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The social inclusion of waste pickers and the adoption of energy recovery using municipal solid waste as a raw material

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ABSTRACT
Brazil produces more than 79 million tons of municipal solid waste per year, and around 1 million waste pickers work in the recovery of this waste. Brazilian law provides for the social inclusion of these workers with a leading role in waste management. The legislation makes it possible to recover energy from waste, but there is resistance from waste pickers, as these technologies can consume materials that are of value to pickers, such as paper, fabrics and plastics. Based on a bibliographic survey, it is intended to contribute to a better understanding of the phenomena involving the modernization of waste management and the social inclusion of waste pickers.
KEYWORDS: Municipal solid waste. waste pickers. Social inclusion.

1 INTRODUCTION

The management of municipal solid waste (MSW) is one of the biggest challenges for public managers, considering the amount of waste generated daily by urban areas, its treatment and inadequate disposal in Brazil.

In 2010, the National Solid Waste Policy (PNRS) – Law 12.305/2010 was instituted, which brought the main definitions, objectives, and instruments for the management of solid waste in Brazil. The PNRS determines that the government establishes goals for the elimination and recovery of dumps, associated with social inclusion and the economic emancipation of collectors of reusable and recyclable materials.

Estimates of the number of waste pickers in Brazil range from around 600,000 to 1 million, according to the Institute for Applied Economic Research (Ipea, 2012) and the National Movement of Recyclable Material Pickers (MNCR), respectively. Regardless of the numerical divergence and the time issue, this value alone already points to the relevance of these workers in the management of MSW in Brazil, highlighting them in the Solid Waste Policy.

The PNRS established the order of priority in the management of solid waste, namely: non-generation, reduction, reuse, recycling, treatment of solid waste, and finally environmentally appropriate final disposal of waste. One of the possible MSW treatments is energy recovery, that is, the use of a technology aimed at producing energy from a specific treatment of these wastes.

In many countries, the energy recovery of MSW, also known as WtE (Waste-to-Energy), has been used as one of the strategies in the integrated management of waste, highlighting the countries that make up the European Union, which carry out energy recovery, on average, 28% of MSW. (TISI, 2019).

In Brazil, energy recovery from MSW is incipient, with 22 Biogas plants, which capture biogas from landfills, which according to the National Electric Energy Agency (ANEEL) represents 0.09% of Brazil's energy matrix. In the state of São Paulo, the first MSW incineration plant is being implemented, in Barueri. (ANEEL, 2021).

There is strong resistance to the implementation of WtE plants in Brazil, considering that these plants use materials with high calorific value as an input, which are also the most commercially valuable for waste pickers, such as paper, cardboard and plastics. (JORNAL ESTADO DE MINAS, 2021).

Therefore, it is relevant to discuss the social inclusion of waste pickers in processes of modernization of MSW management, notably when using WtE technologies.

2 OBJECTIVES

2.1 General objective

Debate on the social inclusion of recyclable material collectors in the process of modernizing MSW management with the adoption of waste energy recovery technologies.

2. Specific objectives

- Debate on the social inclusion of waste pickers;
- Carry out a survey of information on the panorama of MSW management in Brazil;
- Debate on possible guidelines to be adopted aiming at the social inclusion of collectors when adopting WtE technologies from MSW.

2 METHODOLOGY

The study was carried out through a bibliographical and documentary survey, information in official national and international reports, books, magazines, and academic works involving solid waste management, with emphasis on energy recovery, and waste pickers.

The study has an exploratory character, using the hypothetical-deductive method, which through conjectures, based on the premises raised in the literature on waste pickers and energy recovery, can contribute to a better understanding of the phenomena involving WtE and the social inclusion of recyclable material collectors.

3 WASTE PICKERS

Brazil produces about 79 million tons of MSW per year, which is equivalent to the generation of 379 kg of waste per person, according to surveys by the National Sanitation Information System – Solid Waste – SNIS (2019) and ABRELPE (2020) .

MSW serves as raw material for the work of pickers. And according to the PNRS, it is defined as waste originating from domestic activities in urban residences, and that originating from sweeping, cleaning of public areas and roads and other urban cleaning services.

In Brazil there are about 600,000 to 1 million waste pickers, according to Ipea (2012), and the National Movement of Recyclable Material Collectors (MNCR), respectively.

