

## **A new model for fostering SGD 12 in Brazil: Active Recycling Agent - AAR can intensify the circular economy and boost Waste collector's income**

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### **Introdução**

Solid urban waste (MSW) disposal is a major issue in the 21st century. Brazil produced 11% more waste in a decade. Urbanization and the Brazilian economy have failed to absorb and retain a large share of the population in the formal job market and we have now 38.1 million informal workers. Unqualified workers suffer more unemployment and other social difficulties. Waste collection and throwaway products help some Brazilians subsist. Governance Network Theory - GNT may address the complexities, interdependencies, and dynamics of public problem solving like MSW in São Paulo.

### **Contexto Investigado**

The core of this study is one of the author's experiences in using Waste collectors as Active Recycling Agents ('Agentes Ativos de Reciclagem' - AAR) working in the process of his home renovation in peripheral neighborhoods of São Paulo Municipality in the same site where an Ecoponto, a voluntary delivery station exist. Discussion will center on Solid Waste National Policy - PNRS, Sustainable Development Goal 12, Governance Network Theory, and the need for a complete recycling system. It supports a Waste Governance Network, creating a dialogue between society, AARs, and the public sector.

### **Diagnóstico da Situação-Problema**

The present study (qualitative research) seeks to improve the PNRS challenges by redefining the concept, using the designation 'Active Recycling Agent' instead of Waste. It is crucial to push public sector actions' aiming to improve the working conditions of these professionals, who are fundamental human resources for the management of sustainability and to comply with PNRS, minimizing health risks and reducing losses of useful MSW. Furthermore, AAR's job could be economically viable and ecologically efficient if some new arrangements would be assembled.

### **Intervenção Proposta**

The Active Recycling Agent could be a better provider of environmental services to society. The circular economy is one pillar of PNRS, and the use of MSW can reduce the extraction of renewable and non-renewable natural resources from nature, reduce pollution, save water and energy, extend the useful life of landfills, and contributes to sustainable development. This study shows that building community networks considering AAR as the leading actor in a 'regional circular economy' could be of mutual benefit, reducing the cost of both homes and firm renovations and increase their monthly income.

### **Resultados Obtidos**

Active participation was the main method applied in this study, essential for building a collective understanding of the waste collectors' praxis in their daily lives. The four directly involved AARs are 35–55-year-old men with incomplete primary education. Although they contribute to environmental issues, Network Governance arrangements may overcome limitations as: i) low collector remuneration ii) unstable infrastructure ii) unstable infrastructure for collection and sorting, iii) limited scope for selective collection, and iv) an incompleteness of the Recycling Social System (RSS).

### **Contribuição Tecnológica-Social**

An analysis of their relevance to PNRS and the relevance of Ecopontos and ARR in a community network for MSW. After this experience, this study presents a capacity building to increase the monthly income was achieved by four AARs. The Active Recycling Agent is a provider of environmental services to society because, with this activity, it reduces the extraction of renewable and non-renewable natural resources from nature, reduces soil, water, and air pollution, saves water and energy, extends the useful life of landfills, reduces waste and contributes to sustainable development (like SGD 12).

### **Palavras Chave**

Waste collector, Governance Network Theory, MSW

## INTRODUCTION

Brazil has now more than 203 million inhabitants and it is one of the countries that generates the most solid waste, discarded materials, substances, and objects, which should be treated with economically viable solutions in accordance with legislation and current technologies. Some of it is dumped in the open, thrown into the public sewage system, or burned.

Brazilian Association of Public Cleaning and Special Waste Companies (Abrelpe) reports that some MSW is not even collected or are placed in dumpers or irregular landfills. In 2010, 70.8% of the 5,568 Brazilian municipalities disposed of their household solid waste in dumps/controlled landfills; in 2016, this percentage decreased to 59.3% (BRAZIL, 2019).

Since the late 1980s, there has been a growing involvement of Brazilian society in promoting the practice of waste segregation both at the household level and within corporations and public sector. The 2010 National Solid Waste Policy (PNRS) is notable within the global framework for establishing guidelines about post-use waste management, as it effectively incorporates the social, environmental, and economic components.

PNRS defines urban solid waste as all human-made materials, substances, objects, and discarded commodities. Unlike waste, residues can be reused, altered and inserted into a more complete and integrated system. The second cannot be reused and must be disposed of in the most environmentally friendly way. Although the national policy was designed to increase transparency in public and private garbage disposal and management and to foster sustainable development, the reality is different. Most of the solid urban garbage (MSW) is layered in landfills to degrade. In this sense, Brazil's potential for Circular Economy is underutilized.

