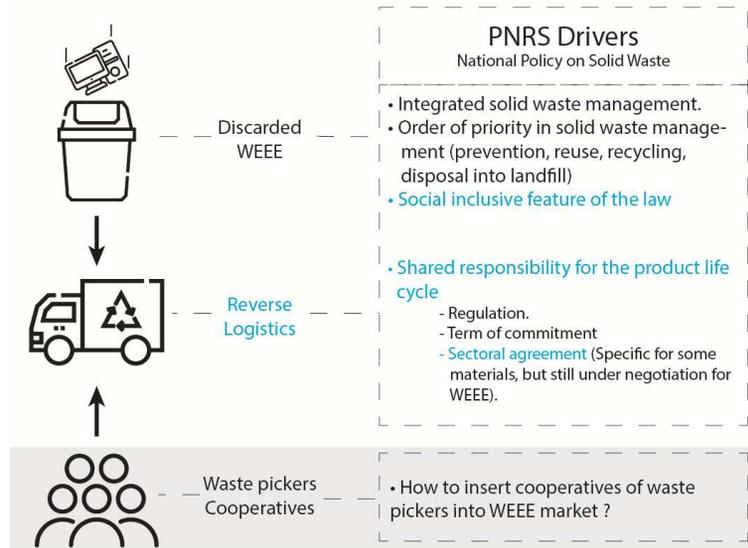
public health and the environment of the generated waste (Brasil, 2010).

The law considers the shared responsibility for the product life cycle to include the disposal of the equipment after its use. Thus, the return of WEEE to manufacturers is done by reverse logistics. In Article 15 of Decree No. 7.404/2010, which regulates the PNRS, three instruments are put in place to implement the reverse logistics: I - sectoral agreements; II - regulations issued by the Government; Or III - terms of commitment (Brasil, 2010). In the case of WEEE, the instrument used is the sectoral agreement. Considering the inclusive nature of the law, cooperatives should have leeway to elaborate and negotiate these identified critical points. Figure

1 below shows that cooperatives can be inserted into the WEEE market through reverse logistics.

Figure 1 shows the scheme that summarizes the four critical points present in the PNRS for the inclusion of waste pickers in the WEEE market (in blue). In this regard, only the waste picker involved in the national movement of waste pickers knew what a sectoral agreement was, but he knew absolutely nothing about the progress of the WEEE agreement.

Oh, that should not be very good for us, no, I think it's more for an entrepreneur... These guys never do a good thing for us ... Never ... Ever since I've been in a cooperative... [...] just wants to take advantage... (Waste Picker 1).



In blue: the critical points present in the PNRS for the inclusion of waste pickers in the WEEE market.

FIGURE 1 – Critical points present in the PNRS for the inclusion of waste pickers in the WEEE market.

SOURCE: Own elaboration. Image by Andrés Felipe Torres.

The other two pickers, despite working with WEEE, did not know what a sectoral agreement was. When it was explained and they were then asked what they expected of the agreement, there were different responses:

So, we are not there, and I would like very much that we, cooperative, not just mine, but all, participated. (Waste Picker 2).

No. Not the electronics. No, we do not. We always try to participate, right?! From the discussion. But never had a more active discussion. The waste pickers have no active participation in this discussion of the agreement. We know it is in process, this whole thing, right?! But we were not called to participate in that, officially to make a discussion. I cannot see it, understand? [Dialogue with the waste pickers] I think that the electronics companies, of course, they want to get ahead, from the point of view of ensuring an agreement that is good for them, right?! (Waste Picker 3 – MNCR).

It is quite clear that cooperatives do not effectively participate in negotiations, are not informed, are not called to participate and are not aware of what has happened to the regulations of materials with which they themselves work. It is also noted that waste pickers do not expect the agreement to be good for them. They have the view that companies will do what is best for them, regardless of the consequences for the cooperatives. There is also a desire for dialogue and participation in the discussions of the agreement, which can be observed in the responses of waste pickers 2 and 3.

As for the general group, everyone knew what a sectoral agreement was. The ABINEE Representative (R-ASS) participated in the meetings on the sectoral agreement and sees the waste pickers

as informal actors which should not exist in the WEEE market.

The industry that produces, the importer, the distributor with this function. The trade that sells, will receive this product back, the consumer returning it at the end of its useful life. Notice that in this value chain there are two actors you commented, that necessarily do not need to exist for this to work. Namely, the waste pickers and cooperatives (R-ASS, 2017).