The profession of waste pickers is recognized in Brazil by Ordinance No. 397, of October 9, 2002, of the Ministry of Labor, in the Brazilian Classification of Occupations (CBO) as “professionals who collect, select and sell recyclable materials. They are professionals who organize themselves autonomously or in cooperatives and associations with directors and management by the Waste Pickers themselves”. (BRASIL, 2002).

The PNRS, in several devices, indicates the participation and importance of waste pickers in the management of solid waste, starting with one of the objectives of the policy, “the integration of collectors in actions that involve shared responsibility for the life cycle of products” (art. 7, item XII). Once the national and state plans for waste management are available (art. 15 and 17, respectively), it becomes necessary to establish “goals for the elimination and recovery of dumps, associated with the social inclusion and economic emancipation of waste pickers reusable and recyclable”.

According to Araújo (2018), dumps are forms of final disposal of MSW by simply discharging it onto the ground, without technical criteria or mechanisms to protect the

environment. In this system, the waste is disposed of in places without any engineering preparation or sanitary control.

The elimination of dumps is still a major challenge for Brazil, considering that more than 40% of the MSW collected is disposed of in these inappropriate places (over 29 million tons). (ABRELPE, 2020).

According to the Brazilian Association of Waste and Affluent Treatment - ABETRE (2020), in 2019, there were 3,257 dumps in the country.

According to MMA (2022), waste pickers are still present in dumps, notably in municipalities that were unsuccessful in adopting structuring measures aimed at recovering discarded materials, and that lack support from the State to develop and participate in integrated management the formal recycling chain.

The goals and programs to end the disposal of MSW in dumps are at the center of discussions on solid waste management in Brazil. The most recent initiative is the "Lixão Zero Program", instituted by the MMA in 2019, through Ordinance No. 307/2019, which aims to eliminate dumps in the country, with measures to transfer resources to states and municipalities, as well as how to support municipalities in more efficient solutions for the final disposal of solid waste. Incentives for the environmentally appropriate disposal of MSW, such as the one in the “Lixão Zero” notice, can contribute to the success of solid waste plans, mainly for the elimination of Dumps.

The MMA, on April 17, 2021, within the scope of the “Lixão Zero Program” published public call notice nº 1, for the selection of projects for the implementation of mechanized sorting plants for solid urban waste, to be executed by public consortia located Minas Gerais state. Under the terms of the Notice, R$ 100 million will be made available, with resources originating from fine agreements for environmental infractions signed between the company Vale S/A and the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA). (MMA, 2021).

The closure of dumps associated with greater economic development in the country may encourage the formalization of part of the waste pickers, in cooperatives, mainly in the participation in the sorting process and in the urban cleaning services themselves, reducing the number of autonomous pickers and pickers in unhealthy conditions (MMA, 2022).

The emphasis on the social inclusion of waste pickers in the PNRS is related to the precarious conditions these workers live in and the social exclusion they are subject to. In an important study on this category, Birkbeck (1978) stated that the work of collecting garbage can be carried out by men or women, and of any age between 5 and 70 years, and, still according to this author, garbage pickers are the “self-employed proletarians”, something like autonomous proletarians who sell their work to recycling companies, without having access to the social security of a formal work relationship, living the illusion of being autonomous professionals.

In this context, Birkbeck (1978) understands that waste pickers are little more than casual industrial workers, being able to decide on the working day, but without having control over the prices of recovered materials, which are determined by the consumer recycling industries.

The routine of waste pickers is extremely exhaustive, having to separate recyclable materials in an amount that is sufficient to sell, there are usually middlemen in the trade between collectors and recycling companies, called scrap dealers. (DE MEDEIROS; MACÊDO, 2006).

For Leal et al. (2002), the waste picker participates in a lucrative productive process, however, he carries out his activities in precarious conditions and cannot have a dignified life with what he receives for his work.

According to De Medeiros and Macêdo (2006), from the 1980s onwards, waste pickers began to organize themselves into cooperatives or associations, seeking recognition for their professional activity. After much articulation, in 2002 the activity was recognized as a professional category.

For Miura (2004), more important than the waste picker being recognized as a professional by law is to guarantee their dignity at work and in life, beyond the simple expectation of survival. Still according to this author, becoming a picker is understood as a way to gain dignity and legality in obtaining income. For this author, scavenging is an activity that makes the excluded worker inserted in the world of work and cannot be confused with a beggar or a loafer.

