

Structured planning for sustainable organic waste management programs in small Brazilian municipalities

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ABSTRACT

A guide for the elaboration of new sustainable programs and policies for managing organic waste in Brazilian municipalities was developed. Analysis of government documents, the Brazilian Solid Waste Policy law and a literature review were conducted to identify the main factors influencing strategic planning of programs for municipal solid waste management systems. A framework presenting steps for planning programs was utilized as basis to conduct interviews with public servants and specialists. Findings about limitations, importance, feasibility and other considerations upon all steps were analysed, and grouped to produce practical recommendations applicable to the Brazilian context. The recommendations and suggested modifications to the original framework are presented in the form of a structured guide for planning sustainable programs and policies.

Keywords: Organic waste; Brazilian solid waste policy; Municipal solid waste; Structured planning.

1. Introduction

The numbers involving Municipal Solid Waste (MSW) generation and precarious scenarios of inadequate waste disposal were, in the past decades, the core reasons for developments of new legislation seeking sustainable practices for new programs and policies worldwide. In Brazil, Law No. 12305/2010 instituted the Brazilian Solid Waste Policy (BSWP). The BSWP contains principles and procedures to guide the adequate management of solid waste and defines responsibilities (Brazil, 2010). Among the primary objectives, the reduction and correct treatment of all MSW can be noted. As a consequence of the objectives, the creation of an integrated plan for Municipal Solid Waste (MSW) management, where the adequate management of all sorts of solid waste has to be planned, became mandatory to all 5.569 municipalities.

Despite the initiative from the government to develop and publish manuals to assist municipalities on elaborating their plans and complying with the Law (MMA, 2012; MMA, 2013), the statistics from IBGE (2013) demonstrated that only 33.5% of all 5.569 municipalities had developed an integrated plan in the terms accorded by the BSWP, even though it is a condition to gain access to federal funds for urban cleaning expenses (Brazil, 2010). In the state of Rio Grande do Sul, where this work was conducted, this number was approximately 46%. In August 2015, months after the deadline for the plans to be drafted and enforced, the Brazilian Ministry of the Environment issued an official calling for all municipalities to answer on the matter, and the quantity of respondents where the BSWP was in place raised to 41.74% (SINIR, 2015).

Regarding waste types, the studies that based the draft of the BSWP show the average urban domicile waste is composed by 31.9% of dry waste (mainly paper, glass and plastic), 16.7% of unrecyclable material, and 51.4% of organic waste (OW), which is mainly constituted of food scraps and pruning residue (MMA, 2011). According to the BSWP, the OW could be treated by other more economically and sustainable solutions, improving the energy use of these materials.

Years after the BSWP was enacted, many aspects of the legislation were not complied by municipalities. For instance, it is estimated that over 46% of the total yearly 79.9 million tons of urban solid waste generated in Brazil is inadequately disposed. It indicates that a significant parcel of the MSW is either not collected or not transported to sanitary landfills, ultimately being disposed in illegal dumps or controlled landfills. The OW fraction of the MSW has been destined to landfills, even where selective collection has been implemented for decades. It is estimated that 60.9% of all OW mass is destined to sanitary landfills, while 0.2% is treated in composting facilities. (ABRELPE, 2015; SNIS, 2015). Because of the total volume of OW that is inadequately disposed today, and because of the huge passive risk attached to the current practices of OW disposal, developing sustainable programs and policies for OW is a major social, economic and environmental issue.

The municipal plans of MSW management can be improved after they are developed and enacted by municipalities. New programs and policies can be added to solve specific problems in MSW context at anytime, or every four years, during a mandatory revision of the plan (Brazil, 2010). However, the low number of total municipalities where plans were developed and the poor numbers of MSW management remain a concern. Researchers have come to the conclusion that most management deficiencies observed in the municipal levels are due to lack of organizational capacities and professional knowledge (Guerrero, 2012). Considering the geographical differences and financial disparities in Brazil, applying the BSWP to small and less structured cities is a real challenge (Filho *et al.*, 2015).

In the context of MSW, Bing *et al.* (2015) identified the consideration of tailored solutions for specific waste types as a relevant research opportunity. Generally, the collection, transportation and disposal of MSW constitute one of the main expenditures of Brazilian municipalities. In the context described so far, the lack of solutions for viable and efficient MSW management that comprise the adequate collection, destination and recycling activities towards organic waste must be regarded as a significant problem, from which environmental, economic, social and legal problems and opportunities derive.

Therefore, this paper presents a study that aims to suggest a practical guide for the elaboration of new sustainable programs and policies through effective structured planning, by small municipalities seeking to solve OW related issues. The work was developed having the principles and objectives of the BSWP as guidelines, searching the literature for solutions.