In addition, RA believes that only the companies should join the discussions of the sectoral agreement, without the participation of the cooperatives or any entity other than the companies.

So who goes, who will compose a sectoral agreement of electronics are these entities. Manufacturers, importers, distributors, traders which must sign the agreement. There is no waste picker (audio failure) in the deal (R-ASS, 2017).

For the teacher of the professional training course for working with WEEE (Project Eco Electro), the negotiations of the sectoral agreements are closed to participants who are not companies. Therefore, the companies hold the power in the decisions on the agreement.

So, there are these types of agreements that are made between companies. And the manufacturing companies, especially, who have the power in their hands today to be able to formulate what this sectoral agreement is going to be, right?! There are some meetings, but it is difficult for the public or any other actor to intervene in a really relevant way in these discussions, right?! It's almost... sectoral agreements are being made behind closed doors and everything that is decided at these meetings is going to be valid when these operations begin (R-ACAD).

To illustrate the position of Cetesb, a member of the government, the interviewee R-GOV says that he sees the cooperatives of waste pickers as an important player in the market, but that their work needs to be properly regulated in the WEEE market.

There are people disassembling electronics in several different ways, right?! From super-well-established companies, it looks like a surgical center [...] to so-and-so under the bridge burning thing to recover copper wire, which is illegal, which is an environmental crime. And between these extremes there are all sorts of situations, including many cooperatives of waste pickers operating in this system, as service providers and that today, it is, our concern to formalize and regularize this operation (R-GOV, 2017).

When asked if the agency recognized the waste pickers as actors in the WEEE market.

Of course! So, I do not have an institutional position for CETESB, but personally, I think that what exists must be recognized. Whether for regulatory purposes or for prohibition purposes. In the case of waste pickers, I think it's regulation, I think that waste pickers can, in some cases, should deal with this waste, provided there are adequate conditions for it (R-GOV, 2017).

To do what the interviewee proposes, investments would be necessary. In this sense, when asked how this could be done, he says that the money raised for reverse logistics should be used to invest in these workers. The position of RC on the work of cooperatives is that there is a need for investment in them, to give them autonomy so that they can compete in the market on equal terms with the companies. However, he realizes how difficult it is for this to happen.

The resources would come from the logistics, from the companies that would have to pay. Now it's hard to move this forward. [...] There will always be levels of cooperatives, but we have to have a mechanism for them to raise their level, not to create a social stratification of cooperatives, there has to be an upward movement of social inclusion that, in my personal opinion, right?! That comes to a point that we can say "this cooperative is already supported, bye, it will not receive support anymore. Walk on its own, participate in the market and compete with the companies". The only difference is that their business name is a cooperative and not a limited company or SA. It is a different legal entity, but the fact that it is a different legal entity should not be a hindrance to the market and no longer needs support, it will compete on equal terms with private companies that offer sorting, dismantling... (R-GOV, 2017).

R-GOV also raises another point, the financial gains that the work with WEEE brings to the cooperatives. This shows how much WEEE can benefit these workers, provided the work is done in an environmentally appropriate way. The interviewee R-GOV recognizes the complexity and scope of problems, like occupational risks, as can be seen in his following responses.

For this I would need a somewhat more robust program, different mechanisms than what we have today, but I firmly believe that cooperatives can and should work in this sector provided they are properly licensed and able to do this service because we have already seen some cases of financial benefit for the cooperative at the end of the month when the electronic device enters, it is very tempting and... if it is done carefully, with an environmental license, there is no reason not to do it. But we have to remember that there are occupational risks, environment, safety, that you have to worry about. (R-GOV, 2017).

4. Case study: *Projeto Eco Eletro*

The Projeto Eco Eletro was selected as the case study to which these findings are applied and tested. The objective of this program is to insert cooperatives of waste pickers into the WEEE market and, for this reason, it was important to identify the difficulties and opportunities surrounding the theme. The Projeto Eco Eletro provided the cooperatives with training courses to learn how to safely handle WEEE, especially how to dismantle, sort and sell these materials, to help to maximize the income of waste picker cooperatives.

