

**Evaluation of Solid Waste Management of Municipalities in the
Inter-municipal Solid Waste Consortium of Oeste Paulista (CIRSOP)**

Laura de Oliveira Battistini Pestana

Master Student, PPGEU/UFSCar, Brasil

laura.pestana@estudante.ufscar.br

Katia Sakihama Ventura

PhD Professor, UFSCar, Brasil

katiasv@ufscar.br

ABSTRACT

The inter-municipal consortium was proposed as one of the initiatives of the National Solid Waste Policy as it allows the deployment of infrastructure on a regional scale, reducing operational costs and increasing the quality of life of the population served by these services. In this sense, the main objective of the work was to evaluate the management of solid waste in sanitary landfill, selective collection, waste composting and reverse logistics for the municipalities of the Inter-municipal Solid Waste Consortium of Oeste Paulista (CIRSOP). The method consisted of the organization of the theoretical framework, the selection of the study object and the evaluation of the initiatives established by the SAGReS software, consisting of an electronic spreadsheet prepared from monitoring variables. Of the total of 10 municipalities in CIRSOP, 50% allocate their waste to sanitary landfill. In addition, there is a lack of control of working conditions in selective collection cooperatives, lack of environmentally adequate destination for organic waste through composting, lack of control of parameters for reverse logistics and the need to disseminate information in online media, as these are not fully available or updated. The study identified that the biggest challenges of CIRSOP are the aspects involving composting, reverse logistics and landfill.

KEY-WORDS: Solid Waste, Inter-municipal Consortium, Public Policies.

1 INTRODUCTION

In 2010, the Federal Law nº 12.305 instituted the National Solid Waste Policy (NSWP) in Brazil. The legislation was responsible for regulating several aspects regarding the integrated solid waste management faced with the scenario of its increasing generation. These aim to minimize or eradicate the negative impacts of the waste inadequate final disposal (BRASIL, 2010). For this, the NSWP has placed some initiatives, such as sanitary landfill, selective collection, composting, public consortium and reverse logistics, to help the municipality in improving the urban infrastructure necessary to raise the population's quality of life.

The sanitary landfill was created with the aim of closing the dumps in operation throughout the country, and the aforementioned has received about 11.5% of the municipal solid waste generated in 2021. This method of disposal has consequences, such as the contamination of soil, air and water (surface and groundwater), exposing the population and the environment to high risks of contamination and interference on health (RAMOS *et al.*, 2017). To avoid the listed risks, the Law 12.305 highlights that the final disposal in sanitary landfills ensures satisfactory environmental control, since it adopts criteria for waterproofing and monitoring throughout its useful life, in addition to including surveillance after the end of its operation (BRASIL, 2010).

Selective collection is the collection of solid waste previously segregated by its composition and origin (BRASIL, 2010). Adequate segregation depends on the behaviour and habits of the citizens and the environmental valuation that it exerts in the environment and can stimulate the habit of separating waste at the generating source for further recycling and use, generate work and source of income, improve the quality of organic matter for composting, among other advantages (RIBEIRO & BESEN, 2006).

Waste composting can be defined as the biological process of decomposition of organic matter found in the remains of animals and plants, resulting in a substrate that can be used as an agricultural input (AQUINO *et al.*, 2005). Despite the advantages, the initiative also faces challenges for its implementation in Brazil, since much of the organic waste - which represents a significant portion of the waste generated in the country - is still destined to landfills and dumps (ABRELPE, 2021).

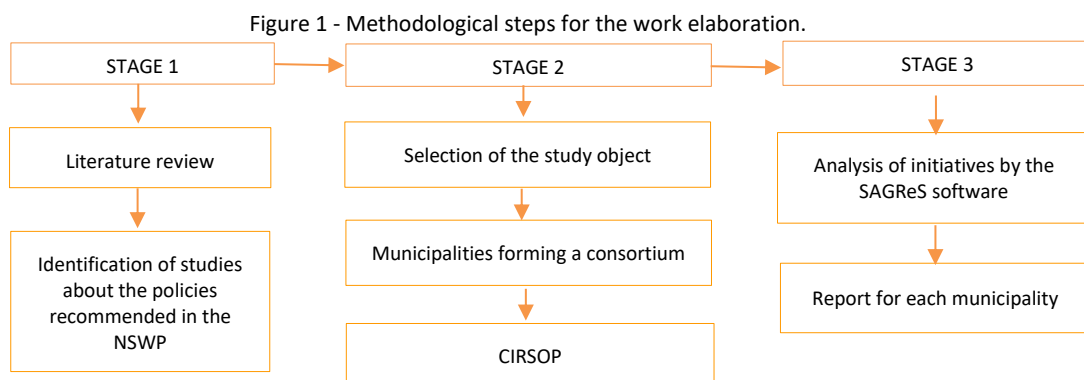
In addition, NSWP proposed shared responsibility for the product life cycle, highlighting reverse logistics in addition to composting for organic waste. This concerns a specialized logistics segment that aims to collect and restore solid waste to the business sector, ensuring the return of products and packaging to a new use cycle and reducing the volume of waste disposed in the environment (BRASIL, 2010; SOUZA NETO, 2019).

In this context, the consortium solutions were instituted by the Federal Law 11.107/2005 and presented as an alternative for the management of solid waste with the objective of enabling the decentralization and provision of public services that involve them (BRASIL, 2005). Public consortia have the intention of assisting in the difficulties faced by municipal administrations and have several advantages, such as integrated planning between municipalities, reducing operational costs and optimizing the use of areas for the disposal of urban solid waste (SILVEIRA, 2016; VENTURA & SUQUISAQUI, 2019). These are points worthy of attention, especially for small municipalities, due to the obstacles faced by the efficient and sustainable management of solid waste, such as the lack of financial resources and sufficient technical staff to do so (DA SILVEIRA, 2016).

The objective of the study was to evaluate the solid waste management based on the implementation of the initiatives of the National Solid Waste Policy (NSWP) for the municipalities of the Inter-municipal Solid Waste Consortium of Oeste Paulista (CIRSOP).