2. Literature review

2.1. Organic waste in Municipal Solid Waste (MSW) systems

Definitions of organic waste (OW) may vary according to the situation. In the context of MSW, non-rarely, OW and *organic fraction* are both related to food waste and green waste

generated by households and local companies, collected either through street sweeping processes or other regular methods by local municipal authorities or any other regulated company or group (Buratti *et al.*, 2014; Oliveira *et al.*, 2016). However, when discussing waste-to-energy solutions, authors consider that OW is consisted of a share of putrescible (i.e.: recyclable) and nonputrescible (i.e.: refuse) OW, meaning the rest of the MSW is considered to be consisted of inorganic waste, both degradable and non-degradable (Korai *et al.*, 2017).

In additional contexts, studies focus on the food waste fraction of the OW itself, referring mostly to food waste generated often by households, addressing this object of study simply as “food waste” or “kitchen waste” (Mourad, 2016; Dai *et al.*, 2016; Moñino *et al.*, 2017). Therefore, generally, OW is considered to be the recyclable matter contained in the total organic fraction of MSW collected at a given municipality.

The material composition of OW can vary significantly according to the time and place of any collected sample. Small variations on OW compositions can have important impacts on the overall rates of energy production, depending on the technology used for recycling the organic fraction of MSW (Alibardi and Cossu, 2014). Characteristics such as lower heating value, methane potential, nutrient content and content of heavy metals are important in order to model the potential environmental effects of different alternatives being considered for OW (Jensen *et al.*, 2016).

A variety of technologies and recycling methods for OW have been suggested and compared in the literature. Usually, national policies would define a hierarchy between technology alternatives available, being the most common technologies: composting, biomethanisation, thermal treatment and sanitary landfilling. Many different settings and operational solutions can be used with each technology.

Composting can be defined as a controlled process of aerobic decomposition of organic material, through the actions of autochthonous organisms and bacteria (Massukado, 2008; de Bertoldi *et al.*, 1982). The product of this process is the known as compost: an organic material with high level of nutrients and fertilizing potential for agriculture. Also, as a result of the composting process, the waste volume can be reduced in more than 60% (Massukado, 2008). The waste composition defines not only the quality of the compost, and consequently its value, but it can also indicate its most proper use and destination (Jensen *et al.*, 2016).

Biomethanisation or anaerobic digestion consists of a set of biological processes in which the OW is converted into biogas and digestate by micro-organisms in the absence of oxygen (Evangelisti *et al.*, 2013). Anaerobic digestion is one of the various technologies that are available for power generation from biomass and OW, being not only feasible in large-scale industrial installations, but also on a small scale scenarios, especially in developing countries and rural areas, where energy supply is limited (Appels *et al.*, 2011).

The OW fraction can be destined to controlled combustion facilities. This thermal treatment, known as incineration, generates electricity from the flue gases of the main process, extracting the heat and using different types of engines to convert it to renewable energy. It is often used as a waste-to-energy technology applied to cases where there is no separation of OW on household level (Thyberg and Tonjes, 2017; Karagiannidis *et al.*, 2008).

The treatment of waste through different technologies can be performed *in situ* (e.g. household or local community level) or *ex situ*, in centralized treatment facilities, depending

on the scale, available structure, and also cultural and social contexts (Massukado, 2008; Hénault-Ethier *et al.*, 2017). Authors have conducted analysis in specific systems and context, showing that particular economical and cultural characteristics in municipalities can indicate the most promising technologies for a particular case (Ruggieri *et al.*, 2009; Walker *et al.*, 2017). Several authors have used life-cycle assessment and other tools to evaluate each case or scenario, comparing treatment alternatives from different perspectives (Jensen *et al.*, 2016; Moñino *et al.*, 2016; Evangelisti *et al.*, 2017; Nghiem *et al.*, 2017)

2.2. Elements affecting strategic decisions in Municipal Solid Waste Management (MSWM)

From the experiences in planning for waste management observed, Alamgir *et al.* (2012) suggest that meaningful dialogue among stakeholders, around intervention options, is essential. Therefore, an appropriate approach to the integrated planning of sustainable infrastructure and operations, and solid evaluation systems applied to demonstration projects should contribute to a cyclic learning process. As to general streams of solutions to food systems sustainability, Mourad (2016) suggests that the “hierarchy” of the organic fraction of MSW system solutions addressed as reduce, re-use and recycle should be considered in the planning of public programs, as they naturally tend to compete. Therefore, for municipalities to go beyond recycling, or weak prevention to strong prevention practices, thus, following hierarchy endorsed by regulations, rethinking the overall governance of the food system and its underlying power relationships between stakeholders is needed. In that sense, aligning decisions for MSW management with current national policies and their principles supports sustainable programs.

Decisions regarding OW treatment alternatives can be a major challenge without the use of a adequate method, or if relevant impacting factors are not taken into account. Bing *et al.* (2015) reviewed decisions in MSWM and initially classified those into three levels: strategic, tactical and operational. In all levels, there are important factors to be analysed before public managers can develop and implement effective programs. Several frameworks and models have been developed to aid decision makers in such occasions.

