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SELECTIVE COLLECTION IN PALMAS/TO: ANALYSIS OF THE FIRST MUNICIPAL RECYCLING PROGRAM

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Abstract

Selective collection aiming the recycling of municipal solid waste is worldwide an alternative to reduce the final disposal in landfills, besides reducing natural resources consumption. This paper aimed to analyze the system of selective collection of recyclable materials proposed by the municipal government of Palmas through the Program "Coleta Palmas", through data collection in the institutions involved, intending to contribute for the improvement of the system adopted. A survey was carried out with the main stakeholders of the Program, with the purpose of knowing the institutional arrangement, the types of partnerships, the objectives and targets set, the actions and strategies planning, the monitoring and results achieved so far. Results showed difficulties involving the coordination unit, and it was noticed that the general view of the operating units on the Program is positive, although for two of them, to date, the participation has not represented financial gains. It was concluded that changes in the management of the Program are necessary, including improvement of social communication and continuous environmental education. Lastly, recommendations made by the operating units were collected in three perspectives: institutional, operational, and environmental education.

Keywords: *municipal solid waste management, selective collection, solid waste pickers.*

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Introduction

The sustainable management of waste produced is one of the major challenges for the globalized and capitalist world. In many countries, the final destination of municipal solid waste has been landfills. However, there are other alternatives to their final disposal, particularly for packaging waste, such as recovery processes, through incineration with energy recovery or recycling. Selective waste collection aiming recycling urban solid waste is a worldwide alternative to reduce final disposal in landfills, thus extending their lifetime. It is undeniable that any recovery system produces a percentage of tailings that are sent to confinement and final disposal in landfills (Da Cruz, Marques, 2014). Globally, in the context of 2030 Agenda, selective collection is present among many of the United Nations' Sustainable Development Goals, especially linked to Objectives 11, Goal 11.6 and 12, Goals 12.4 and 12.5 (Nações Unidas Brasil, 2019).

In Europe, with adoption of Directive 94/62/CE and Directive 1999/31/CE, which made mandatory the collection of packaging waste and final disposal of municipal solid wastes in landfills, respectively, as well as set demanding targets for recovery and recycling of packaging waste, the solid waste management has profoundly changed (Mannarino et al., 2016). So that it made the Member States of the European Community to be elected by the United Nations (UN) and the International Solid Waste Association (ISWA) as those countries that have reached the most advanced level of waste management in the world (Barroso, 2013).

In Japan, selective collection has been developed confronting challenges as small territorial area, economic expansion and growth, technological development, and high population density. Its waste management system has been refined since the 1970's, including the private sector, developing recycling, landfilling and energy recovery through incineration (MME, 2014). In the United States, the city of San Francisco has reached the target of diverting 75% of materials from the landfill (San Francisco, 2019). However, North America still faces difficulties due to scarce local success models given the world's largest per capita generation of solid waste: 2.21 kg per inhabitant a day (Kaza et al., 2018).

In Brazil, according to data from Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE, 2019), in 2018 the average per capita generation of waste was 1.039 kg per inhabitant a day. The Brazilian National Policy on Solid Waste – Federal Law 12.305/2010 (Brasil, 2010) stipulates that among all materials generated in domestic and commercial activities, and collected by public cleaning services, only those whose reuse is not possible or feasible must be sent to landfills. However, according to Amaral and Rodrigues (2018), in 2016 almost 30 million tonnes were not properly disposed, representing a percentage of 41.6% of the total generation, bringing serious environmental and sanitary problems.

In Tocantins, State located in the Northern Brazil, one of the newest federated units of the country, the State Waste Management Plan was just approved in 2017 and proposed two

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alternatives to regional landfilling to all 139 municipalities. So far, not much has been seen in terms of state politics on regional arrangements for solid waste management. According to the State Plan, approximately 23,898 tonnes are generated monthly, and 65% of this comes from the cities of Palmas, Araguaína and Gurupi, the main solid waste generating centers, due to the highest population density and economic activities concentration. These municipalities are responsible for the generation of 66% of dry waste, 56% of wet waste and 25% of tailing in the State (Tocantins, 2017).