2. MATERIALS AND METHODS

The research was developed in 3 stages, presented in Figure 1.



Source: The author, 2023.

Stage 1 - Identification of studies regarding the initiatives recommended by NSWP

The first stage comprised the bibliographic survey about sanitary landfill, selective collection, composting, public consortium and reverse logistics to identify indicators, advantages and disadvantages of management and operation for each initiative, both at the municipal and regional scale.

For such, studies, publications, dissertations and theses were sought in the available scientific bases (Scopus and Web of Science). The keywords for the two bases used were: “sanitary landfill” AND “indicator”; “selective collection” AND “indicator”, “waste composting”

AND “indicator”, “public consort” AND “indicator” and “reverse logistic” AND “waste” AND “indicator”.

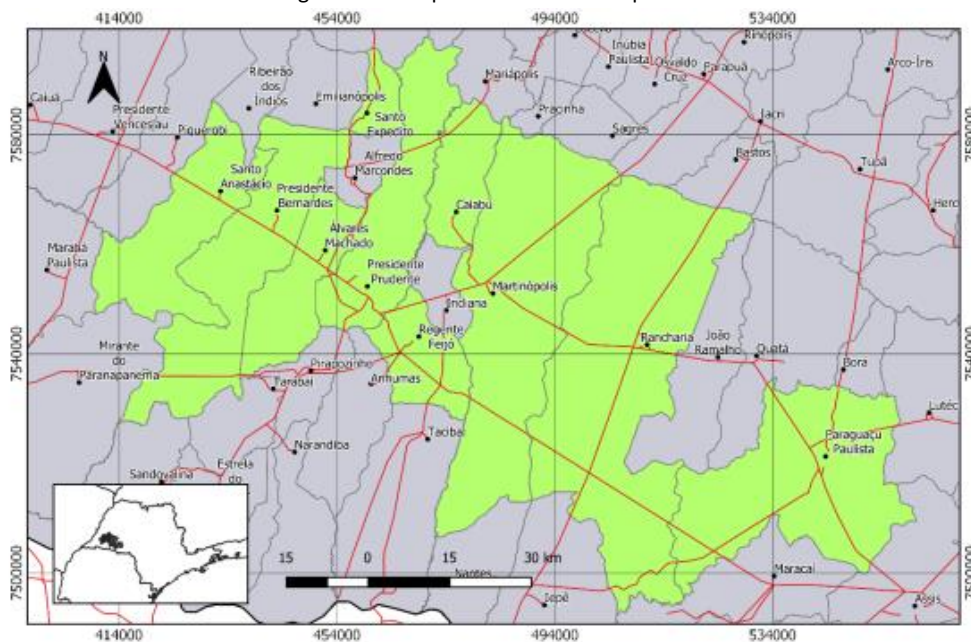
Stage 2 – Selection of the study object

The public consortium was the principal instrument for the selection of the study object. That is, from selection, all initiatives were evaluated.

The selection criteria of the consortium were: to contain more than 5 municipalities, generating a greater number of indicators and municipal profiles for study; to include small-sized municipalities, mostly identified as those that have the greatest need for consortium initiatives; to have approximately 400,000 inhabitants; to have an Inter-municipal Plan for Integrated Solid Waste Management (IPISWM) elaborated and approved and to have information for remotely / online research.

The Inter-municipal Solid Waste Consortium of Oeste Paulista (CIRSOP) met the established criteria. It was founded in 2018 and consists of 10 municipalities in the state of São Paulo presented in Figure 2: Álvares Machado, Caiabu, Martinópolis, Paraguaçu Paulista, Presidente Bernardes, Presidente Prudente, Rancheira, Regente Feijó, Santo Anastácio and Santo Expedito.

Figure 2 – Cirsop constituent municipalities.



Source: FUNDUNESP, 2020

Stage 3 – Analysis of initiatives by SAGReS software

At this stage of the research, the Evaluation System for Urban Solid Waste Management (SAGReS) software conceived by Suquisiqui (2020) was used.

The software is organized in an electronic spreadsheet composed of macros and comprises 50 variables that assess the need for managers to pay attention to five NSWSP initiatives. Its purpose is to identify the main gaps present in the management for each of the initiatives evaluated in order to solve the deficiencies pointed out (SUQUISAQUI, 2020).

For each of the variables, three items were evaluated, as shown in Chart 1.

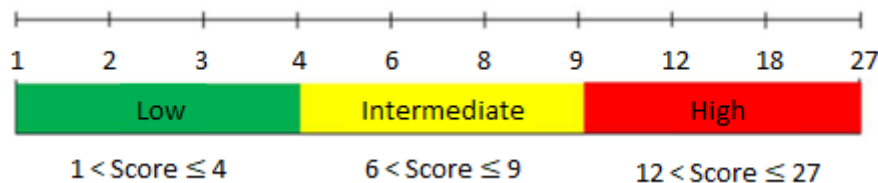
Chart 1 - Description of the items evaluated in the SAGReS tool.

Item	Description	Score	Reference
Information Existence	It refers to the information that the variable represents.	1	Exists
		2	Under Development
		3	Does not exist
Information Quality	It refers to the quality of the information given the level of detail it presents.	1	Good
		2	Intermediate
		3	Bad
Significance of information	It refers to the significance of information related with the analysed variable.	1	High
		2	Intermediate
		3	Low

Source: Suquisaqui, 2020.

The final value per variable results from the multiplication of the three items and represents its classification level (Figure 3). At the end of the process, a graph per initiative is generated. This composes a report with the details of this survey organized in seven pages. The higher the result obtained, the worse the situation and the greater the manager’s attention must be to establish priority actions that integrate the variable into the municipal management of urban solid waste.

Figure 3- Variable classification level.



Source: Suquisaqui, 2020.

The municipalities (MN) were identified by code, being MN_i (i=1 to 10).

3. RESULTS

Inter-municipal Solid Waste Consortium of Oeste Paulista (CIRSOP) context

In 2010, the NSWP highlighted the adoption of consortium solutions for the solid waste management. As a result, there was an incentive for studies aimed at not generating such waste, reducing the generated volume, segregation, selective collection, reuse and environmentally appropriate final disposal (BRASIL, 2010).