The GEA Institute - Ethics and Environment (hereafter “the GEA Institute”) has been working with waste picker cooperatives since 1999. With the increase in the disposal of electrical and electronic equipment (EEE), accompanied by an increase in recyclable material cooperatives and the lack of legislation to support waste pickers, the GEA Institute realized there was a need to provide technical support to the cooperatives handling WEEE and to reduce the manifold risks of contamination. In 2010, after a visit to the Center for Disposal and Reuse of Information Technology Waste (CEDIR), at the University of São Paulo (USP), the Projeto Eco Eletro was created, in partnership with the Sustainability Laboratory (LASSU) of the Electrical Engineering Department of the University of São Paulo. The laboratory and CEDIR have contributed with technical knowledge, together with the GEA Institute, to train waste pickers to handle WEEE, dismantling and sorting materials in a safe and profitable way (Goya *et al.*, 2013).

The project was financed by Petrobras and lasted for two years (2011-2012). This phase of the

project was able to provide greater knowledge in some areas related to the environment and electronic screening and to teach cooperatives to safely handle electronic materials and increase their income. In the Projeto Eco Eletro, classes were taught about what WEEE is, its health hazards and environmental problems through incorrect handling of waste, how to add value to WEEE and how to obtain greater gains in sales to the recycling industry (Goya *et al.*, 2013). Thus, the main objectives of the project were:

1. To improve cooperative income
2. To insert cooperatives into the WEEE recycling market
3. To prevent cooperative members from being contaminated by WEEE
4. To promote the proper disposal of WEEE

The program was effective in relation to its objectives in that it qualified waste pickers in the safe handling of WEEE and increased the income of cooperatives. In Figure 2, the value of the sale of WEEE before and after the project can be observed. On average, the sale of WEEE obtained a value of R\$ 3.00.

In light of this good performance, a second edition of the course was held between 2014 and 2015. The second phase of the project included the preparation of a new course: remanufacturing of computers. The objective of this phase was to increase the income of the cooperatives and to promote an introduction to the digital inclusion of the waste pickers. In addition, project knowledge replication courses were given to six other universities in Brazil, with the goal of expanding the range of this initiative to cooperatives in Brazil. In this second phase, an online platform for project follow-up and

a book on waste picker stories were developed. A further 78 waste pickers were trained, and the sale price of remanufactured materials reached R\$ 15.00/kg.

The experience with the project provided a series of reflections upon the structure and effectiveness of the National Solid Waste Policy. Thus, opportunities and challenges faced by the project can now be listed, which are the same as those faced by cooperatives in their day-to-day work within the WEEE market.

Challenges:

1. Attempting to partner with companies. At the beginning of the program, there were several attempts at forming partnerships with companies in the hope that they would start using the reverse

logistics services offered by the cooperatives. In this way, the companies would donate to the cooperatives and they would dismantle and sell the pieces to certified buyers. Result: it was concluded that the companies had no interest in this collaborative service due to the lack of knowledge about the work of the cooperatives and distrust of the work of the waste pickers.

2. Competition with companies in the area. The reverse logistics companies of this equipment are competing with the waste pickers' service and, therefore, having the status of company, end up capturing most of the market.

3. Buyers. When waste pickers sell the materials to certified companies, they sell abroad. But this process is a little time consuming, which