The division into three main factors being Environmental, Social and Economic, and their inter-relations is often used as basis for framework developments for MSWM. Fig. 1 shows the organizing structure proposed by Chonget *et al.* (2016) for the development of sustainability metrics for waste-to-energy systems.

A dynamic model for OW management systems proposed by Hénault-Ethier *et al.* (2017) showed results in different scenarios from economic, social and environmental perspectives. The model integrates six modules, referring to different aspects affecting the scenarios' results: population, technology, environment, economy, governmental decisions, and social and institutional decisions. In the last two modules, the authors consider feedback loops in the simulations, meaning social, institutional and governmental decisions not only affect MSWM results, but are also affected and limited by the society and groups involved.

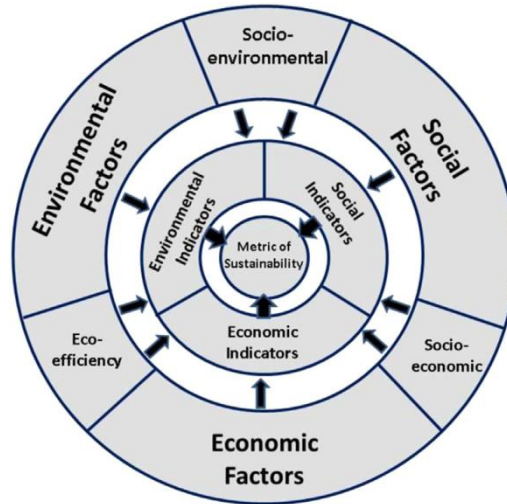


Fig. 1. An organizing structure of sustainability considerations. Source: Chong *et al.*, 2016.

Guerrero *et al.* (2012) summarized the main factors that affect the performance of waste management systems through a review of different authors that consider specific factors of influence (Fig. 2). The authors also present the five most common elements affecting waste management system performance in the literature: generation and separation; collection, transfer and transport; treatment; disposal; and recycling.

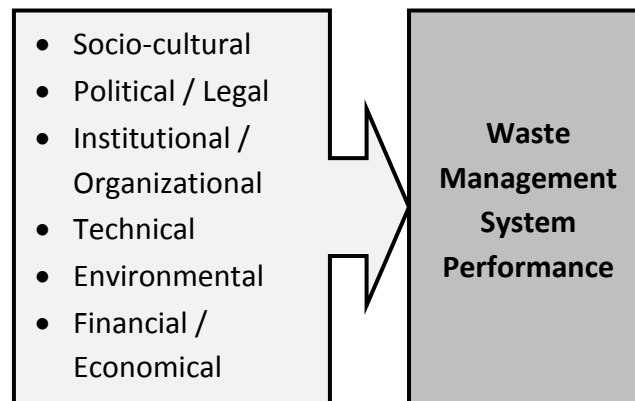


Fig. 2. Factors that influence the aspects of waste management systems. Adapted from Guerrero *et al.*, 2012.

Through the consideration of existing MSWM system models, Thyberg and Tonjes (2015) identified the lack of integration of diverse stakeholders into waste planning as a deficiency in previous models. Also, besides identifying stakeholders, it is extremely important to consider the adequate production and handling of reliable data when implementing solutions for MSW systems (Alamiret *et al.*, 2012; Guerrero *et al.*, 2012; Rigamontiet *et al.*, 2015; Chong *et al.*, 2016). Moreover, MSWM systems must have adequate performance indicators defined by critical criteria. Assessment indicators should be: direct; objective and specific; clear; practical; reliable; useful for waste managers; and relevant (Thyberg and Tonjes, 2015).

Finally, considering systems engineering and assessment tools as key components, Thyberg and Tonjes (2015) proposed a framework that comprises all relevant criteria, while taking a holistic and interdisciplinary view of MSWM. The framework clarifies many

decisions to be made in the strategic level before public managers should move on to tactical and operational concerns. The authors divide the framework into four overarching components: Plan, Implement, Evaluate and Improve. Each component involves several steps, and the Plan component of the framework can be related to the strategic level decisions in MSW (Table 1).

Table 1

Waste framework for WMS. Source: Adapted from Thyberg and Tonjes (2015).

Overarching Component	Step	Description
Plan	1. Define System	a. Define scope of system
		b. Define system boundaries
		c. Define overall system objectives (environmental, social and economic)
		d. Clearly state definitions for key terms
	2. Programs and Policies	a. Determine programmatic (including technological and policy) options
		b. Evaluate the programa with regards to Step 3-8 of the framework. Perform detailed assessments, including optimization analysis or simulation analysis, as necessary
	3. Requirements	a. Identify and/or define applicable legal requirements
		b. Identify and/or define other applicable requirements (e.g. institutional)
	4. Resources	a. Define required economic resources; consider long-term funding
		b. Define other required resources (e.g., human resources, specialized skills)
		c. Ensure required resources are available. Perform detailed cost assessments, such as cost-benefit analysis, as necessary
	5. Responsibilities	Define roles and responsibilities for system managers, other personnel, and stakeholders
	6. Environmental Impacts	Evaluate environmental impact of program. Use LCA or another comprehensive approach if possible
	7. Stakeholders and social impact	a. Identify stakeholders and their concerns regarding the system
		b. Define methods for stakeholders communication, including regular outreach and education; include approaches for integrating their knowledge and concerns early in the planning
		c. Identify impact of programs on society
	8. Measure	a. Identify and define performance indicators. Include environmental, financial, regulatory, social, and stakeholder concerns
		b. Define methods for ensuring efficient and regular data
9. Select Program / Policy	Select best program option based on findings from Plan steps	