This scenario has been observed in Presidente Prudente since 2017, which had the end of the useful life of the municipal landfill as propeller ideal. The initiative was studied aiming towards operational benefits and economic advantages by establishing a consortium for solid waste management with different municipalities. In 2018, the legal constitution of CIRSOP was carried out, with its head office currently located in Álvares Machado (FUNDUNESP, 2020).

The ten CIRSOP municipalities occupy a total area of 6,664,044 km², which represents an expressive portion of the area of the West of São Paulo. The consortium serves approximately 396,342 inhabitants, of which 58.5% correspond to the population of Presidente Prudente (SP) (FUNDUNESP, 2020; IBGE, 2021).

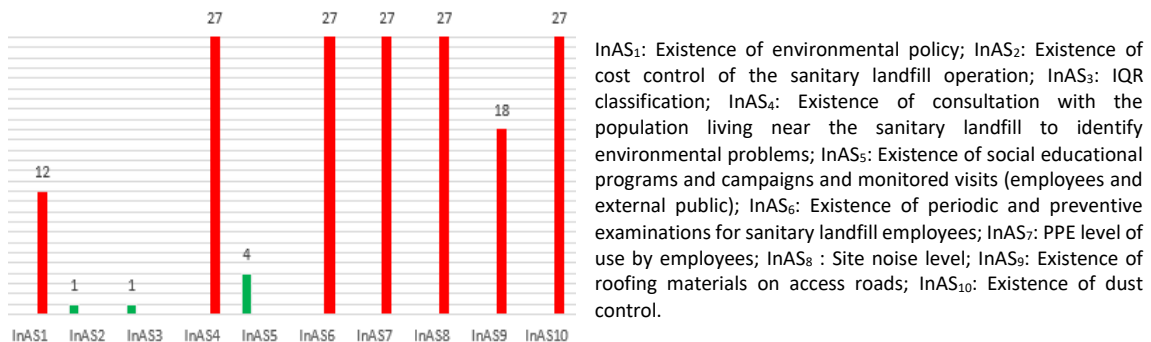
Regarding the urban solid waste generation in the consortium municipalities, in 2019 the volume generated was around 400 t/day. The investment was R\$ 32 million per year for solid waste management and public cleaning (FUNDUNESP, 2020).

The final disposal of these solid waste is not the same at all CIRSOP municipalities and, therefore, occurs in landfills, controlled municipal or private sanitation (FUNDUNESP, 2020). According to information released by the National Sanitation Information System (SNIS) in 2020, selective collection does not cover 100% of the area of all municipalities (largely not reaching rural areas).

Final disposal in sanitary landfill

Among the consortium municipalities, only five (50%) route their household solid waste (HSW) towards a sanitary landfill, located in the city of Quatá (SP). This was evaluated in the SAGReS software, and its results are presented in Figure 4. The other municipalities allocate the solid waste (SW) into municipal controlled landfills, which made it impossible to analyse using the chosen software.

Figure 4 - Results for the variables of "Sanitary Landfill" for the municipalities of CIRSOP from December 2021 to June 2022.



Source: The author, 2023

As observed in Figure 4, only three variables have presented satisfactory results, these being: InAS₂=1 (Existence of cost control of the sanitary landfill operation), InAS₃=1 (IQR Classification) and InAS₅=4 (Existence of socio-educational programs and campaigns and monitored visits (employees and external public)).

These are due to the existence of information for consultation through remotely available/online databases, since:

- For the variable InAS₂, annual records were found, where information regarding the cost of operation is disclosed through inventories, in a transparency portal of the company responsible for the sanitary landfill (REVITA ENGENHARIA S.A., 2018);
- For the variable InAS₃, the Waste Landfill Quality Index (IQR) available in the 2021 State Solid Waste Inventory, published by the Environmental Company of the State of São Paulo (CETESB), was consulted. The document classifies the Quatá Private Landfill (SP) as adequate, scoring IQR=9.3. However, the same consultation for transshipment stations, analysed by IQT (Quality Index of Solid Waste Transshipment Stations), showed

that two municipalities present places which have inadequate levels of operation, demanding special attention from management (CETESB, 2022);

- For the variable INAS₅, the survey returned information disclosed through news and diagnosis, that scheduled visits are conducted by municipal schools to the sanitary landfill, in addition to environmental awareness projects with the population surrounding the landfill site (NUNES, 2019; REVITA, 2022).

On the other hand, the other variables have presented scores at unsatisfactory levels, mostly due to the lack of information for consultation. This represents 60% of the searched information.

In this scenario, the results point to the need for greater dissemination of information by the municipalities that are part of CIRSOP regarding the parameters which involve the operation, control, and safety of the landfill in order to assist in identifying opportunities for improvement in its management.

The need for priority attention regarding the implementation of landfills is emphasized. This is because, while the Quatá Private Landfill (SP) has a high IQR and is classified as suitable for operation, the analysis from the SAGReS highlights several points of priority attention, which are:

- Existence of an Environmental Policy;
- Existence of consultation with the population living near the sanitary landfill to identify environmental problems;
- Existence of periodic and preventive exams for sanitary landfill employees;
- PPE level of use by employees;
- Site noise level;
- Existence of roofing materials on access roads;
- Existence of dust control.

Selective collection operationalization

Unlike the common scenario among the municipalities, obtained in the analysis of the initiative "Sanitary Landfill", the "Selective Collection" (SC) presented specific behaviour for each municipality in the analysed variables, as shown in Figure 5.

Figure 5 – Results for the "Selective Collection" variables by municipality of CIRSOP from December 2021 to June 2022.