Palmas is the newest brazilian State capital, influenced by sustainable cities concepts. Despite its "green" vocation, Palmas has not been successful in developing recycling so far. Selective collection in Palmas has been carried out by the waste pickers since mid-2002. Only in 2017, after the approval of the Municipal Solid Waste Management Plan (occurred in 2014), a selective collection initiative was conducted by the local government: The *Coleta Palmas* Program. The Program has been implemented an informal partnership with those recyclable materials pickers organizations, with the purpose of encouraging the local population to sort and dispose solid waste for recycling (Palmas, 2019).

This paper aimed to analyze the selective collection system of recyclable materials proposed by Palmas Municipal Government through the *Coleta Palmas* Program, by means of data collection and interviews conducted with representatives of the institutions involved, intending to contribute to the enhancement of the adopted system.

Methodology

Initially, the authors have gathered information on the *Coleta Palmas* Program in many departments of Palmas Municipal Government, in order to know its institutional organization, institutions involved, which type of partnership was established between these institutions and local government, and which were the objectives and goals set. Interviews were conducted with representatives of the program coordinating unit, as well as documentation and official publications queries. The planning and strategies of the Program were also investigated, regarding the system's expansion and types of materials collected, community engagement, laws compliance, new institutions admission and the formulation of new partnerships. It was also investigated the management of waste in the stations, the monitoring procedures and results achieved by the Program so far, considering the pickers' organizations (operating units) point of view. That information contributed to the better comprehension of the Program's organization.

Finally, informal interviews were conducted with the representatives of the operational units to know their general opinion about the Program, the main difficulties faced by each institution, as long as the benefits and results glimpsed so far, the main destinations of the collected materials and which may offer the best financial return to them. Based on this information, the main actions

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and propositions pointed by the operational units as essentials for the Program enhancement were listed. Then, a chart was outlined with the main suggestions, considering the institutional, operational, and educational perspectives.

Results and discussion

The *Coleta Palmas* Program is a municipal selective collection program, designed in a voluntary recyclable materials delivery basis (MMA, 2019) in stations maintained by Palmas Municipal Government. Each delivery station consists of three plastic containers with a volumetric capacity of 1 (one) m^3 each one, colored yellow, blue and red, identified with the recyclable material type it must receive, according to CONAMA Resolution No. 275/2001 (Brasil, 2001). The current selective collection system employed in the city was adopted concerning the aspirations of community for selective collection, empirically designed, and aiming low deployment and maintenance costs, due to the scarcity of financial and human resources for this purpose.

Regarding its institutional arrangement, the municipal environmental agency (FMA) is the Program's coordinating unit, encompassing employees of the Environmental Project Division (coordination, monitoring, planning and social mobilization), Environmental Education Division (social mobilization and education activities) and Recovery of Degraded Areas Division (monitoring activities). The Municipal Secretariat of Infrastructure and Public Services is an executive support unit. Also, the Municipal Health Secretariat and the Municipal Education Secretariat act as executive support units. The waste pickers organizations legally constituted in Palmas are the operational units of the Program, operating the waste collection in the stations, and also participating in the mobilization, monitoring and planning through periodic meetings held with the other units involved. The government's partnership with the Program's operational units took place informally. However, according to FMA, this informal partnership was constructed through consultation and agreement with picker’s organizations.

As for its goals, the Program aims to implement municipal selective collection permanently and comply with Federal Law No. 12.305/2010 (Brasil, 2010). In interviews with technicians (municipal employees) involved in the Program, it was found that the document that describes and formalizes the *Coleta Palmas* Program has not been published. The goals and targets set for the Program, and their status are shown in Table 1. The technical staff responsible for coordinating the Program revealed that among the results there are great contrasts. While there are stations that have received a large amount of recyclable materials in good conditions (sorted by type, clean and dry), there are other ones that have received organic and other types of improper wastes.

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Table 1. Objectives and goals set for Coleta Palmas Program and their status.