Therefore, the search for the social inclusion of pickers is not simply the legalization of their activity, but a set of actions aimed at guaranteeing the dignity of these workers. Sidegum et al (2015), researching the perception of pickers and the meaning of their work, concluded that collectors believe they perform an important job for society, but they are not seen this way, as they feel judged as marginal, unemployed and losers.

However, the insertion of these people in the productive chain of the recycling industry occurs in a perverse way, as the pickers are included when they have a job, but excluded due to the type of work they perform, precarious, in inadequate conditions, with a lack of minimum safety conditions. health, and finally without social recognition. (DE MEDEIROS and MACÊDO, 2006, p. 66).

For De Medeiros and Macêdo (2006), despite the very adverse conditions of work and life of the pickers, the activity of collection allows the survival of many workers who slowly seek to organize themselves in cooperatives and associations, aiming at better working conditions. The pickers' organizations must be encouraged by the public authorities, including as an instrument of the PNRS. And the business sector also plays an important role in social inclusion, as it is one of the agents responsible for implementing shared responsibility for the life cycle of products, integrating waste pickers in this process.

3.1 Government Programs for the social inclusion of waste pickers

According to Saffer et al. (2014), even with the inhuman working conditions, over the years, the number of pickers has increased significantly, because of high unemployment rates, leaving these people to work in dumps and streets of urban centers as a means of survival.

However, in the last decade, social inclusion policies aimed at waste pickers have emerged, such as the Pró-Catador Program, instituted by Federal Decree No. 7,405/2010, which, according to Saffer et al. (2014), develops qualification, training, technical assistance, incubation of cooperatives and studies on the life cycle of products and shared responsibility, in addition to encouraging the acquisition of equipment, machinery and vehicles.

Decree No. 7,405/2010 created the Interministerial Committee for Social and Economic Inclusion of Reusable and Recyclable Material Collectors (CIISC), which has the important attribution of promoting the active participation of pickers in policies involving solid

waste, notably on the recycling cycle, life of products and packaging, shared responsibility, recycling, and waste disposal.

There are numerous state and municipal initiatives aimed at the sector. In the State of Minas Gerais, in 2011, the Bolsa Recycling Program was instituted, by State Law nº 19.823/2011, which deals with the payment of financial incentives for the provision of environmental recycling services, in line with the State Policy on Solid Waste, State Law No. 18.031/2009. The financial incentive from the State of Minas Gerais is granted to pickers' cooperatives and associations registered in the Program. According to FEAM (2018), the organizations participating in the Program must prove the segregation, baling and commercialization of plastics, paper, metals and glass, subject to return to the productive chain.

The PNRS determines that Municipal Plans have programs for the participation of pickers, such as the adoption of selective collection with the participation of cooperatives and associations of waste pickers, there is the "CATAVIDA Program", of the Municipality of Novo Hamburgo (RS) , created in 2010, which according to Gutbier; Goetz and Rambo (2014), has the overall objective of promoting integrated waste management actions, in the social, economic and environmental dimensions, enhancing the work of pickers. In 2014, the CATAVIDA Program was awarded by the United Nations Organizations with the Millennium Development Goals Award (MDG Award).

The PNRS instituted instruments of economic, financial, and fiscal incentives for the fulfillment of its objectives, mainly with a preventive character and reduction of waste generation in the production processes, in addition to promoting the development of products with less impact on human health and environmental quality in their life cycles, however these actions have not advanced much. (REVEILLEAU, 2018).

A recent initiative to structure waste picker organizations took place with the enactment of Law nº 14,260, of December 8, 2021 (Brasil, 2021), which established a mechanism for deducting income tax for individuals and legal entities in implementation projects and adaptation of physical infrastructure of cooperatives and associations of pickers, that is, a deduction mechanism similar to what occurs in cultural projects under the Rouanet Law.

Another instrument to encourage the social inclusion of waste pickers is to value the work of these professionals through payment for environmental services. According to Altmann (2012), payment for environmental services is "retribution, monetary or otherwise, for human activities to restore, recover, maintain and improve ecosystems that generate environmental services and that are supported by specific plans and programs". By definition, payment is consideration for human activities in favor of the environment, that is, a service provided to improve the quality of the environment is worthy of remuneration.

The PNRS enables the implementation of government payment programs for environmental services, as recently regulated in Decree 10,936, of January 12, 2022.