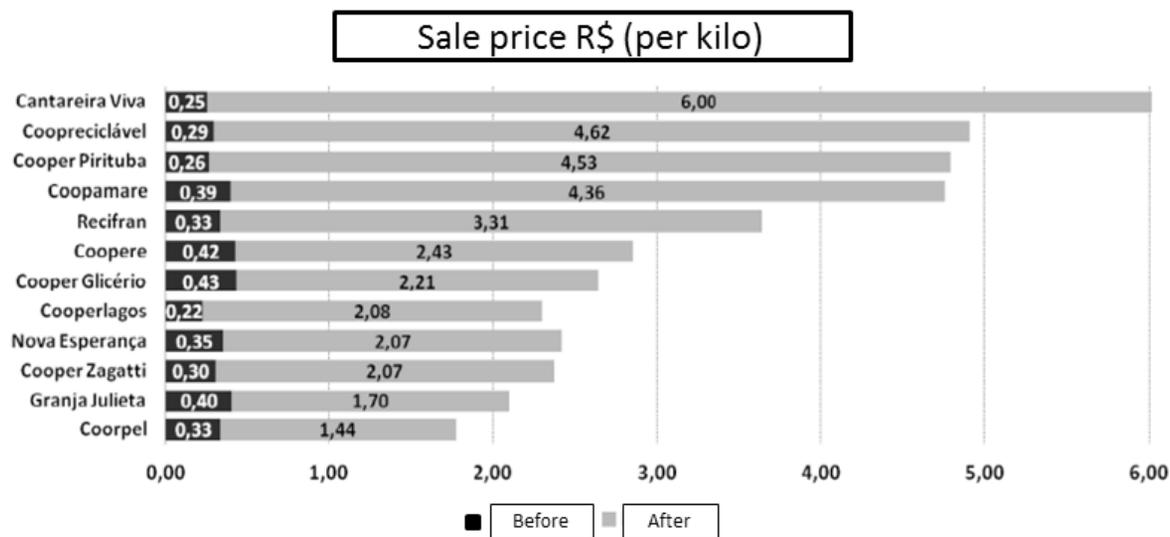


FIGURE 2 – Results of the Projeto Eco Eletro: amounts charged by each cooperative in 2012.

SOURCE: Goya *et al.* (2013).

discourages the waste pickers from pursuing this approach.

4. Quantity. The volume of material to be sold must be large so that the waste pickers can get good prices and negotiate values. However, collecting material is very difficult and it takes time to accumulate it.

5. Little effectiveness of the law. Despite the inclusive nature of the law and its various management tools, the PNRS has not been effective enough to definitively include the waste picker in the reverse logistics of WEEE.

6. Lack of knowledge of the law. Although some cooperative members know about the PNRS, most do not. The lack of knowledge about the policy and its guidelines harms the cooperative because it does not allow the workers to protect and demand their rights.

Opportunities:

1. Collection campaigns. The difficulty in collecting materials with companies forced the workers to collect this equipment in another way. Thus, the most successful model to solve this problem was collection campaigns. In these campaigns, the collection days were publicized, and condominiums, clubs, small offices, the public and streets were mobilized for the collection of WEEE. In each campaign, approximately 800 kilograms of WEEE were collected.

2. Awareness. Collection campaigns brought the public closer to the work of the cooperatives, raising awareness about the importance of the issue to society.

3. New projects. The Projeto Eco Eletro enabled the creation of new projects, such as the “Descarte Legal” (Cool Discard), a program funded by Caixa Econômica Federal. This project was linked with reverse logistics. Caixa Econômica Federal wanted to implement the right model for the disposal of WEEE. To do so, they contacted the manager of Projeto Eco Eletro and suggested a collaboration on a new program.

4. Constant dialogue with buyers. Research showed the importance of communication with buyers and the knowledge they can bring to the commercialization of the materials. Therefore, maintaining contact with them proved to be crucial to the success of sales.

The waste pickers of the cooperatives participating in the Projeto Eco Eletro worked with WEEE but did not sell their materials to certified companies, as most cooperatives do not. Most of the time they sell this equipment to scrap dealers as iron scrap and earn little from the sale of the material, besides having no guarantee as to the final destination of the waste. The Projeto Eco Eletro works precisely on these critical points, seeking to enable waste pickers to work with WEEE, encouraging them to sell to certified buyers and work safely with this material. In this sense, it was possible to note that Projeto Eco Eletro contributed to the inclusion of approximately 60 cooperatives in the WEEE market and increased their technical and operational capacity.

However, in enumerating the difficulties encountered and the complexity in solving them, it was found that with the few resources they have, it would be very difficult for cooperatives

to access this market without the technical and financial assistance of the Projeto Eco Eletro. It was also found that a constant effort is needed to actually include cooperatives in the reverse logistics of WEEE.

5. Discussion

With the sections of the law highlighted in this study, concern with the inclusion of the waste pickers in waste management is evident. Even so, despite the appearance of inclusion in the text of the law, the difficulties encountered by the Projeto Eco Eletro and reported in the interviews show that waste picker cooperatives have been increasingly excluded from the WEEE market, and especially from the sectoral agreement negotiations.

The Projeto Eco Eletro has effectively put several cooperatives in the WEEE market; however, constant support and technical and financial investments are fundamental for these cooperatives to remain in this market. These workers exploit the other side of the system, reintroducing value and invigorating a previously unexplored part of the economy.