Objectives and goals	Status/Initiatives
Replacing installed containers by standardized Voluntary Delivery Stations template by the end of 2018.	This goal was reconsidered and the current Voluntary Delivery Station template with colored containers was remained.
Mechanize the collection of recyclable materials, using appropriate collection vehicle (truck) after the completion of the previous goal.	Inclusion of a collection vehicle exclusively for selective collection to be contracted by the Secretariat of Infrastructure and Public Services.
Generate weekly and monthly reports with data of quantity of materials collected in the stations.	Undefined / No information available.
Collect at least three tonnes of recyclable materials per month by the end of 2018.	The coordinating unit developed a community outreach and mobilization strategy through a standardized approach to selective collection awareness.
Improve the procedures and acquire resources for enhancing the Program monitoring.	The monitoring record has changed several times since the Program's kick-off, applying several different models of documents, but still requires material resources.
Establish continuous improvement procedures for Program management.	The Program is developed by a team that constantly holds meetings and seeks to adopt continuous improvement procedures, such as defining the standard approach.
Include selective glass collection in the Program.	In research step.
Establish and regulate the *Coleta Palmas* Program through appropriate legal instruments.	Undefined / No information available.
Formalize and promote partnerships with waste picker's organizations.	In research step.
Reactivate and maintain the activities of the "Municipal Waste and Citizenship Forum" by 2018.	This Forum was reactivated on May 17, 2019.
Install 30 standard Voluntary Delivery Stations by the end of 2018.	The program has 18 Stations and aims 40 in operation by the end of 2019.
Start a door-to-door selective collection route in 2019.	Undefined / No information available.
Start designing the Screening Plant project and seek resources for its implementation in 2020.	In research step

(Fundação de Meio Ambiente de Palmas - FMA, 2019)

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According to a standard procedure, after a direct awareness approach with the population of the station surroundings, if the deposition of materials fails, with the constant presence of tailings and organic waste in the containers, the station is relocated. This decision is taken after a monitoring period of a month, with special attention of the Program coordination unit on monitoring results.

The team has been discussing the need for intensification of environmental awareness and education activities, as well as the need for social communication, with the dissemination of the Program and how it works, as well as the creation of a direct communication channel with the citizens. The formulation of a social communication plan was mentioned as an important demand.

As operating units, three waste pickers organizations were involved in the *Coleta Palmas* Program, to collect the selected materials at the stations. This participation, however, was made informally with Palmas government, and there is no partnership agreement or other legal instrument signed by the parties yet to this date. In this study, they were called Organization A, B and C.

When asked about the main operational difficulties faced to develop their activities, organizations reported aspects such as vehicle maintenance expenses (fuel and repair) and financial difficulties to maintain equipment used for sorting and baling. The need to purchase and ensure the use of personal protective equipment (PPE) for the pickers involved and deficient physical structure or lack of space in their headquarters for selection and baling were mentioned as well.

Regarding the strategy employed in monitoring the Program, it consists of conducting weekly surveys at the stations, which results allow decision making. All the stations of the Program are visited, photographed, and observed. When atypical or relevant situations are found, the monitoring team must promptly inform the Program coordinating unit, as shown in Table 2.

It was noticed that there is no clear division of the area of activity of each organization in relation to the collection of materials in the stations. The collection is carried after the request of the coordinating unit (FMA), which indicates the station that should be collected. It was observed that the coordinating unit did not establish clear criteria for the performance of each organization, to avoid conflicts of overlapping areas of activity.

Organization C reported to collect material from all stations, in a contrary way to a pre- stablished “planning” by the coordinating unit. It is believed that this happens because this organization has a better structure for transportation (vehicle), and a large number of employees, as well as a different view regarding *Coleta Palmas*, as compared to the other organizations involved. The program chart is presented in Figure 1.

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It is noteworthy that all organizations reported that they have other partnerships for the selective collection, involving public agencies and private institutions, companies located in commercial zone, among others. Table 3 presents these, and other general characteristics of the organizations involved in the Program.

Participating organizations were also asked about the benefits of participating in the Program and the results achieved so far. Two organizations said that it has not yet been able to bring them significant financial benefits but recognize that it brought new experiences and contributed to raising awareness for selective collection and recycling among the population. Organization C was satisfied with the results and declared to have satisfactory financial return from its participation. Two organizations highlighted the increase in the amount of material available as the main benefit.

Table 2. Monitoring of the Coleta Palmas Program: detection of deviations and preventive/corrective measures.