Also in the PNRS, there is the principle of shared responsibility for the life cycle of products in the reverse logistics system, which, under the terms of article 3, item XII, of the PNRS is the "instrument of economic and social development characterized by a set of actions, procedures and means aimed at enabling the collection and return of solid waste to the business sector, for reuse, in its cycle or in other production cycles, or other environmentally appropriate final destination". In other words, it is the set of actions by the business sector to collect or forward after-sales or post-consumption for the reuse or proper disposal of waste from commercialized products.

Reverse logistics, according to MMA (2022), is a way to relieve holders of public cleaning and solid waste management services, attributing responsibility to the productive sector, that is, the public power reduces costs and shares responsibility for waste from who generated them (companies).

The PNRS listed in Article 33 the productive sectors obliged to structure and implement reverse logistics systems, such as pesticides (waste and packaging); Batteries; tires; lubricating oils; and fluorescent lamps.

According to Reveilleau (2018), the PNRS gave Waste Pickers a leading role in waste management, especially regarding the necessary social inclusion, associated with the integration of cooperatives and associations of pickers in the integrated management of solid waste, as enshrined in art. 7, item XII.

The researcher Reveilleau (2018) cites the Aurélio dictionary definition of protagonist to emphasize the importance that the PNRS gave to waste pickers: “main actor, person who occupies the first place in any event, promoter; intervening in an episode of everyday life”, still according to this author, the pickers are people who, in the service of the environment, promote the recycling of raw materials, considered by society as “garbage”.

However, the protagonist of the PNRS has not yet received due attention, considering the reality experienced by the pickers, as highlighted by Reveilleau (2018), as many live informally, without labor rights and guarantees, in situations of health risks, and in a way generally marginalized by society.

3.2 The associativism and cooperativism of the waste pickers

The PNRS established as one of its instruments “the incentive for the creation and development of cooperatives or other forms of association of pickers of reusable and recyclable materials” (Art. 8, item IV).

In fact, the encouragement of pickers' organizations assumed a significant weight in the text of the PNRS, since in nine devices cooperatives and associations of pickers are foreseen, notably regarding the priority of access to Union resources for municipalities that implement selective collection with the participation of cooperatives or other forms of associations of pickers (Art. 18, § 1), the priority of organization and operation and hiring of cooperatives and associations for activities involving urban cleaning and solid waste management, such as selective collection, recycling (Art. 36, § 1), and the possibility of incentives and financing for the implementation of physical infrastructure and the acquisition of equipment for cooperatives and associations (Art. 42).

The main advantages of the waste pickers' cooperative are: ease of interfering in the negotiation of recyclable materials, increasing competitiveness by increasing the supply of materials in a larger volume that guarantees gains in scale. (DE MEDEIROS and MACÊDO, 2006).

The main objective of waste pickers' cooperatives is to guarantee work and income opportunities for their members. According to De Medeiros and Macêdo (2006), the organization of pickers in cooperatives is a fundamental element in obtaining better conditions for direct sales and, consequently, obtaining better prices for recyclable materials.

According to the survey by the National Sanitation Information System - SNIS 2019, it is not uncommon for city halls to be unaware of details about waste pickers' organizations, and this may explain the reduced number of waste pickers' organizations in the surveys carried out

by SNIS. In the official survey, 1,480 organizations of waste pickers were identified in the country, in 994 municipalities, totaling 31,500 waste pickers linked to these entities – associations or cooperatives (Brasil, 2020). Considering the most discreet estimate of the number of collectors in Brazil (400 thousand), less than 10% would be organized in associations or cooperatives, an index that demonstrates the necessary use of the PNRS instrument, to encourage the creation and development of these organizations of pickers (PNRS , article 8, item IV).

An important goal was established in the National Solid Waste Plan – 2022 of the MMA, which establishes that 95% of the municipalities that use the services of waste pickers and cooperatives must formalize contracts with these organizations of pickers for the provision of MSW management services, however this The index is currently around 7.9% on the national average, which demonstrates the low level of formalization of the waste pickers. (MMA, 2022).

4 ENERGY RECOVERY OF MUNICIPAL SOLID WASTE (WTE)

One of the objectives of the PNRS is the adoption, development and improvement of technologies to minimize the environmental impacts of waste management and disposal (Art. 7, item IV), and the encouragement of the development of management systems aimed at the reuse of solid waste , including recovery for energy use (Art. 7, item XIV), with the possibility of MSW treatment aimed at energy recovery, as observed in Art. 9, § 1.