The framework can be first used as a planning tool in the strategic decisions level to design or decide a new program, policy or technology and to evaluate outcomes. In addition, it can be used to evaluate an existing program seeking improvement possibilities. It can be

used at various system stages, or applied to a specific component of a MSW system, such as the OW.

2.3. Aspects of the Brazilian Solid Waste Policy (BSWP)

The Law No. 12305/2010 presents eleven principles to be taken into account when planning MSW management systems in the Brazilian territory (Brazil, 2010). Amongst those, are: a) prevention and precaution; b) sustainable development; c) cooperation between government, companies and society; d) respect to local diversity; and e) society's right to information and social control. Following, the Law presents fifteen objectives of the BSWP. Between the main objectives, is the protection of public health and the quality of the environment. Another objective exposes the hierarchy of solutions for MSW: non-generation, reduction, re-use, recycling and correct treatment of solid waste. Furthermore, the objectives of stimulating the recycling industry, promoting an integrated management of MSW, continuous technical capacitation in the area of solid waste, the integration of waste-pickers in new policies, and stimulating the life-cycle assessment of products are present in the BSWP.

According to the BSWP, each municipality is responsible for the management of the solid waste generated by its population. MSW management must be conducted with the aid of integrated plans of MSW by each municipality, or consortiums, in the cases where smaller cities decide to elaborate a joint plan for managing MSW, or creating their plans. Furthermore, all twenty-six states are to elaborate a solid waste management plan, defining their own goals and guidelines for all municipalities within the specific region. All plans, national, state, and municipal, must be created in order to project actions for the next twenty years, and updated at least every four years. The Law No. 12305/2010 also specifies the minimum content required for the plans to be elaborated and implemented. For municipalities of less than 20.000 inhabitants, a simplified plan, with fewer minimum content requirements, is permitted.

The BSWP defines that the access to federal funds for urban cleaning expenses for the municipalities is conditioned to the creation of the integrated plans. Moreover, it is also defined that consortium solid waste management initiatives, and initiatives involving the inclusion of recycling cooperatives, should be prioritized in the access to federal funds. The policy states that the Brazilian government will institute and support financing alternatives primarily for initiatives aiming to: a) prevent and reduce the generation of solid waste; b) implement structures for recycling cooperatives and low-income groups; c) develop solid waste projects in inter-municipal consortiums; d) develop research in clean technologies applied to the MSW context; and e) develop environmental management systems focused on improving the productive processes and the re-use of solid waste. In addition, the BSWP projects that WTE technologies can be implemented, as long as their financial and environmental feasibility is proven.

3. Material and methods

In this paper, a qualitative method was followed. First, a descriptive research was conducted, focusing on having a preliminar diagnostic and a general understanding of the existing gaps and inconsistencies in the planning processes in the Brazilian context. This was conducted through a literature review and documental analysis. Based on analysis of the preliminary findings, an exploratory study was conducted through qualitative investigation on interviews.

3.1. Municipal Solid Waste (MSW) and Organic Waste (OW) scenario

Because many municipalities of all national regions have been reported to not have complied with the new legislation (IBGE, 2013; SINIR, 2015), it was assumed that a study in any particular region can contribute to the issue. Also, even though only municipalities with less than 20.000 inhabitants are considered small in the terms of BSWP, it was assumed that cities with fewer residents than 20.000 may lack infrastructure to conduct any substantial developments at the present moment. Therefore, this paper was developed in municipalities in the state of Rio Grande do Sul, Brazil, containing from 20.000 to 40.000 inhabitants.

Although other fractions of the MSW are directly related to the OW, as they are usually collected at the same location, solutions for the correct treatment of OW were the focus of this paper, as this fraction corresponds to the larger parcel of MSW generated.

Because of the apparent Brazilian reality, it was considered that there could be gaps in the official manuals and guidelines, or even recurrent issues that public managers and other entities face, that are contributing to the overall failure of the national policy so far. As a review on the literature showed that this reality is not exclusive to this country, studies in other countries comparing practices and solutions for the matter were considered.