Monitoring situation detected	Action to be taken
Volumetric capacity depleted (full station)	Contact operating units to perform Collection.
Presence of organic waste.	Conduct environmental education work with the community near the station as a corrective measure.
Presence of other waste (tailings) such as wood, electronics, tires, medicines, light bulbs and construction and demolition waste, batteries, health care waste, dead animals, disposable or Styrofoam.	Call the competent agencies (executive support unit of public services) to conduct collection, when the tailings occupy most of the volumetric capacity of the station and transport them to final disposal in landfill.
Presence of dead animals and disease vectors.	Call Public Services Support Unit to proceed special collect and communicate Health Support Unit (Health Surveillance)
Occurrence of odor.	Activate operational staff for cleaning and reinforce the environmental education campaign with local community, scheduling an educational visit around the neighborhood
Problems with the physical integrity of the station, if the wheels are locked and intact, if the identification sticker is in good condition, etc.	Carry out the necessary correction in case of misplaced containers, wheel locking, etc. (monitoring team) and report to the coordinating unit about problems with stickers to decide for their replacement or any other necessary measures.

(FMA, 2019)

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Figure 1. Coleta Palmas Program chart.

Table 3. General characteristics of waste picker organizations involved in the Coleta Palmas Program.

Organization	Organization Total Number of People Involved	Beginning of recyclable materials collection activities	Own Area	Number of Own Vehicles	Other partnerships for collecting recyclable materials?	Total average amount of recyclable materials collected monthly
Organization A	9 people	2004	Yes	1	Yes	38 tonnes
Organization B	16 people	2007	Yes	1	Yes	40 tonnes
Organization C	15 people	2015	No	2	Yes	45 tonnes

The amount of materials recovered by the *Coleta Palmas* Program was not known. Regarding the recyclable materials market, the organizations have pointed that paper, cardboard and plastic in general are the materials that provided them the highest financial return. The destinations of the selected materials are mainly the large centers of the Midwest, Southeast and South Brazil. However, some part ended up being absorbed in the Tocantins state itself (plastic film and ferrous metals).

About the participation of organizations in the Program, it was pointed out that they were not heard by the government in the program design phase. The distance between the stations and the headquarters of the organizations was considered long. The quality of materials collected at the stations was also reported as poor by two organizations, which reported frequent occurrence of contamination due to improper disposal. The fact that the stations were installed in open areas to the public, without any control, was also pointed out as negative. Figure 2 shows a station of the *Coleta Palmas* Program, located in the downtown area.

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Finally, the organizations were invited to make suggestions for improvements for the *Coleta Palmas* Program. These suggestions were organized according to three perspectives, presented in Figure 3: Institutional (INST), Operational (OPE) and Environmental Education (EE).

Figure 2. Coleta Palmas station.