The regulation of the PNRS made by Decree nº 7.404/2010 established that the Federal Government would publish an ordinance disciplining the energy use of MSW, which occurred after nine years of the PNRS, through Interministerial Ordinance nº 274/2019. (BRASIL, 2010 and 2019).

According to MMA (2022), the energy use of MSW occurs with the adoption of waste recovery systems, only disposing of waste in landfills, after all possibilities for its recovery have been exhausted, under the terms of the PNRS.

WtE plants have been a common practice in several countries as a form of final destination for waste that was not used in recycling or composting, that is, waste that, if not recovered, will go to landfills. (TISI, 2019).

Considering the growing volume of waste due to economic and population development, member countries of the European Union, and countries such as South Korea, China, Japan, India, have adopted the "Waste management hierarchy", which in general terms aims to prioritize a: (i) waste reduction, (ii) adopt recycling, (iii) composting and (iv) energy recovery through WtE plants. (THEMELIS et al, 2013, p. 17).

The prioritization of WtE to the detriment of disposal in sanitary landfills has been demonstrated in international experience as an environmentally appropriate form in the waste management hierarchy, because after economically viable recycling, the fraction of remaining waste or rejects can be thermally treated, that is, recovering its energy value, otherwise, there would be waste of energy when disposing of it in landfills (TISI, 2019).

According to Tisi (2019), in 2012 in Europe, 456 MSW WtE plants prevented 79 million tons of solid waste from being deposited in landfills. Still according to this author, the energy generated is equivalent to the consumption of a population of 14 million inhabitants.

According to Tisi (2019), the main obstacle to the implementation of WtE plants in Brazil is the initial cost being higher than landfills, however, in the long term, landfills have high costs

considering the irreversible environmental risks to nature, and a need for stricter regulation on the design and monitoring conditions of these projects.

Tisi (2019) cites the European Union regulation on landfills (European Directive 1999/31/EC) which makes the use of landfills very costly, as there is a mandatory monitoring during the entire operation, and for a period of at least 30 years after the closure of the MSW disposal, or if the authorities consider that the landfill may pose a danger to the environment. (EUROPEAN UNION, 2009).

An example in the European Union of excellence in MSW management is Germany, considered a world leader in solid waste technologies and public policies – it has the highest utilization rates in the world. In recent decades, the generation of domestic waste has been reduced, and disposal in landfills, which is currently less than 1%. (SENADO FEDERAL, 2014).

Another highlight on energy generation from MSW is China, with its population of more than 1.3 billion, which has, according to Tisi (2019), today the largest installed capacity of WtE plants in the world. In 2017, according to this author, there were 339 plants in operation, generating 7.3 GW, with a plan to reach 10 GW of installed capacity by 2023, which is equivalent to an Itaipu plant.

On the other hand, the energy recovery of MSW is highly criticized by collectors, as there is an understanding that there would be competition for recyclable materials, that is, they would be incinerated, reducing the raw material for their work. (CORNIERI, 2011).

According to article 9 of the PNRS, the order of priority or hierarchy of solid waste management indicates that non-generation, reuse and recycling treatments are not competing technologies with WtE, but complementary.

Waste collected dry or after mechanized or manual sorting must be reused or recycled, but the fraction mixed and contaminated with organic fractions, and which are economically unfeasible for its use, the most efficient way is to send it to the WtE, in addition to the sorting system itself and recycling can provide waste destined for these plants (ABRELPE, 2013).

The experiences and initiatives for WtE in Brazil are still not very intense, and according to the MMA (2022) it is necessary to strengthen them as complementary tools for the proper disposal of waste, avoiding sending waste with economic value to landfills. There are currently 22 MSW Biogas plants, according to official data from Aneel, in the Generation Information System – SIGA.

In the state of São Paulo, a MSW incineration plant is being set up in Barueri. The guidelines and conditions for operating and licensing this type of solid waste thermal treatment activities were established by State Resolution No. 79/2009. For Tisi (2019), this rule from the State of São Paulo was mirrored in the best regulatory practices adopted in the European Union.

In Minas Gerais, in the municipality of Boa Esperança, the first MSW gasification plant in Brazil was completed, with capacity to generate 1 megawatt-hour (MWh), having received the necessary environmental licenses. It is a venture with national technology, with an investment of R$ 32 million by Furnas S.A. (JORNAL O TEMPO, 2019).