In this sense, investing in the qualification of waste pickers for the handling and sale of WEEE should be a fundamental point in the discussions of the sectoral agreement. Investing in the work of these people within the WEEE market ensures that more waste is recycled, promotes environmental education, social inclusion of cooperatives, reinsertion of materials in the production chain, avoiding their inappropriate disposal, and generates an increase in income for cooperatives. Certainly, the presence of the government in the regulation of

the reverse logistics market of WEEE is the most fundamental factor for the coordination of the actors in structuring the reverse chain of WEEE.

The activities carried out by recyclable waste pickers are an important source of income for many families. Enabling ways to promote the organization of these workers in a socially just and economically viable way, besides promoting their independence, is very important to removing this population from a state of vulnerability and to contributing to the improvement of the socio-environmental conditions of the country. However, elements such as the participation of those involved in the discussions of the sectoral agreement and adjusting rules and norms to the local reality are fundamental to the successful implementation of policies around the WEEE reverse chain. Moreover, there is a need for all spheres of government (municipal, state, and federal) to provide subsidies and tax incentives for recycling - promoting environmental education for citizens and implementing more effective mechanisms for the remuneration of services rendered to the municipality - and technical and operational training of waste pickers for the recycling of WEEE.

No other actor was observed participating in the negotiations of the sectoral agreement beyond the companies, which leads us to question whether, after concluding the contract, there will be any room for the waste pickers in this market or whether they will be definitively excluded from this market.

According to specialist Tasso Cipriano, a researcher at the Forschungsstelle für Europäisches Umweltrecht (FEU) at Bremen University, because of the inclusive nature of the law, recyclable waste

pickers are open to working with WEEE and could be part of this large WEEE market².

It is concluded, therefore, that the National Solid Waste Policy is not effectively inclusive when dealing with WEEE, although it does in theory. Another question is raised about the interest of companies in the participation of cooperatives to contribute to the management of WEEE. Since no sectoral agreement is defined yet, cooperatives should be included in the WEEE market should they so wish.

It has become apparent that, even with the work of the cooperatives being carried out in a safe and profitable manner, the Sectoral Agreement favors the companies over the cooperatives. The commitment of companies, public and competent authorities to the principle of inclusion of the waste pickers, as provided by the law, must be explored. The participation of all involved in drafting the sectoral agreement to ensure the inclusion of waste pickers in the reverse logistics systems would benefit all. Despite consistent efforts made by the Ministry of the Environment to promote the WEEE sectoral agreement between the public and private sectors, there are many divergent economic interests of the parties involved. Such factors are unfavorable to the insertion of the waste pickers in the reverse logistics of WEEE in Brazil. There is a contradiction in the government since it establishes by law the inclusion of the waste pickers but does not to execute actions for such inclusion to occur, especially given the economic interests that exist in the private sector.

Considering that the PNRS explains the need to assure the rights of the waste pickers, it is necessary to strengthen the cooperatives and associations

of waste pickers. We must recognize the value of pickers in urban solid waste management and their role in recycling in Brazil by promoting effective access to their rights and ensuring their real participation. These people live in conditions of social vulnerability as economic actors whose work is worthy of recognition and whose rights should be protected. However, it is essential to emphasize that the strengthening of the participation of the waste pickers in the WEEE reverse chain involves its own dynamic and internal organization. State actors and companies involved in the reverse chain of WEEE should support cooperatives of collectors in the coordination and integration of operations in collaborative networks, be it for mobilization, commercialization or technical and operational training. Figure 3 shows where the cooperatives can be inserted into the reverse logistics of WEEE.