3.2 Work development description

Figure 3 shows how the work was developed. First, data on the actual scenario of MSW in Brazil was gathered, and public documents issued by the government were analysed to give the authors an understanding of the context. Following, a literature review was conducted systematically, through the selection of relevant topics, mostly from papers in the ScienceDirect™ database. The definition of the main terms present in the literature related to MSW and OW treatments was reviewed. Next, the strategic level perspective in which the paper and all future reviews would be approached from was defined. Following, papers containing information on implementation and results of different technologies and management systems for OW in various countries were reviewed. Furthermore, major guidelines for sustainable Municipal Solid Waste Management (MSWM) and frameworks comprehending practical solutions for strategic decision-making were researched. The literature review also involved the research of main aspects of the BSWP.

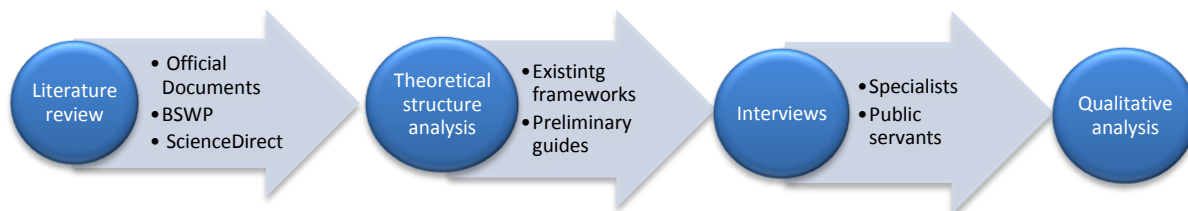


Fig. 3. Paper development steps.

Following, the analysis allowed the construction of a preliminary guide, containing a suggested order of practical decisions and analysis that managers should make when planning sustainable solutions for OW issues. Thyberg and Tonjes (2015) framework presented in Table 1 was used to model the basic structure of the interviews. It was adapted so that specific elements of interest observed in the official documents could be discussed in more detail during interviews, while maintaining the original logical sequence proposed in the framework. The structure used to conduct interviews is given in Appendix A.

The Step 1 from the original framework was divided in steps “Define System” and “Define Scope and Objectives”. The objective of this modification was to discuss the overall quality of information of municipal plans with interviewees. The third step presented to interviewees, “List program/policy options” was used to discuss the process of elaborating new solutions to OW in small municipalities. The following three steps were focused on discussions around the limitations and suggestions for performing legal, financial, human resource and environmental impacts analysis. Next, Step 7 from the original framework was divided in “Stakeholders” and “Social impact”, giving the opportunity for further questioning on cooperatives and waste-pickers issues, as this is particularly present in the BSWP. Finally, aspects and importance of indicators were observed in the interviews, and the last step created the possibility of discussing how decisions are or should be made, in addition to any final considerations.

During interviews, the structure obtained from the adaptations to the framework was presented as a “preliminar guide”, while questions were made to trigger interviewees’ opinions on limitations, importance, feasibility and any other considerations upon all steps. Seven interviews were conducted individually, between September and November of 2017, lasting around one hour each.

For the purpose of this work, the interviewees were distributed in two groups: specialists and civil servants. Specialists were selected by convenience, while seeking to interview professionals with long experience in waste management, and different sorts of experience and formation in the subject. The civil servants were municipal professionals, not holding political offices, of three different municipalities with population numbers in the range defined. All civil servants were currently working in areas or programs directly related to MSWM. Table 2 presents the letters utilized to refer to each interviewee in the Section 4 of this paper, and also the formation and relevant MSW experience, when the information was disclosed by the interviewees.

Table 3 shows the role each civil servant was responsible for, inside each municipal technical body. Municipalities were named City 1, City 2 and City 3, for further reference in the article. Seven municipalities were contacted, and only three responded. Municipalities

were selected as to the following criteria: proximity to authors' university location; time availability for interviews; population range; municipal plan already elaborated. All three municipalities are part of a consortium, meaning the integrated municipal plans for solid waste management of the municipalities were developed by a single group, funded by 26 municipalities of the consortium altogether.

Finally, the data was analysed and interpreted. The analysis was conducted to produce a series of recommendations for more effective practices in strategic decision-making processes for OW management plans. Moreover, recommendations were put together in a final guide presented in Section 4, proposing to effectively apply the principles of the current Law, and achieve its sustainable goals through a structured planning process.

Table 2
Interviewees categories, formation and experience.

Ref.	Group	Formation	MSW experience
A	Specialist	Civil Engineer; Master of Engineering; Doctorate in water resources and environmental sanitation	11yr - University teacher; 27 yr - Municipal Cleaning Department Engineer (former Director); National Solid Waste thematic chamber Coordinator
B	Specialist	Environmental Management Technologist; Specialization in Strategic Urban Territory Management	3 yr - Consulting for Cooperatives; 1 yr - Selective Collection coordinator
C	Civil servant	Not informed	Not informed
D	Specialist	Biology graduate; Environmental planning post-graduate	11 yr Chief of Department of Environment (municipal); 7 yrs Environmental Education coordinator (municipal)
E	Civil servant	Biology graduate; Masters and ABD in Education	5yr - Environmental Licensing
F	Civil servant	Not informed	Not informed
G	Specialist	Social communication graduate; Social and Environmental management specialization; Masters in Social Sciences; Environmental Management for Sanitation graduate;	13 yr - solid waste management in private companies, environmental consultant for research institutes; Municipal Environmental planning advisor; 8 yr - co-founder of a Social and Environmental Consulting group

Table 3
Interviewed civil servants roles and municipality.