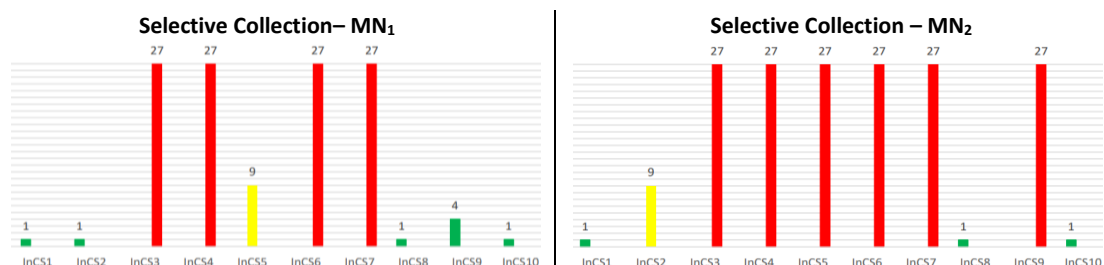
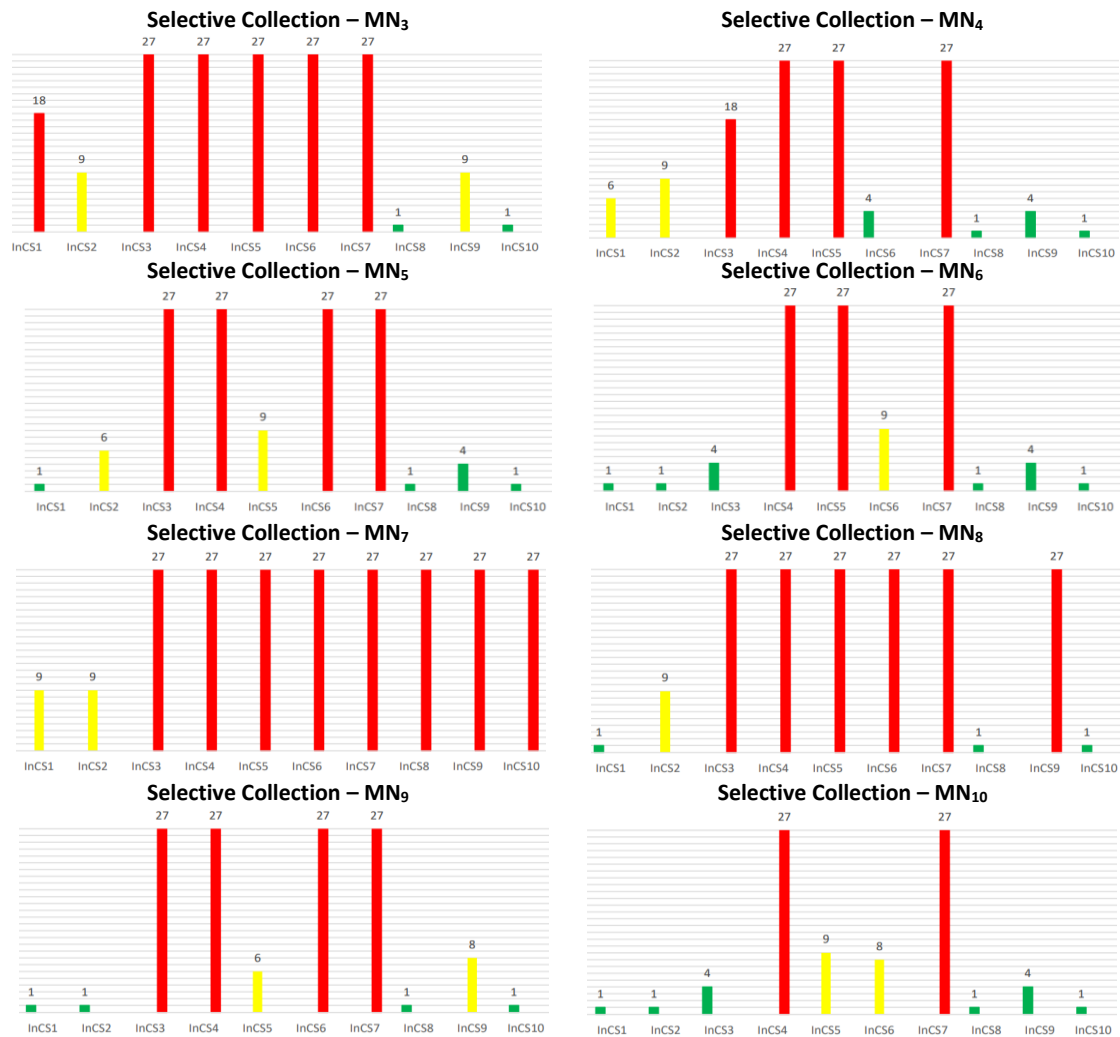


Figure 5 – Results for the "Selective Collection" variables by municipality of CIRSOP from December 2021 to June 2022.



Obs: i=1 a 10

InCS₁: Existence of the topic "Selective Collection" in MPISWM; InCS₂: Existence of partnerships for the operation of the SC; InCS₃: Existence of channels for the participation of the society and organizations in the management of SC; InCS₄: Level of working conditions from the perspective of the cooperative associate; InCS₅: Existence of monitoring and analysis of separation in the cooperative; InCS₆: Existence of planning and support for the training of waste pickers; InCS₇: Existence of survey and control of the causes of absenteeism; InCS₈: Amount (kg or %) of materials used by SC (excluding tailings); InCS₉: Existence of diversification in the cooperative; InCS₁₀: % of the coverage of SC in the municipality.

Source: The author, 2023.

The variable InCS₁ deals with the existence of the topic "Selective collection" in the Municipal Plan for Integrated Solid Waste Management (MPISWM). The information was obtained by consulting the MPISWM of each of the consortium members and evaluated with a minimum score when the document contained diagnostic and planning information for this initiative. In this context, the variable showed a positive result for 7 municipalities (InCS1= 1), with the other average or unsatisfactory.

The variable InCS₂, which deals with partnerships for the operation of selective collection, considers the existence of agreements with Associations, Cooperatives and Autonomous Carriers and analyses if they have partnerships that subsidize equipment, financial resources, and other instruments necessary to enable their activities. For this variable, the level of compliance ranged from high (01) to average (09), demonstrating the need for management

attention for municipalities that do not have effective partnerships, seeking to strengthen existing ones and establishing new agreements.