Additionally, the most recent data of IBGE- Brazilian Statistics Institute, the Continuous National Household Sample Survey (in Portuguese 'Pesquisa Nacional por Amostra de Domicílios Contínua' - Monthly Release - Apr-May-Jun 2023) Report of IBGE- <https://sidra.ibge.gov.br/home/pnadcm>) depicts a difficult situation. The occupation level, which reflects the percentage of people employed in the population of working age is 56.1% and the informality rate is 39.0% of the employed population (or 38.1 million informal workers).

Including other social crisis, there is a higher unemployment rate of less qualified for the formal job market. Among people who did not complete primary school in Brazil, the unemployment rate was almost eight percent in the second quarter of 2023 (<https://www.statista.com/aboutus/our-research-commitment>). Consequently, some of the most vulnerable Brazilians seek disposable items in urban areas and have waste collection as a means of survival.

In a study developed in 2010 (SILVA; GOES; ALVAREZ, 2013) in Brazil, 387 thousand people said their main occupation was scavenging (Waste collectors or Waste picker's), with a national average income of BRL 571.56 per month (at the time above the Minimum Wage of BRL 510.00 - around USD 100). Some of this study outcomes are presented in Table 1 (including only the region where São Paulo State is) concerning the major aspects related to the present investigation.

**Table 1 – Data on the Waste picker’s social situation in the Southeast**

Total Number of Waste picker’s	Age (Average)	Percentage of Women	Percentage of black and mulatto	Percentage of residents in urban areas	Average income
161.417	40,6	30,9	63,0	96,2	BRL 629,89

Source: (SILVA; GOES; ALVAREZ, 2013)

Regarding the recycling production chain, waste collectors are primarily involved in the sorting and informal collection of materials, a relatively unfavorable position that reveals four significant limitations: i) low collector remuneration ii) unstable infrastructure for collection and sorting; iii) limited scope for selective collection (DE PAULA; LIMA; ALVES DE SOUZA, 2016); and iv) an incompleteness of the Recycling Social System (RSS). The collectors are the link in the recycling production chain that appropriates the smallest portion of the value, despite being the most numerous economic agents.

São Paulo is the largest city in Brazil, with a population of around 12.18 million. According to a survey carried out by the City of São Paulo, between January and April of 2022, the city had more than 2,500 points of irregular garbage disposal. One of the strategies to deal with this situation was to install several Eco ponto in all districts, with the objective of storing MSW for recycling, reuse and correct final disposal.

Ecopontos (could be interpreted as ‘Eco-points’) are places for voluntary delivery of small volumes of urban waste (up to 1 m<sup>3</sup> or 20 bags), large objects (furniture, sofas, etc.), tree trimmings and recyclable waste. In these structures, citizens can dispose of waste free of charge in separate buckets for each type of material. As an example, Figure 1 displays an overview of the Eco ponto ‘Vila das Belezas’ sited at Campo Novo do Sul Street nº 500 - located at Campo Limpo, District at São Paulo Metropolitan Region (SPMR)



**Figure 1. Eco ponto of Vila das Belezas – Campo Limpo, São Paulo-SP.**

As observed in the image above, these EcoPonto are spaces made available for the collection of objects and materials that should not be disposed of in the common trash (for municipal waste collection), due to their large volume, the need for specific treatment for their parts or components and their potential for contamination. The main purpose of an EcoPonto is to enable the correct disposal of these utensils, avoiding their abandonment on streets, sidewalks, vacant lots and their final disposal in dumps or sanitary landfills, situations that can lead to environmental damage and the quality of life of the population.

The São Paulo City Hall currently provides 124 units with daily and free service. In 2022 around 315,731.39 tons of waste were received at RMSPP EcoPontos ([https://www.prefeitura.sp.gov.br/cidade/secretarias/spregula/residuos\\_solidos/ecopontos/index.php?p=4626](https://www.prefeitura.sp.gov.br/cidade/secretarias/spregula/residuos_solidos/ecopontos/index.php?p=4626)) Nowadays, they are distributed across the circumscription area of the 32 sub-prefectures. However, citizens must observe the established quantity limits (up to 1m<sup>3</sup> or 20 bags per discharge), avoiding overloading the recycling bins, as each unit can receive up to 150 m<sup>3</sup> of waste in total.