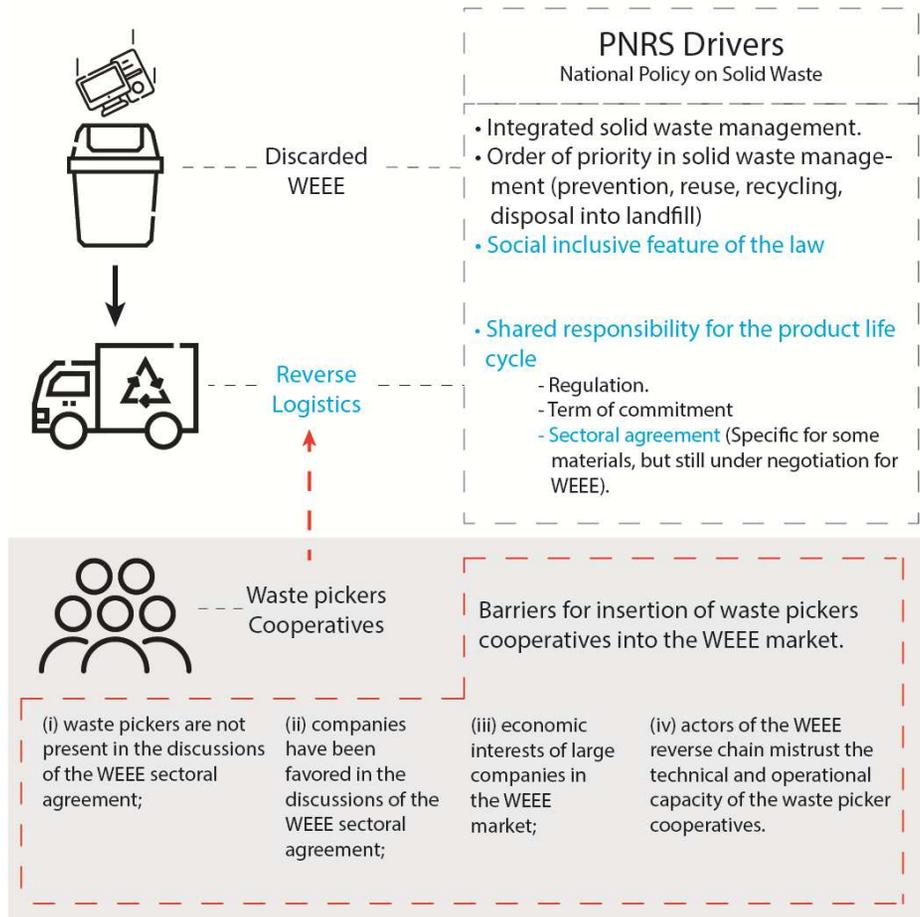
However, there is a clear barrier for the waste picker cooperatives in the negotiations of the Sectoral Agreement and also in the reverse logistics market, as exemplified by the case of Projeto Eco Eletro. Some of these barriers can be explained: (i) waste pickers are not present in the discussions of the WEEE sectoral agreement; (ii) companies and their respective professional associations have been favored in the discussion and construction of the criteria and rules of the sectoral agreement; (iii) economic interests of large companies in the WEEE market weaken the participation of waste pickers; (iv) actors involved in the WEEE reverse chain mistrust the technical and operational capacity of the waste picker cooperatives.

² Information provided in a lecture in the discipline Solid Urban Waste and its Social and Environmental Impacts in the graduate program in Environmental Science of the University of São Paulo in São Paulo, on September 15, 2015.

When Figures 1 and 3 deal with “Environmentally Sound Destination” and “Environmentally Appropriate Final Disposal”, they are referring to Article 3, Chapter VII of the National Policy on

Solid Waste, including the order of priorities to solid waste management:

Environmentally sound final destination: including reuse, recycling, composting, re-cycling or other or subsequent use introduced by the competent bodies



In blue: the critical points present in the PNRS for the inclusion of waste pickers in the WEEE market.
 In red: Barriers for insertion of waste pickers cooperatives into the WEEE the Sectoral Agreement and also in the Reverse Logistics market

FIGURE 3 – Barriers for insertion of waste pickers cooperatives into the WEEE market.

SOURCE: own elaboration. Image by Andres Felipe Torres.

of SISNAMA, SNVS and SUASA, including final disposal, prevention of serious health problems and environmental safety. Environmentally appropriate final disposal: orderly distribution of tailings in landfills, observing specific operational standards in order to avoid damage or risks to public health and safety and to minimize adverse environmental impacts (BRASIL, 2010).

Therefore, even when provided in law, waste pickers cannot access their potential position within the WEEE management under reverse logistics. This causes a problem for waste collec-

ting cooperatives that already work with WEEE, as they encounter obstacles to continue with their work. Additionally, this is also a problem for the collectors who want to enter this market, as they have difficulty crossing the barrier to access it, as shown in Figure 3 above.

Figure 4 shows the flowchart of WEEE in the reverse chain. In blue are the actors presented in the paper, the waste pickers who collect the recyclable material and the capacities of the cooperatives (in this paper exemplified by the Projeto Eco Eletro).