According to Tisi (2019) the main advantages of WtE are: (i) addition of an alternative source of energy; (ii) mitigation of greenhouse gases; (iii) development of national technology, with the use of labor, in the various stages of the recovery process.

According to Cherfem (2015), an important factor for the use of WtE technologies is the high production of dry waste and low amount of organic waste, which is not the case in Brazil,

which has more than 50% of organic waste, which makes it difficult for the process to reach high temperatures and reduce the volume of ash produced.

According to GIZ (2017) there are five main WtE technologies: incineration, co-processing, anaerobic digestion, landfill gas and pyrolysis/gasification.

5 DISCUSSION AND CONCLUSION

The modernization of MSW management in Brazil cannot be dissociated from the social inclusion of waste pickers, as determined by the PNRS. (BRASIL, 2010).

A fundamental step to start the modernization process is to eliminate the dumps, considering that the work carried out by the pickers in these places violates the dignity of the human person, given the precariousness of the working conditions.

The extinction of dumps should be a priority in solid waste plans, but the resulting process should establish the participation of collectors, preferably formalized in cooperatives or associations, to carry out the processes of waste sorting, recycling and eventual urban cleaning.

As for the adoption of technology for the treatment and final disposal of waste, Brazil cannot strictly follow the guidelines outlined in the legislation of developed countries, considering that in these countries there is not, a priori, a significant portion of the population devoid of basic survival conditions , that in many cases, the food of the day comes from dumps or landfills, sometimes for the remuneration received for the sale of the collected materials, or even for the collection of food directly from the garbage.

In the most widespread modernization process today, there are technologies for energy recovery from solid waste, which, if implemented, in the current Brazilian scenario of low recycling rates, selective collection service, can further aggravate the situation of exclusion of collectors , considering that formal and informal waste pickers need to compete for waste with WtE plants or enterprises.

The modernization of MSW management cannot be a way of further excluding these people, collectors of reusable and recyclable materials. Therefore, initiatives to modernize MSW management must follow some minimum guidelines to ensure the social inclusion of pickers, such as incentives for formalization in cooperatives, access to financing and prioritization of hiring.

Encouraging the formalization of the work of pickers through cooperatives and associations is one of the initial instruments to achieve the social inclusion of these workers.

The National Solid Waste Plan – 2022 of the MMA established the goal that 95% of the municipalities that use the services of waste pickers and cooperatives should formalize contracts with these cooperatives or associations of pickers to provide the service in waste management by the year 2040, however, no action or proposal was included in the plan to achieve this goal, considering that in 2020 only 7.9% of municipalities had a formal contract for this service.

It should be noted that the process for contracting cooperatives and associations of pickers by the government is simpler than that of private companies, given that the bidding process is unnecessary, in accordance with article 24 of Law 8666/1993. (BRASIL, 1993).

However, the numbers indicate that hiring is negligible, and one of the causes is the lack of effective incentives from the public authorities so that these cooperatives and associations are able to establish themselves and take on contracts.

The recent Law nº 14.260/2022 can contribute to the structuring of organizations of waste pickers, as these cooperatives and associations will be able to seek, through fundraising projects, financial resources directly from the private sector to carry out the acquisition of infrastructure, equipment, vehicles, in addition to other incentives. These projects must be approved by the Ministry of the Environment, in accordance with the system of cultural incentives in the Rouanet Law, that is, with the deduction of income tax. Therefore, it is up to the Federal Government, with the urgency that the case requires, to regulate this Law, to the Municipalities the promotion and technical-legal assistance so that the associations can elaborate the fundraising projects.

The structuring of waste pickers' cooperatives and associations (infrastructure, equipment and training) makes it possible for these organizations to participate more efficiently in the stages of solid waste management, especially in the selective collection, segregation, packaging and transport of waste, increasing gains in scale and consequently, better conditions to operate in the recycling market, avoiding middlemen.

An important aspect in the structuring of waste pickers' organizations is the creation of special lines of credit, aimed at the formation of working capital and investments, along the lines of government financing programs for family farming and for rural producer cooperatives, which offer financing for productive funding, infrastructure and development of rural activities, always with interest below the market average, that is, with government subsidies.