The variable InCS₃ refers to the existence of participation of the civil society and the organization of cooperatives associated in the management of selective collection. The attendance to this variable was mostly non-existent, since most municipalities do not have information that records social participation, resulting in the negative result ranging from 18 to 27. This highlights the need for attention from the consortium management, as well as from the municipalities individually, with the intention of inserting the company for direct participation in the management of selective collection.

The variable InCS₄ evaluates the level of working conditions from the perspective of the cooperative associate, considering whether there is control within the cooperatives to evaluate the circumstances involving their employees, such as the use of Personal Protective Equipment (PPE) and ergonomic issues. The search for information did not return results for any of the CIRSOP municipalities, which obtained InCS₄= 27. The negative result in 100% of the cities evaluated shows that all consortium members need to set priority attention towards the surveying of this information, either by the municipal management or the consortium.

The variable InCS₅ deals with the existence of monitoring and analysis of separation in the cooperative. For this, information was sought to demonstrate the acquisition of equipment for waste separation, control of sales by type, investments in training course and marketing of products, among others. For the municipalities of CIRSOP, the attendance to the variable InCS₅ ranged from 06 to 27 since, although 40% of them present information about the separation, this disclosure does not occur in a constant and effective way. Therefore, it is imperative that managers spend their attention analysis and separation activities within the cooperative.

The variable InCS₆ also acts within the scope of monitoring the collection cooperatives, evaluating the existence of planning and support for the training of the cooperative associate through courses offered by the municipal government or by the cooperative itself. For the municipalities of CIRSOP, this variable displayed a wide divergence, with values ranging from 04 to 27, and the result was unsatisfactory for 70% of the municipalities. The difference between the low performance in the variable for those that presented an average and satisfactory performance lies in the fact that the latter two disseminate information that deals with training campaigns and dissemination of knowledge to waste collectors associated with cooperatives.

The variable InCS₇ deals with the existence of survey and control of causes of absenteeism, based on the control by the administration over absences and absences in general in cooperatives, as well as actions to prevent them from occurring. As shown for variable InCS₄, no information was found about such a survey for any of the CIRSOP municipalities, which resulted in 100% of the consortium members with a maximum unsatisfactory score (InCS₇= 27).

On the other hand, the variables InCS₈ and InCS₁₀ deal with easily accessible information from surveys conducted by SNIS. The first of them considers the existence of information about the amount of materials (kg or %) reused by selective collection (excluding tailings). The second InCS₁₀ considers the percentage of coverage of selective collection in the municipality. For both, the result was satisfactory in 90% of the municipalities, diverging only in one municipality, as a result of it being a defaulter for USW in 2020 (i.e. no information was made available for control and consultation). Thus, the need for attention of the management of this municipality in the

effective implementation of the initiative in its territory, allied to the dissemination of information to the competent agencies has to be observed.

Finally, the variable InCS₉ analyses the existence of diversification in the cooperative. It considers whether there are services for collection, such as: door-to-door collection, segregation, accounting, among others. The results for the CIRSOP municipalities showed divergence, being: 50% low priority of care (InCS₉ = 4), 20% average priority of care (InCS₉ = 8 and 9) and 30% high priority of care (InCS₉ = 27).

Based on this scenario, the analysis of the selective collection in the CIRSOP municipalities demonstrated that it is relevant to study the mechanisms for implementing its activities efficiently in the whole consortium, since significant differences were observed between the behaviours of its consortium municipalities.

In summary, the analysis highlighted as main indicators for attention to the SW management regarding the selective collection in CIRSOP:

- Existence of channels for the participation of the society and organizations in the management of selective collection;
- Level of working conditions from the perspective of the cooperative associate;
- Existence of monitoring and analysis of separation in the cooperative;
- Existence of survey and control of the causes of absenteeism;
- Existence of planning and support for the training of waste pickers.

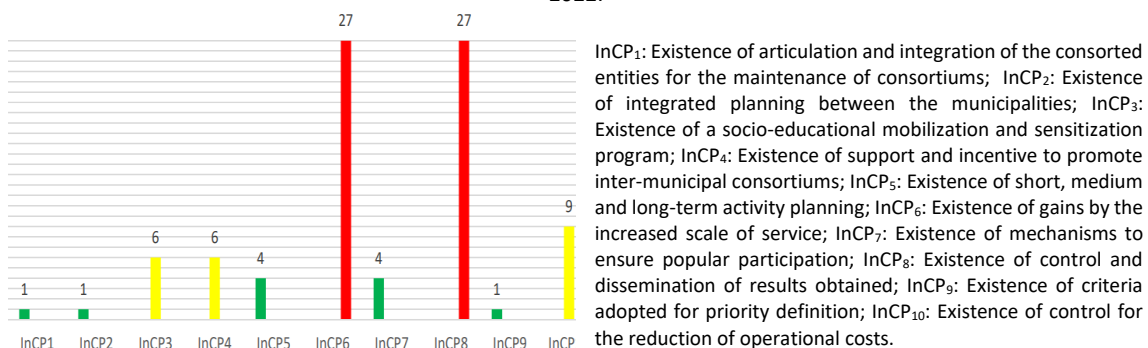
Observation for Waste Composting

The survey of information about waste composting did not provide feedback to any of the CIRSOP municipalities, demonstrating that this initiative is not yet effectively applied in these municipalities. Thus, the need for attention of municipalities stands out, since their organic waste ends up being sent to landfills, generating negative environmental impacts.

Public Consortium Evaluation

Since all municipalities compose the same consortium, the results for the variables of "Public Consortium" are presented in Figure 6.

Figure 6 - Results for the "Public Consortium" variables for the CIRSOP municipalities from December 2021 to June 2022.



Source: The author, 2023.

The analysis of Figure 6 shows that the variables InCP₁, InCP₂ and InCP₉ reached a satisfactory maximum score (01), requiring no priority actions from the consortium management.