Ref.	Current role	Municipality	Population (IBGE, 2015)
C	Chief of Department of Environment	City 1	30.175
E	Biologist – Environmental Licensor	City 2	26.092

Ref.	Current role	Municipality	Population (IBGE, 2015)
F	Selective collection coordinator	City 3	34.341

4. Results

This section presents the most relevant considerations of specialists and public servants on the steps of the preliminar guide. Rather than following the original order of steps used to conduct interviews, the results are presented by common subjects, as many answers or comments can be related to more than one step of the framework.

4.1 Considerations on the BSWP and Municipal Plans

All interviewees demonstrated an overall knowledge and understanding about the main elements of the BSWP. However, key terms had other synonyms commonly used in the context of planning for MSW. For instance, only interviewee C didn't indicate that the term *project* and the term *program* present in the BSWP work as synonyms. Interviewee A also commented that the first step "Define system" is highly related with what the government manuals call "Diagnostic of the System". Moreover, it is commonly accepted that, by law, the responsibility for planning and managing MSW systems belongs primarily to the municipality, as interviewee D said:

"The legal responsibility for managing the municipal solid waste belongs to the city hall. It belongs to the public power, and there is no way of scaping it."

Being the integrated plans for MSWM the most relevant document for planning programs, the interviewees said that the availability and quality of information in those documents deserve attention. Interviewees E and G reported frequent consultations to the municipal plans developed by the consortium, indicating that all the relevant information and guidance can be found in there, including program options and past projects.

However, interviewees C and D said the method by which the municipal plans were elaborated brought a great amount of unspecified data, and therefore, jeopardized the elaboration of new programs based on reliable data. The main issue was the centralization of all the elaboration process by the contracted company. Interviewee D spoke about the first plan created in City 1 by the municipality professionals in the 90's:

"So maybe it was not an academic level plan after all, but it was feasible for our reality. [...] The results of the programs are much more effective when you work with the people who deal with it in a daily basis."

Specialist A said that many municipalities make the mistake of trying to plan programs without knowing itself through reliable data. Public servant E also agrees with this perspective, saying a municipality cannot hope to improve waste management practices before it knows the main numbers about a current MSW system.

Interviewees A, B, E, F and G said that a study of the waste composition is the major starting point for that, along with the mapping of all current costs involved in collection, sorting and destination. Interviewee B was of the opinion that due to the usual lower complexity, these studies are more easily conducted in small municipalities.

Interviewee G pointed out that the lack of reliable and up-to-date information also affects the quality of projects developed by private companies for public-private partnerships, since companies normally have to base their projections on public data. Also, the available infrastructure for controlling and gathering data was cited by interviewees C, E and F as a necessary analysis starting point, saying municipalities often have trouble maintaining its basic assets, such as trucks, weighing-machines, etc.; which may compromise the effective operation and measurement of data for key indicators.

4.2 Legal considerations

All interviewees regarded the BSWP and other related legislation as complete, in the sense that it does not lack clear definitions and guidelines to support the evolution of the Brazilian MSWM. Public servant E referred the hierarchy involved:

“I think our BSWP is well structured. From it comes the State policy, which is basically a copy, adjusted to the smaller region. And from that one comes the municipal policies and plans.”

Furthermore, the actual enforcement of the laws was cited as a main issue by all interviewees. As interviewee E stated:

“So I don’t think we have a legislation problem in waste management, right now. I think that what we have is a problem of applying the Law. Enforcing the Law.”

Interviewee A, B and G gave examples of laws that are not applied in practice. In addition, specialist D reported:

“The 237 CONAMA resolution from 1997 already forced the battery manufactures to collect their products, and still today municipalities fight so that companies collect these types of waste, even with the BSWP speaking about reverse logistics, defining manufacturers must implement collection points in municipalitie... and I don’t see that happening. So, if we look at all legislation, we have more than enough laws.”

The interviewees agree that thinking about legal requirements should be the first analysis to be made. However, interviewee C and F pointed out that municipalities need to be careful to avoiding creating local laws by copying what is already stated in higher legislation, since it consumes resources usually lacking in small municipalities. Only laws in which the current municipal system is capable of fully putting into practice should be moved forward. Moreover, public servant E said that conducting a whole planning or assessment of programs relying on future modifications of creation of laws is counter-productive, since it involves a variety of other political factors and influences.