Moreover, concerning Global Governance, one of the most significant concerns lies in the successful integration of environmental sustainability with economic growth and welfare. This implies the separation of environmental deterioration from economic growth and the achievement of greater efficiency in resource utilization. The SDG 12 relies on Sustainable Consumption and Production (SCP) and UNEP's implementation of SCP is fully aligned with the circular economy.

Circular Economy is a strategic concept that is based on the reduction, reuse, recovery and recycling of materials and energy. Replacing the end-of-life concept of the linear economy with new circular flows of reuse, restoration and renewal, in an integrated process, the circular economy is seen as a key element to promote the decoupling between economic growth and the increase in resource consumption. , a relationship hitherto seen as inexorable.

Taking inspiration from the mechanisms of natural ecosystems, which generate long-term resources in a continuous process of reabsorption and recycling, the Circular Economy promotes a reorganized economic model, through the efficiency of production and consumption systems in closed circuits. Besides, it materializes in minimizing resource extraction, maximizing reuse, increasing efficiency and developing new business models.

Unintentionally, the implementation of EcoPontos accidentally facilitated some businesses that contributed to advancements in the management of solid waste in the periphery of São Paulo. These sites serve as a connecting mechanism to engage different actors that could address the aforementioned deficiencies.

The priority agenda is premised on the need expansion of recycling of MSW in Brazil, the idea that this expansion must be based on the economic and social inclusion of collectors of recyclable materials and the basis that only by bringing together the efforts of federated entities (Union, States, and Municipalities), the private sector, social movements and universities will be able to formulate and implement it.

This study examines the improvement of urban solid waste (USW) management by empowering the Waste pickers' as Active Recycling Agents (AAR), which is relevant due population growth and consumption patterns are increasing waste production and because it involves innovative public policies (HEBER; DA SILVA, 2014) that encourage municipal cooperation and regional governance.

## THEORETICAL FRAMEWORK

Public Policy is defined (LYNN; GOULD, 1980) as a specific set of government actions that will produce specific effects. Another relevant author (PETERS, 2005) follows the same point of view: public policy is the sum of government activities, acting directly or through delegation, that influence the lives of citizens. The difficulties of coordination and even coherence in government policies is a problem recognized in the literature.

More than a decade ago it was stated that Governance Network Theory (GNT) had matured into a prominent public administration theory (KLIJN; KOPPENJAN, 2012). The emergence of New Public Governance presents new challenges, but GNT may address the complexities, interdependencies, and dynamics of public problem solving and service delivery that NPM failed to address.

Coordination is the organizing of all activities to reach consensus between individuals and organizations to achieve group goals. Although coordination implies cooperation, they are distinct concepts as individuals cooperate voluntarily for mutual gain (SOUZA, 2018).

Literature indicates that proponents of enhanced coordination tend to advocate for actions that go far beyond what is feasible through voluntary coordination alone. However, as stated “when structural problems inherent within the public sector blocked effective co-ordination the same advocates would fall back upon the argument that the only solutions for co-ordination were voluntary actions by individual organizations”(Peters, 1988, p. 295).

In the realm of Brazilian public policy, there is a physical and structural separation between the principal government agencies that formulate national standards and guidelines and the executing agencies. This distance, compounded by the difficulty of effective effectiveness between different government bodies, creates problems of policy integration, both vertically (between different levels of government) and horizontally (within the same level of government, between public policy sectors that are necessarily complementary, such as sanitation and the environment) (MAIELLO; BRITTO; VALLE, 2018).

Coordination is very important in the policy implementation phase. Implementation is the phase of public policy in action, or what occurs between policy objectives and results, as well as how actors and institutions are coordinated to carry out the policy. Implementation is what connects policy objectives to their respective results (SOUZA, 2018, p. 52). In the case of Brazil, society participation is required both during formulation and implementation.

Federal Law 12,305/2010 (BRAZIL, 2010) establishes the Brazilian National Policy on Solid Waste (PNRS), and establishes principles and objectives for the country, but these activities are to be implemented at the municipal level. An analysis of Municipal Integrated Solid Waste Management Plans (PMGIRS) of the minimum content required under PNRS/2010 sampling seventeen Municipalities (population over 200 thousand inhabitants) regarding the implementation of selective waste collection, concluding that Municipal plans must still address issues of inclusion of unorganized waste collectors, structuring training programs and technical assistance and



infrastructure, so that they can provide selective collection and sorting services (DE OLIVEIRA; GALVÃO JUNIOR, 2016). Furthermore, eight plans analyzed considered the possibility of hiring Waste pickers' to provide door-to-door selective collection.