The variable InCP₁ deals with the existence of articulation and integration of the consorted entities for the maintenance of the consortium, that is, it analyses the existence of planning so that the municipalities are always in contact with each other, making the maintenance of the consortium easier. The satisfactory result observed (InCP₁= 01) was a consequence of the information obtained in the online search, which returned news and records on the consortium's website informing the holding of sporadic meetings to discuss the planning and definition of activities involving all municipalities, assemblies to elect representatives, among others (CIRSOP, 2022).

The variable InCP₂ also deals with the joint action between the municipalities, providing information on the existence of integrated planning between the municipalities. Its analysis is based on whether there is a plan for all the entities involved to be working together. In a similar fashion to that described for the previously analysed variable, it presented satisfactory scores (InCP₂= 01). This is the result of the information disclosed, up to that point, of meetings and discussions between the consortium cities.

Finally, the variable InCP₉ refers to the existence of criteria adopted for priority definition, i. e. whether there were criteria to prioritize the activities of the public consortium. This variable presented satisfactory results (01), since the information presented in the Inter-municipal Plan for Integrated Solid Waste Management (IPISWM) of CIRSOP has found several goals and actions for the future of the consortium, guiding its priorities (high, medium and low) on predefined criteria (FUNDUNESP, 2020).

The variable InCP₅ deals with the existence of planning of short, medium and long term activity planning. For this, it analyses the adoption of different time scales for the actions, being careful as to keep the focus on present activities without failing to pay attention to those in the long term. The result was satisfactory (InCP₅= 04) because of all the guidelines proposed in the CIRSOP IPISWM present actions planned for the short (1 to 5 years), medium (6 to 10 years) and long terms (11 to 20 years).

The variable InCP₇ deals with the existence of mechanisms to ensure popular participation. Its result was considered satisfactory (InCP₇= 04) because of the information provided by the IPISWM of CIRSOP. The Plan considered the popular opinion regarding several aspects involving the management of the SW of its municipalities, such as: issues related to the low compliance of the population concerning the adequate separation of recyclable materials, low rate of selective disposal for the selective collection and irregular disposal of waste in specific points of the cities (FUNDUNESP, 2020).

For this initiative, three variables presented a medium need for management attention (InCP₃, InCP₄ and InCP₁₀), while two presented high attention points (InCP₆ and InCP₈). This is the result of the following behaviours observed:

- The variable InCP₃, which considers the existence of a socio-educational mobilization and awareness program, had an average result (InCP₃ = 06) due to the fact that CIRSOP guide the population through specific publications on its website, but without further

records regarding the dissemination of information for those who are unaware of the formation of the consortium (CIRSOP, 2022);

- The variable InCP₄ deals with the existence of support and incentive to promote inter-municipal consortium and had average result (InCP₄ = 06) due to the partnerships being established and adjusting even today, since CIRSOP's date of formation is recent (2020);
- The variable InCP₁₀ (existence of control and dissemination of the results obtained for the actions proposed by the consortium) obtained an average result (InCP₁₀ = 09) because it does not yet have records that could be carefully consulted, given the recent formation of CIRSOP. However, its IPISWM presents the initiative to control and measure the results achieved through indicators, which are specifically assigned to each of the objectives and actions outlined in the prognosis (FUNDUNESP, 2020);
- The variables InCP₆ and InCP₈, which deal with the existence of gains by increasing the scale of service and control for the reduction of operating costs, respectively, are priority points of attention because they deal with information that should be monitored according to the development of CIRSOP's activities over the years, since its recent formation makes this control immediately impossible to the present day.

In summary, the analysis of the variables per public consortium showed that 80% of them presented information available for online consultation, a large part originating from the preparation of the IPISWM of CIRSOP. These should be followed up in the years following the implementation of the public consortium, which are:

- Existence of control to reduce operating costs;
- Existence of gains by increasing the service scale.

Implementation of Reverse Logistics

The results obtained for Reverse Logistics are shown in Figure 7.

Figure 7 - Results for the "Reverse Logistics" variables by municipality of CIRSOP from December 2021 to June 2022