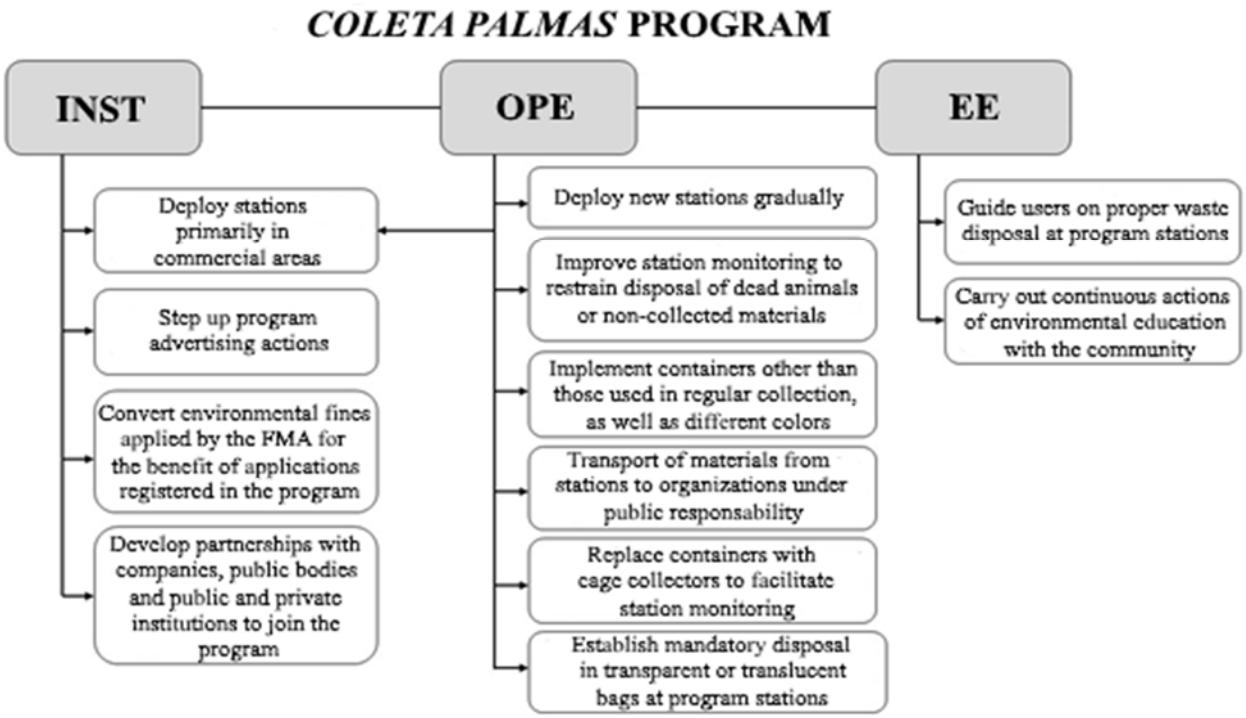

Figure 3. Suggestions to improve Coleta Palmas program, under the involved organizations' view.

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From an institutional (INST) and operational (OPE) perspective, organizations reported that deploying Program stations in primarily commercial areas would bring greater amounts of good quality (cleaner) recyclable materials and could return better financial gains. One of the organizations mentioned to be collecting in commercial areas, from partnerships with local merchants. Greater disclosure was suggested, aiming to publicize the Program and its actions, which could bring greater participation and engagement of the society. Finally, organizations suggested a possibility of expanding the Program through partnerships with commercial companies, agencies and public or private institutions to make available a bigger amount of recyclable materials.

From the strictly operational perspective (OPE), six suggestions for improvements were made. The gradual deployment of new Program stations, to be closer to each other (due to the difficulty of collecting materials at many stations scattered throughout the city), advancing to new areas of the city. Therefore, organizations believe that the gradual implementation in commercial zones, could bring scalability to the Program and greater financial return. Another suggestion concerns the monitoring of the stations. It was suggested the use of transparent or translucent plastic bags to dispose materials, to facilitate the identification of the content. Two suggestions relate to the types of collectors at the stations. According to the interviewees, the containers used are the same model as those of conventional collection, which was a problem. It was suggested the adoption of containers of different shapes and appearance (diverse of the ones used for conventional collection), and the use of containers in a “cage” type, to facilitate the visualization of the content. Finally, two of the three organizations reinforced that transportation should be carried out by the government.

The third perspective evaluated was about environmental education (EE). The first suggestion was the orientation of the users, so the population should be educated, using the media: radio, television, newspapers, social media and others to disseminate the Program, types of materials and their correct disposal at the stations. The second was carrying out continuous environmental education actions with the society to overcome all perceived difficulties in the development of the Program.

The Figure 3 shows all the suggestions made from the organizations to improve the program. Finally, the organizations' overall view of the Program is positive, although for two of them, so far, participation had not represented financial gains. However, all of them see that the *Coleta Palmas* Program increased the supply of recyclable materials and brought social and financial returns to the involved, as well as helped the government to meet their legal obligations, set out in the National Solid Waste Policy.

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Conclusions and recommendations

The *Coleta Palmas* Program emerged in a Voluntary Delivery stations model, resulting from a partnership between local government and waste pickers' organizations, to meet a social demand for selective collection. The coordinating unit oversees the planning, monitoring, social mobilization, and environmental education of the Program, along with three support units. Some difficulties related were about formalizing, publicizing, and carrying out social mobilization and environmental education actions with the community in general.

The operating units (waste pickers' organizations) are responsible for the collection, transportation, sorting and baling for commercialization of the recyclable materials received. They contributed with twelve suggestions, which in their view can contribute to its improvement and effectiveness, from different perspectives. The main problems they reported were incorrect disposal, the long distance between stations and their headquarters, and monitoring failures.

However, the Program is considered as positive and contributes to the social awareness and dissemination of selective collection, as well as the increase in the volume of recyclable materials. It should be expanded through new partnerships, including companies, public and private institutions, and should be widely publicized. In addition, the *Coleta Palmas* Program helped local government to comply with their legal obligations under the National Solid Waste Policy. There is great potential for future studies in relation to the results of the Program, among which are recommended studies of physical characterization of materials and studies of sociocultural and behavioral aspects of selective collection in Palmas.

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