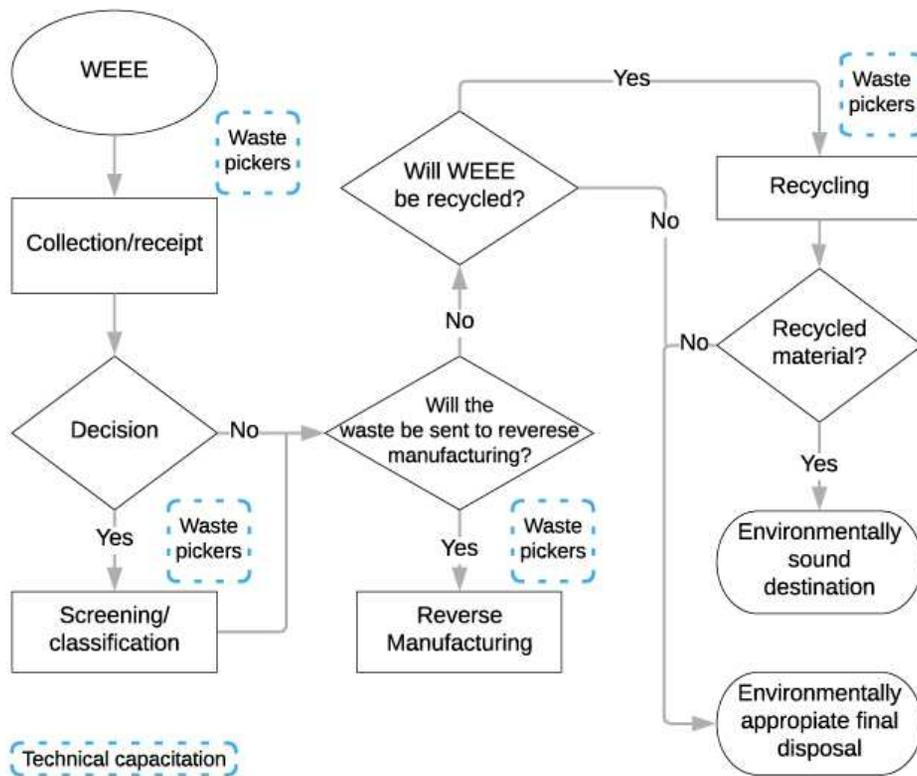


FIGURE 4 – WEEE Reverse Chain Flowchart.

SOURCE: modified from Ewald and Moraes (2014, p.154) with the inclusion of waste pickers into WEEE market

The other actor presented here was a government entity that should be involved in the entire process.

This means that, by law, WEEE should ultimately be recycled. The destination of WEEE ends up being the cooperatives of waste pickers, streets, vacant land and other inappropriate places. In this way, although the PNRS emphasizes the insertion of the waste pickers in solid waste management, there are still many questions to be answered for the legitimization, technical structuring, training, instrumentalization, professionalization, and regulation of waste picker activities in the WEEE reverse chain. Some authors recommend the creation of a discussion forum at the municipal, regional and state levels (Pereira Neto, 2011, Gonçalves-Dias *et al.*, 2014) for capacity building; administrative and operational organization; health and safety at work; infrastructure adjustments; equipment acquisition; technological innovation and support in the elaboration of projects to raise funds to improve the cooperatives of waste pickers in the management, dismantling, remanufacturing and commercialization of WEEE.

6. Final remarks

Considering that the PNRS opens up new opportunities for the waste pickers in their work with recycling, it was expected that the cooperatives would take their place in the WEEE market. However, even with the inclusive nature of the law, the insertion of cooperatives is neither simple nor easy. With the example of the Projeto Eco Eletro, it was possible to identify a series of difficulties and barriers to the insertion of waste pickers into the WEEE market. As a result, certain points of the

law are criticized since in principle it should make proper provisions for the inclusion of cooperatives in the WEEE market but in practice it prevents their inclusion.

The main results were summarized in four critical points present in the PNRS for the inclusion of waste pickers into the WEEE market, and opportunities and challenges faced by the Projeto Eco Eletro, which are the same as those faced by cooperatives in their day-to-day work within the WEEE market. It was concluded that there is a clear barrier for the waste picker cooperatives in the negotiations of the Sectoral Agreement and also in the market. Moreover, there is a contradiction by the government, which envisioned the inclusion of waste pickers without executing actions for such inclusion to occur, especially in the face of the economic interests that exist in the private sector.

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