Furthermore, there were reported examples of how different laws and applications can support programs. Specialist A said the majority of small municipalities don't have specific legislation towards MSW. Only sometimes, there are succinct definitions inside laws related to other economy sectors, and therefore, municipalities should develop new legislation to both incentive and punish certain practices inside the system. Interviewee B commented that a common practice in municipalities is to include the taxes for urban cleaning in the IPTU - urban land and property tax -and since this tax is known to have high evasion rates, charging the taxes for urban cleaning together with other sorts of tax could lead to more tax revenue. Interviewees A and E said the tax payment should be redesigned to charge households per waste volume generated, which would require not only different laws but a new infrastructure. They said this would certainly lead to a significant change in household behaviour towards waste generation.

4.3 Environmental awareness and treatment alternatives

The population awareness about three main waste streams was reported as a great barrier for implementing new programs. Interviewee A said that separating the organic waste in the source is a necessary step in the evolution of waste management in Brazil, and that any program should consider this. Interviewee C said it would require a system redesign so that a third parcel, the unrecyclable waste, could be treated in separate from the organic waste. Interviewee G said:

“[...] because when the population thinks about organic waste, it sees it as trash, as unrecyclable material. They don't understand they are throwing away, wasting, nutrients that should be returning to nature and contributing to food production.”

All interviewees cited composting as the main alternative for organic waste treatment. However, interviewees C, D, E and F reported studying failed experiences with different centralized composting technologies in other cities in the past years. They said the main cause for the failure was not considering the poor organic waste separation at the source, and not developing methods to enhance this separation at the household level. In the opinion of interviewees A, D, F and G, home composting is an feasible alternative in the actual scenario, that should be highly regarded in environmental education initiatives. Interviewees B, C, D and E said that nowadays, programs of centralized composting only for green residue are either operating or being implemented.

Interviewees B and D said the hierarchy of solutions to waste proposed by the literature, and corroborated in the BSWP, is not usually followed when public managers elaborate programs for organic waste. They reminded that reducing the amount of waste generated should be a priority. In addition, interviewees E and G said the common solution to organic waste continues to be thinking about landfills and cheaper ways to dispose of this waste parcel. Moreover, interviewees B, C, D and E reported that the generation of options of programs depends highly on the experience of public agents involved on the process, since there is no specific information sharing policy between municipalities.

4.4 Cooperatives and waste-pickers influence

All interviewees cited local cooperatives as key stakeholders in the MSW systems in Brazil. Interviewees B, C and D explained that because cooperatives have a direct interest in the overall quality and evolution of the system, their participation is important to achieve success. Interviewee C attributed the shift in how City 1 handled waste to the effective communication and constant capacitation of the local cooperative, that handled the OW in past, but today is only responsible for sorting dry waste. Furthermore, it was explained that the ability to financially support the cooperative was an important factor for the continuity and evolution of the work. Interviewee E said that cooperative initiatives can be a solution, but that it was not a success in City 2, further saying:

“[...] Cooperativism itself is a complex endeavor. It needs people who understand it, so they can feel safe in it. So you have cooperatives that work, and those who don’t. But it is a social enterprise. And this brings all the sort of complexes and issues in any human being.”

The social matter of waste-pickers was commented by interviewees A, B, F and G, who indicated that this is a delicate issue in the Brazilian context that has to be taken into account in the process of planning programs and public policies. Specialist A said professionals from Social Sciences should be assigned to plan and implement any communication with these and other socially vulnerable groups. Interviewee F reported recent experiences of programs in City 3 that failed because the municipality was not able to establish effective communication and engagement from the aimed groups.

4.5 Financial resources

All interviewees said that the tax revenue that is exclusively destined to urban cleaning does not cover all the expenses municipalities have with MSWM. Interviewee B reported a recent experience where a medium sized city was operating on a deficit of over R\$7 million because the municipality spends much more than it collects from taxes, and that it is a reality in the majority of Brazilian municipalities, independently of population numbers. Another issue cited by D, G and E is that allocating resources to MSW management and programs is usually not a priority, much due to lack of public interest on the matter. Interviewees C and D said that the population’s pressure is one of the key factors considered by public managers for allocating resources. Society engagement was one of the main success factors for programs in City 1. Interviewee G also said that even inside the solid waste context, programs and resources to organic waste matters are not prioritized inside the municipalities. In addition, it was said that because municipalities have very few laws that would obligate that some resources are allocated to MSW or OW programs, creating municipal laws could promote continuity of existing programs and the evolution of the system.

Interviewee A said that compared to past decades, there is not much financial resources made available by the government to solid waste programs. On the other hand, interviewee B is of the opinion that even during an unfavorable political and economic scenario, there are resources to be sought. Interviewees B, C, D, E, F cited financing lines of the Ministry of

Environment, national and global private finance entities. Furthermore, interviewees E and F pointed out that because solid waste programs can be included in sanitation work projects, the access to larger long-term financing resources is facilitated. Interviewee B and G reminded that, by the BSWP, intermunicipal consortiums end up receiving preference for financing lines from the government.