Although the activity of Waste collectors was recorded in the Brazilian Code of Occupations (CBO) in 2002, representing the formal recognition of the profession, the actions of the Pró-Catador Program (launched in 2003), whose purpose was to integrate and articulate the federal government's efforts to support and promote the productive organization of waste collectors, increase the possibility of reusable and recyclable materials, improve working conditions, expansion of social and economic inclusion opportunities, and expansion of the selective collection of solid waste in Brazilian municipalities are incipient.

Also, even though in 2008 the Cataforte Program was created with the aim of promoting various training actions, technical assessment to consolidate waste picker enterprises, as well as the development of a network action plan, it was discontinued after 2018 (<http://www.ceadec.org.br/projetos/cataforte-III--negocios-sustentaveis-em-redes-solidarias/apresentacao> ).

In the present investigation, the waste collector will be referred to as the Active Recycling Agent (AAR in Portuguese). The main reason for this decision is to change the power of the central figure involved in the activity, since the Portuguese term "catadores" (Waste collector) is considered to be a deficient and unequal simplification of AAR's economic potential.

## **METHOD**

This study uses the action-research method, which facilitates a stronger connection between the researcher and the evaluated group. This approach, being a collaborative methodology, encourages discussions and promotes the establishment of a cooperative process for generating specific knowledge of the group's daily experiences. Consequently, this methodology diverges from the conventional bureaucratic and academic research orientation. The objective of incorporating dialogue as a component capable of unveiling subjectivities was to provide individuals with a genuine opportunity to examine the operations of interactive structures within the community (THIOLLENT, 2005).

Data collection was through observations at Ecopontos and informal interviews (dialogues), during the period spanning from February to August 2023, as a member of the authorship team undertook the responsibility of overseeing, supervising, and executing several refurbishment endeavors pertaining to a residential property situated in the southern region of São Paulo, specifically inside the Campo Limpo district. Over the course of about 120 working days, the researcher engaged in interactions with several AARs. Certain aspects are directly associated with the work's requirements, while others are indirectly related.

Concurrently, visits were conducted to Ecopontos, as well as some 'Junk yards' (in Portuguese 'Ferros Velhos') establishments located in the Campo Limpo neighborhood. These locations named 'Ferros Velhos' can be characterized as areas utilized by waste purchasers for the purpose of accumulating and subsequently selling

waste in bulk. This understanding is crucial in order to comprehend the intricacies of the relationship between the waste purchasers, known as AARs, and the locations where waste is bought for their monthly income.

The term directly Active Recycling Agent refers to the four garbage pickers who frequented the street where the house being restored was located, which part of their daily work considered 'the need to search for items with economic value discarded to sell to this article author, for use in the refurbishing'. On the other hand, the term "AAR indirectly linked refers to other Waste collectors who were seen during the 27 days when the researcher transported solid waste to the Ecopontos.

The two Units that are included by convenience (near the author's home renovation site – Campo Limpo District) in this exploratory study are as follows.

- *Ecoponto: Olinda* – #11 visits  
Address: Rua Nelson Brissac, s/nº x Av. Padre Adolfo Kolping  
Opening: 02/23/2013
- *Ecoponto: Vila das Belezas* – #21 visits  
Address: Rua Campo Novo do Sul nº 500  
Opening: 04/11/2013

On certain occasions (phases of the remodeling project), either one or both Ecopontos were utilized for waste disposal resulting from the author's home improvements, as previously stated, due to a daily delivery restriction. The largest one, Vila das Belezas, was the most relevant (as one can see in the number of visits- twice as many as to the Olinda's).

## RESULTS

Carrying out training activities in waste picker entrepreneurial activity must aim to develop skills and generate positive impacts to guarantee their survival as well as contribute to SGDs. One possible strategy is to create a Network of Producers – Collectors – Consumers of MSW locally (integrating the community). Brazil is committed to by 2030, substantially reduce waste generation through the Circular Economy and its waste prevention, reduction, recycling and reuse actions (indicator 12.5.1 - National recycling rate, tons of recycled material).