One way to preserve the participation of pickers in the discussion involving the modernization of solid waste management is to prioritize the contracting of enterprises with public power partnerships, the so-called public-private partnerships, because, as already pointed out by Levaggi et al (2019), private WtE plants tend to define the amount of waste to be recovered in order to maximize their profit, which can lead to competition with the recycling rate, and consequently with the gains of pickers and their organizations.

The PNRS established prioritization of access to public resources to municipalities that effectively implement selective collection with the participation of cooperatives or other forms of association of pickers of reusable and recyclable materials formed by low-income individuals. However, the municipalities do not carry out these contracts because the organizations of collectors do not have sufficient structures to meet the contractual commitments of the public service, or because of the position of municipal managers to prefer to hire private companies with greater mechanization and lower contractual costs.

However, the PNRS imposes the priority of hiring cooperatives and associations of pickers to carry out the selective collection service, and the municipal power does not have discretion to hire companies to the detriment of organizations of pickers, unless there are no pickers or organizations of them, or even if it is not feasible to make waste available to organizations in other neighboring municipalities, or even if cooperatives and associations collectors do not have the adequate structure to carry out the selective collection service, or there are still formal impediments to their operation.

Municipalities can use the instruments of environmental licensing and operating permits of certain productive segments to insert conditions in these licenses aiming at the priority destination of recyclable waste for cooperatives and associations of pickers.

There is still the important discussion to be carried out by Brazilian society about the payment for environmental services provided by waste pickers, considering that there is a

provision in the PNRS, but still pending better regulation and implementation by the public authorities.

Another source of funds for the development and structuring of waste pickers' organizations would be the prioritization of part of the programs for converting environmental fines into development projects for cooperatives and waste pickers' associations, along the lines of what already occurs with the Program for Conversion of Environmental Fines of the IBAMA, in which the environmental violator has the possibility of having a discount of up to 60% of the fine, investing in projects destined to the provision of services of preservation, improvement and recovery of the quality of the Environment. That is, in theory, projects could raise funds from the conversion of fines with the aim of improving urban environmental quality in terms of solid waste management, promoting the development of cooperatives and associations of pickers.

In order for conversions of environmental fines to revert to the benefit of pickers, the government has to establish this priority in the public notices calling for projects for conversion.

No less important than the structuring of waste pickers' organizations is the recognition of the role of pickers in society and the environment. One of the possible strategies is for the government to promote permanent education and publicity campaigns on the subject, that is, the collector would be positioned as an essential profession for the functioning of Brazilian society.

It should be noted that more important than a specific action aimed at the social inclusion of pickers is the recognition of the role of these workers in the management of solid waste, which is a legal mandate of the PNRS.

Therefore, the modernization of solid waste management, especially with the adoption of WtE technologies, must always be oriented towards achieving this essential goal: social inclusion and economic emancipation of pickers of reusable and recyclable materials.

The choice of WtE technology to be adopted by a municipality or group of municipalities necessarily involves technical and environmental feasibility studies and the implementation of a toxic gas emission monitoring program approved by the environmental agency, pursuant to § 1 of the article 9 of the PNRS.

In the State of Minas Gerais, there is a greater restriction than the federal norm regarding energy recovery technology through the incineration of urban solid waste, which is expressly prohibited by the Minas Gerais State Policy on Solid Waste. The ban took place after great pressure from waste pickers' organizations, fearing that the technology would be implemented in the state without first having effective policies for the social inclusion of pickers.

The incineration technology is the most used in the world, including in European countries, mainly due to its low cost and its versatility in relation to pyrolysis and gasification technologies. In developing countries like Brazil, with high social inequality, the aspects involved with the population that lives and works due to the quantity and quality of solid waste, the social aspect must be one of the pillars of technology feasibility studies.

This work was not intended to assess the feasibility of WtE technologies, but to discuss possible guidelines to be adopted for the social inclusion of waste pickers to occur when choosing one or another technology in the process of modernizing solid waste management. , thus satisfying the legal mandate of the PNRS, and above all, an important fundamental objective of the Brazilian republic expressed in the Federal Constitution (the construction of a

free, fair and solidary society, the eradication of poverty and marginalization and the reduction of social inequalities and regional).

In view of this, any modernization of solid waste management, starting with the most basic, the elimination of dumps and replacement with sanitary landfills, even the implementation of energy recovery plants, must have as one of its main objectives the promotion of social inclusion pickers, ceasing this need when there are no more pickers of reusable and recyclable materials.

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