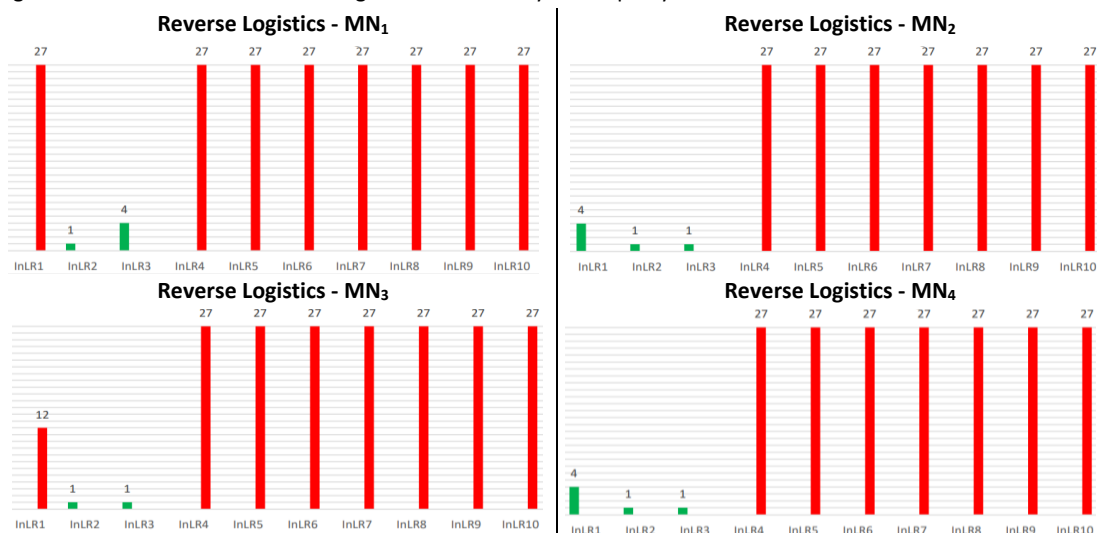
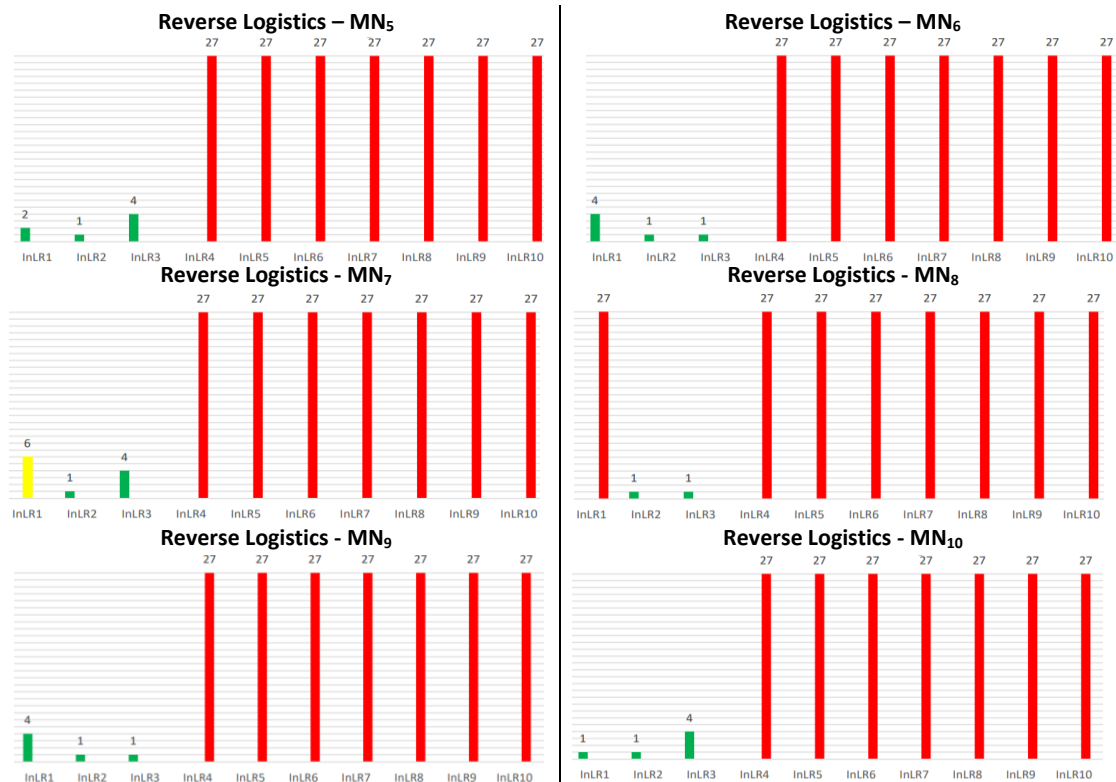


Figure 7 - Results for the "Reverse Logistics" variables by municipality of CIRSOP from December 2021 to June 2022



InLR₁: Existence of communication channels; InLR₂: Existence of a partnership between reverse logistics and recyclable collection; InLR₃: Existence of network or consortium for implementation and maintenance of reverse logistics; InLR₄: Recovery efficiency rate; InLR₅: Existence of legislation for reverse logistics; InLR₆: Amount (kg or %) of material recovered in relation to that received; InLR₇: Existence of technologies and process innovation; InLR₈: Existence of financial control of reverse logistics; InLR₉: Minimized amount of environmental impacts; InLR₁₀: Existence of characterization and control of identified risks.

Source: The author, 2023.

For Reverse Logistics, only three variables presented information that could be consulted online: InLR₁, InLR₂ and InLR₃.

The variable InLR₁ deals with the existence of communication channels, that is, it analyses if the organizations and the State provide communication channels which are easily accessible for the whole society (videos, websites and reports) in order to provide information about reverse logistics. The attendance to the variable was satisfactory in 60% of the municipalities, which demonstrates the need to implement communication channels in the other municipalities, since they can be important instruments for the population to be aware of and actively participate in the process, returning their products to the productive chain.

The variable InLR₂ discusses the existence of reverse logistics partnership with the collection of recyclables. The result obtained was satisfactory for all municipalities due to the IPISWM of CIRSOP presenting the information that, in some of them, a portion of the activities inherent to the initiative in question is carried out by the Associations/Cooperatives of recyclable material collectors. Records of occasional campaigns to collect specific materials with local and municipal partnerships have also been found (FUNDUNESP, 2020).

The variable InLR₃ deals with the existence of a network or consortium for the implementation and maintenance of reverse logistics and it has achieved a satisfactory score for all municipalities. This behaviour results mainly from the fact that the studied municipalities

have signed an inter-municipal partnership through CIRSOP. The IPISWM analysis of the consortium presents several intentions involving reverse logistics, such as: partnerships with recyclable material collectors to establish an operational support in primary waste management; support to Municipalities, Companies and Collectors' Organizations to access federal and state tax incentives, in order to make reverse logistics feasible, among other initiatives (FUNDUNESP, 2020).

The other variables have shown no results. Thus, for the consortium studied, the software pointed out as a point of attention:

- Recovery efficiency rate;
- Existence of legislation for reverse logistics;
- Amount (kg or %) of material recovered in relation to that received;
- Existence of technologies and process innovation;
- Existence of financial control of reverse logistics;
- Amount of environmental impacts minimized;
- Existence of characterization and control of identified risks.

4. CONCLUSION

The study demonstrated that, in general, the analysed initiatives are not consolidated and effectively implemented in the municipalities that make up the CIRSOP.

Considering the online research, the initiatives that did not reach satisfactory levels for the municipalities that make up the CIRSOP were sanitary landfill, waste composting and reverse logistics. In addition, none of them identified actions aimed at composting organic waste. Thus, they need more attention from management.

It has been observed that there is a lack of availability of information for consultation in a remote/online way, indicating the need for tools for monitoring and consequent improvement of the monitored parameters. For this, CIRSOP proposed in its Integrated Management Plan, among other activities, the establishment of indicators to analyse the performance of the proposed actions.