The capacity building to increase income and reducing the cost of refurbishing through interactions with AARs, wherein they were taught how to effectively search for certain products while exploring the neighborhood, resulted in a mutually beneficial outcome. This waste management strategy offers numerous advantages that have significant implications for society as a whole.

One notable advantage is its capacity to facilitate the conversion of waste into money by selling selected waste. Therefore, analyzing the sales potential of discarded items following the demands of a community enables their reintegration into the production cycle, thereby generating higher financial rewards for the recycler. Moreover, its utilization yields several benefits for the conservation of natural resources and the ecosystem's equilibrium.

As an additional result, it also yields advantages for the overall well-being and health of the community by diminishing the amount of waste that is not utilized in Ecopontos and subsequently disposed of in landfills. Various materials, including wood, bricks, tiles, iron, metals, glass, and certain forms of plastic, such as tile fragments, are currently undergoing a progressive trend toward reuse.

The incorporation of recycled materials in remodeling projects might yield substantial cost reductions within the construction budget. Furthermore, apart from their ecological and economic advantages, these materials possess the potential to be utilized in innovative and unconventional manners, thereby facilitating the transformation of one's residence into an exclusive and customized environment.

Iron in railings and gates can be incorporated into internal or external areas after treatment. The utilization of recycled glass extends to several applications, including wall coverings, flooring, and even furniture parts. The utilization of recycled aluminum is applicable in several applications such as frames, doors, and windows. Recycled wood has the potential to be utilized in various applications such as flooring, wall coverings, and furniture. The utilization of recycled plastic is applicable in several applications such as the production of tiles, flooring materials, and wall coverings.

By comprehending the distinct attributes of every repair or building endeavor, the AAR may envision the manner in which the requirements for waste disposal by one community member can be aligned with the utilization by another community member.

#### *Almost a logic sequency RSS - AARs*

In the perfect model of Recycling Social System whoever generates the waste (residents of the neighborhood) would need to know which waste can be reused and recycled, so separation would reduce the time spent by AARs "rifling through" garbage bags and will, therefore, have more inputs to be sold. The AARs, in turn, would need some physical space to sort solid waste in order to connect potential claimants who could remunerate them with much higher amounts than the large waste aggregators for wholesale sale ('Junk yard').

Considering the major objectives and targets of Brazilian National Solid Waste Policy – PNRS, the relevance of the Active Recycling Agents is punctuated (Table 2). The evolution of the Waste pickers' role by integrating the community they are related to in peripheral regions of urban areas, allows their protagonism in ecological efficiency and collaborate to interinstitutional cooperation (public and private sector). Thus, only two of the 15 goals of this Law are not related to them ('Environmental labeling', and 'Regularity, continuity, functionality and the universality of services provided').



**Table 2. Objectives and Targets of the PNRS Law No. 12,305/2010 and their Relation to AARs (Active Recycling Agents).**

Guiding principles	Relation to AARs (Y/N)	Direct (DIR), Indirect (IND) or N/A (Not Applied)
Interinstitutional cooperation	Y	IND
Ecological efficiency	Y	DIR
<b>Objectives</b>		
Not generating waste/Reducing the quantity of waste produced	Y	IND
Protection of public health	Y	DIR
Reducing hazardous solid waste	Y	DIR
Economically appropriate final disposal	Y	DIR
Reutilization and recycling	Y	DIR
Integrated management and sustainability	Y	DIR
Technical capacity	Y	IND
Reverse logistics	Y	DIR
Integration of waste Collectors	Y	DIR
Sustainable public purchases	Y	IND
Clean technology	Y	IND
Using waste to produce energy	Y	DIR
Environmental labeling	NO	N/A
Sustainable consumption	Y	DIR
Regularity, continuity, functionality and the universality of services provided	NO	N/A

Source: This research

The fundamental concept of Action research can be comprehended by analyzing its name, which signifies the integration of study and action, or the combination of theory and practice (MCKAY; MARSHALL, 2001). Additionally, it is also dedicated to generating information by seeking solutions to problems in real-world scenarios. In the following sections, the data resulting from the unstructured interviews and subsequent conclusions of this action research will be presented.

Regarding their socioeconomic characteristics, the four directly involved AARs are 35–55-year-old men with incomplete primary education, 25% has an incomplete high-school degree. The Data on the Waste picker's educational situation in the Southeast region of Brazil (SILVA; GOES; ALVAREZ, 2013) shown that 13,4% are illiterate, 28,3 above 25 years old has concluded fundamental school and 13,5% finished high school. However, they appear to be cognizant of their significance within the community as they undertake the task of removing items that homeowners are unsure of how to properly dispose as mentioned during the interviews events.

All four Waste collectors associated with the building site (namely, the author's home renovating project) have consistently highlighted the same issue, the insufficiency of available room to effectively manage and arrange the accumulated garbage. Frequently, despite the potential economic benefits associated with the waste, the collector was compelled to dispose of it as scrap or low-value refuse.

About the assortment of garbage that was gathered, it was observed that there were instances where certain items possessed potential alternative applications. Notably, tiny household appliances that were still functional, toys, and residual chemical substances contained within plastic or metal containers (such as glue and paint) were regularly encountered.

Also, during the 120 days of the experience, the AARs provided information on garbage costs and operational specifics pertaining to the initial layer of recycling (Tier I).

- Metal (iron and steel) between BRL 0.50 and BRL 0.70 per kilo. Most of the time BRL 0.50 (USD 0.10).

- Plastic BRL 0.50 per kilo. Price was very stable during the period, although several plastics were not collected by AARs, as regional buyers did not process them for future sales (#1: incompleteness number 1 noticed in this study).

- Tetra Pak packaging was not accepted by AARs, for the same reason (#2: incompleteness number 2). In some regions there is a market for tetra Pak packaging. However, it is worth mentioning that in the region of the project there was little supply of these packages (#3: incomplete number 3). Residents of the region did not separate these packages and, therefore, for the AARs to be able to collect them, they need to open the garbage bags placed 3 times a week (Monday, Wednesday and Friday). This lack of supply eliminates a link in the chain (the AAR itself), therefore, it does not enable regional buyers.

- Copper and aluminum had much higher prices in relative terms, but they were rarely collected by the AARs, so they didn't even know what the prices were on the day.

To enhance the role of collectors and facilitate their transformation into Active Recycling Agents (AARs), the researcher elucidated the requirements of the reform and put up the proposition: "I shall procure waste materials that hold utility for the designated purpose," with a specific emphasis on metals.

Following the initial contact, the AARs presented several offers pertaining to the sale of solid trash, including metal gates and doors, metal fragments, remnants of paint, bits of pipe, and plumbing components, among others. On other occasions, alternative possibilities were introduced that had not been previously discussed, accompanied by recommendations for their utilization. A number of these proposals were deemed acceptable due to their high level of creativity and productivity.

In most transactions, purchases were conducted without any form of condescension, meaning that they were not undertaken without an economic aim on the part of the buyer but rather with significant benefit for AAR. The prices levied were five to seven times more than the prices that would be attained through sales to 'Ferros Velhos' (Junk yard). Hence, the negotiations proved to be mutually beneficial for both the buyers and sellers.

At this stage of the study, it became apparent that the participants possessed a substantial amount of knowledge regarding the recycling and waste management procedures acquired via their routine encounters in urban environments. The potential in

question is not fully utilized due to the situations outlined in the RSS Incompleteness section.

However, it was seen during the stay at the Ecopontos that several small-scale businesses generate revenue by engaging in the processing of garbage and afterward bringing it to the Ecoponto facilities. Several individuals residing in the area remunerate these collectors with sums exceeding the daily earnings from transporting kilograms. At this juncture of the investigation, it became evident that implementing well-defined recycling systems gives rise to a market that fosters economic prospects for many people.

### *Recycling Social System - RSS incompleteness*

During the management of the property renovation under the sustainability lens, with the simultaneous focus on understanding the microprocesses of recycling and reuse, several structural incompleteness was noticed. The biggest and, in practice, the generator of all the others is the lack of a systemic and systematizing perspective on the recycling and reuse process. To have this consolidated perspective, we need an RSS closely integrated with the AARs, with some structural contributions from public entities. In addition to the 3 gaps mentioned above, with digressions in the texts above, there are some others:

- #4: The waste generators (residents of the region) only know about some waste that could be reused or recycled, not separating it to enable the work and income of the AARs.
- #5: Construction professionals, when carrying out renovations, cannot use the time spent on tasks in the recycling process, as this would greatly reduce their monthly income. By spending a lot of time recycling, it would reduce paid time, as contractors pay for the task performed and not for the ecological efficiency achieved. Thus, various waste from a project is not reused (being thrown into dumpsters or Ecopoints unnecessarily).
- #6: Waste that could be reused has no economic value, for example, pieces of brick. But they have value in use, that is, there are people who would need them at certain times. However, storing them would require a lot of space and a lot of time, until there is a connection between the offerer and the demander. This incompleteness makes their mitigation less viable, as they know in detail the urban space they travel through and know, in detail, who is generating each type of waste.