The best evaluated initiative in CIRSOP was the public consortium. It was observed, then, that the municipalities participating in its formation lacked the establishment of a consortium performance in the management of SW to assist in the better organization, systematization and planning of both municipal and inter-municipal management activities.

5. REFERENCES

AQUINO, A. M.; OLIVEIRA, A. M. G.; LOUREIRO, D. C. Integrando Compostagem e Vermicompostagem na Reciclagem de Resíduos Orgânicos Domésticos. **Circular Técnica**, 12. Seropédica, junho, 2005. Available on: <<https://www.infoteca.cnptia.embrapa.br/bitstream/doc/596884/1/cit012.pdf>>. Accessed on: may 2022.

ASSOCIAÇÃO BRASILEIRA DE EMPRESAS DE LIMPEZA PÚBLICA E RESÍDUOS ESPECIAIS (ABRELPE). **Panorama dos resíduos sólidos no Brasil 2021**. Available on: <<https://abrelpe.org.br/panorama/>>. Accessed on: dec. 2021.

BRASIL. **Lei nº 11.107 de 6 de abril de 2005**. Dispõe sobre normas gerais de contratação de consórcios públicos e dá outras providências. Brasília, 2005. Available on: <http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2005/lei/111107.htm>. Accessed on: apr. 2022.

BRASIL. **Lei nº 12.305 de 2 de agosto de 2010**. Institui a Política Nacional de Resíduos Sólidos; altera a Lei nº 9.605, de 12 de fevereiro de 1998; e dá outras providências. Brasília, 2010. Available on: <http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm>. Accessed on: jan. 2022.

COMPANHIA AMBIENTAL DO ESTADO DE SÃO PAULO (CETESB). **Inventário Estadual de Resíduos Sólidos Urbanos 2021**. São Paulo, 2022. Available on: <<https://cetesb.sp.gov.br/residuossolidos/wp-content/uploads/sites/26/2022/07/Inventario-Estadual-de-Residuos-Solidos-Urbanos-2021.pdf>>. Accessed on: jun. 2022.

CONSÓRCIO INTERMUNICIPAL DE RESÍDUOS SÓLIDOS DO OESTE PAULISTA (CIRSOP). **Prefeito Roger é eleito presidente do CIRSOP**. 03 de março de 2022. Available on: <<https://www.cirsop.sp.gov.br/noticias/visualizar/506>>. Accessed on: may 2022.

FUNDUNESP (Fundação para o Desenvolvimento da Universidade Estadual Paulista “Júlio de Mesquita Filho” (UNESP)). **Plano Intermunicipal de Gestão Integrada de Resíduos Sólidos (PIGIRS) do Consórcio Intermunicipal de Resíduos Sólidos do Oeste Paulista (CIRSOP)**. Presidente Prudente, dezembro de 2020.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE). **Áreas Territoriais**. 2021. Available on: <<https://www.ibge.gov.br/geociencias/organizacao-do-territorio/estrutura-territorial/15761-areas-dos-municipios.html?=&t=acesso-ao-produto>>. Accessed on: jul. 2022.

NUNES, G. Alunos de química visitam aterro sanitário. **FEMA**, 2019. Available on: <<https://fema.edu.br/index.php/blog/1370-alunos-de-quimica-da-fema-visitam-aterro-sanitario>>. Accessed on: may 2022.

RAMOS, N. F.; GOMES, J. C.; CASTILHOS JR, A. B.; GOURDON, R. Desenvolvimento de ferramenta para diagnóstico ambiental de lixões de resíduos sólidos urbanos no Brasil. **Eng. Sanit. Ambient.**, v. 22, n. 6, p. 1233-1241, 2017.

REVITA ENGENHARIA S. A. **Demonstrações financeiras individuais e consolidadas em 31 de dezembro de 2018 e 2017**. 2018. Available on: <https://www.revita.com.br/_files/ugd/ad2a37_4778f6cd910c4ffe8b4a64b5e2aeadaa.pdf>. Accessed on: apr. 2022.

REVITA ENGENHARIA S. A. **Educação Ambiental**. 2022. Available on: <<https://www.revita.com.br/educa%C3%A7%C3%A3o-ambiental>>. Accessed on: jun. 2022.

RIBEIRO, H.; BESEN, G.R. Panorama da coleta seletiva no Brasil: Desafios e perspectivas a partir de três estudos de caso. **Revista de Gestão Integrada em Saúde do Trabalho e Meio Ambiente**, 2006.

SILVEIRA, R. C. E. Consórcios públicos de resíduos sólidos no Brasil: uma análise do perfil da gestão compartilhada no território. **Revista Brasileira de Desenvolvimento Regional**, Blumenau, v. 4, n. 02, p. 49-77, 2016. Available on: <<https://proxy.furb.br/ojs/index.php/rbdr/article/view/5866>>. Accessed on: oct. 2022.

SOUZA NETO, P. M. de. Logística Reversa de Resíduos Sólidos: Uma análise bibliométrica. **Revista de Ensino**, Pesquisa e Extensão em Gestão, v. 2, n. 1, 2019, e21. Available on: <<https://periodicos.ufrn.br/revenspesextgestao/article/view/23505>>. Accessed on: jul. 2022.

SUQUISAQUI, A.B.V. **Elaboração e aplicação de ferramenta para avaliação da gestão e gerenciamento de resíduos sólidos urbanos para municípios brasileiros**. Estudo de caso: municípios de Araraquara (SP) e São Carlos (SP). 2020. Dissertação (Mestrado em Engenharia Urbana). Centro de Ciências Exatas e de Tecnologia. Universidade Federal de São Carlos (UFSCar), São Carlos, 2020.

VENTURA, K.S.; SUQUISAQUI, A.B.V. Aplicação de ferramentas SWOT e 5W2H para análise de consórcios intermunicipais de resíduos sólidos urbanos. **Ambiente Construído**, v. 20, n.1, p. 333-349, 2019. Available on: <<https://www.scielo.br/j/ac/a/PjBPmYbmRGHktMHZFPzfV9t/?lang=pt>>. Accessed on: jun. de 2022.