Various waste from a construction site was discarded in rubbish bins or at Ecopoints. For example: very old canvases, pieces of brick, pieces of wood, etc. All of these residues are useful for some uses (the focus of future research by the authors of this article).

It was evident from the interviews with the key informant groups that the majority of the MSW collectors' activities take place in the neighborhood streets, without access to water or facilities necessary for the development of their work, such as bathrooms. They frequently work lengthy hours, and some of the items may have no sales potential. Adding to this framework of living and working conditions is the fact that the local government (district) does not pay for the collection service, and sometimes no firm acquires their goods, resulting in extremely low compensation.

As mentioned in a previous study (GUTBERLET, 2016), during their activity, the AAR carried out significant climbing and descending of the landscape, not always in the most appropriate way. Regarding the daily income, waste pickers have to support the car's weight and the collected material, thus overloading their muscles and spine, which could cause a set of body pains. Combining this physical sacrifice with low financial compensation, the Waste collector may disappear in some regions.

To overcome some of the challenges of this occupation, and as a result of this diagnosis, the following steps were designed:

- Expand networks among the neighborhood, including territorial coverage and communication.
- Development of logistics plans to support the creation of new markets for material reuse.
- Empowerment of the AARs regarding their role in recyclable markets and carrying out political negotiations.
- Establish new partnerships, for example, with EcoPontos.
- Increase the amount of materials destined for recycling, to increase the income of collectors.

The action research involved all participants (pickers, university students and experts) from the beginning, in all stages of the process. This allowed the creation and mobilization of knowledge about the characteristics of high-value-added materials and optimization of collections in the region of operation. It also facilitated obtaining valuable primary information about the relevant work they perform and the opportunities to increase their income generation.

## **FINAL REMARKS**

The objective of this study is to expand knowledge about the working conditions and possible opportunities associated with the collection, classification, handling, and transportation of materials separated for recycling purposes. Besides, it emphasizes the importance of EcoPontos in a Waste Management Governance Network, including different actors: citizens, AAR (waste collector), public administration, NGOs, and academic researchers.

Governance Network Theory (GNT) states that implementing public policies is a cooperative task and it is impossible to conceive the one organization without others. Coordination of public policies is also required between political and bureaucratic organizations and actors that make up the same level of government (horizontal coordination) or that make up different levels of government (vertical coordination). In the sense of coordination, these actors and agencies play different roles in different phases of the same public policy.

The selective collection, separation, and recycling of materials are carried out primarily by less educated Brazilians either formally, through associations and cooperatives of waste collectors, or informally. So, it is necessary to rethink their role in circular economy improving their business opportunities, as presented in this paper.

Moreover, regarding SGD 12 and Goal 12.a (the same for United Nations and Brazil) there is a need to support developing countries to strengthen their scientific and technological capabilities to shift to more sustainable patterns of production and consumption (indicator: 2.a.1 - Amount of support granted to developing countries for research and development on sustainable consumption and production and environmentally safe and rational technologies).

In this sense, it would be important to develop financial support to carry on more qualification initiatives for this category of workers. As previously stated, capabilities are needed to solve the problem of low income and security problems, expand their role as environmental agents aligned with the SGDs.

It is noteworthy that waste collectors still suffer stigmatization and exclusion, both socially and as well as economically, in a generalized way. The research process was articulated with strategies training in relation to materials with greater commercial value, helping to overcome knowledge gaps, training and highlighting participants as agents of social change by designating them as Active Recycling Agents.

The study accentuates the need to increase population awareness of their work for them to be recognized and compensated as environmental agents who perform an essential public service by cleaning and recovering recyclable materials. The designation 'Active Recycling Agent' (referred to as AAR in Portuguese) reflects better the role of the central actor engaged in the endeavor, as the Portuguese term "catadores" (Waste collector) is deemed to be an inadequate and inequitable oversimplification of AAR's economic capacity and 'game changer'.

Undoubtedly, the text of the PNRS/2010 law recognizes the waste collector as one of the actors in the integrated management of urban solid waste (MSW). However, it is the format of the policy's implementation that will determine whether these subjects will occupy a position other than their margin. The force of change demands human valorization.

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