A strong opinion of interviewees A, B, C, D, E was that municipalities must manage their agents so that there is a group, or at least one person in the case of smaller cities, solely responsible for prospecting possible revenue streams to be destined to MSW programs. Furthermore, interviewee D pointed to the common practice in municipalities of establishing their budget in pre-defined dates, meaning the process of planning new programs must be conducted with these pre-defined dates in mind. In addition, interviewees B, E and G stated that it is very important to have qualified technical staff who can write official documents aiming to access funds from governmental financing or private investors. However, all interviewees said that a qualified technical body of agents inside the municipality is a distant reality for most small cities, in terms of both quantity and variety of professionals. Interviewee A stated that the lack of a qualified technical body also creates communication difficulties for municipalities when external services, such as consultancy, are contracted to supply specific needs in MSWM.

Interviewee B reported experiences where a multidisciplinary group of municipality professionals were capable of generating a significant amount of programs approved for different sorts of financing and investments. Moreover, interviewees C and D relate the relatively frequent acquisition of new investments and financing to City 1 programs to the creation of what they called “reputation”, made through years of reliable data gathering on the results and continuity of programs. Interviewee C said that nowadays, many private companies seek the local cooperative to invest in capacitation and new machinery acquisition, due to the continuity of their work, and the ability to generate constant and reliable reports. When questioned about the reasons why City 1 have had success in acquiring investments from different sources over the past years, interviewee said:

“It is because of our history. Our municipality has a history of own will. It has been providing resources for years, with no legal obligation. The BSWP is from 2010 and the municipality does that since 1994.”

4.6 Municipal technical and political body organization

To interviewees B, C, D, E and G, the political influences involved in the planning and continuity of programs are the part of the main issues encountered. Interviewees C and E explained that municipalities are structured hierarchically in departments, which respond to secretaries. Usually, the final decision is made by the head of the secretary, while most of the planning is conducted by the technical body inside the departments. As all interviewees said, in small municipalities, it's not uncommon that one person is responsible for more than one secretary.

Furthermore, interviewees C, D, E and G reported that decision making responsibilities are usually assigned to holders of political offices, and rarely to own municipality career agents. Interviewees A, C, D, E and G said that political office positions are non-rarely occupied by people without technical understanding or even experience in MSW management. For public servant E, there must be discernment between political and technical decisions in MSW, so that technical agents are empowered to effectively make decisions, suggesting that for the continuity of programs, program managers should be professionals not holding political positions in the municipality.

Moreover, interviewees brought to light the continuity of programs as an issue. Due to municipal election processes every four years, interviewees B and G said that changes in government, especially when different political parties are involved, historically leads to significant losses in current programs. Interviewee B reported a recent experience where five strategic solid waste collection points were reduced to one malfunctioning point over the course of three years, after a change in the municipal public power after the elections. In addition, loss of information on current and planned programs was reported as being another consequence of these events. Furthermore, interviewees A, C and D said that they have experienced continuity of programs over changes in government positions inside municipalities, but said that these events require an extra effort from the municipal departments, as A said:

"[...]Here we have fifteen engineers, but from time to time there are somethings that we loose, even though the technical team continues. When the government changes here, we have to "sell" the programs again, saying "Hey, this is important". If you don't have someone who does that, whoever is assuming the secretary does whatever he or she wants, and normally, because the person has no qualification, it's something wrong."

4.7 Responsibility in MSW programs

Although all interviewees agree that the management, control of indicators and strategic decision making should be centralized in public agents inside municipalities, there were different opinions and reports about outsourcing parts of planning and implementation of programs. Overall, all interviewees said it is generally much more expensive to outsource the collection services and other treatments, but reminded that not doing so requires constant capacitation of the municipal technical body. Interviewee F said that contracting out is a more interesting choice, since the municipality won't need so many professionals involved, and the contracted companies can be asked to answer for any problems that may arise. However, public servant D said that after more than twenty years since selective collection was implemented in City 1, the direct relationship with city employees and the regular meetings between public agents, cooperative and city employees involved in programs created a more solid MSW system. Specialist D added:

"Our municipality is part of a minority that does not contract out (selective collection), but has high source separation indexes and waste reuse, and we have proof of that. [...] If you have a fixed team of employees, it is easier to manage."

Moreover, specialist G saw outsourcing as a complementary solution in most cases, suggesting outsourcing smaller parts of programs can promote benefits to the system, for example, through sharing of external experiences and knowledge. An example given was the environmental impacts analysis. Interviewees A, E and G said environmental impacts analysis are complex, and indicated it should be conducted by qualified personal or contracted companies. Interviewee G said that in bigger municipalities, this analysis can be conducted by own personal. However, it is not always conducted through proper methodologies, and this would be an even more significant issue in small municipalities.

4.8 Cultural aspects

A recurrent reference during the interviews was environmental education as a major factor influencing the success of programs and policies. Interviewees C, D said that environmental education must be present in all discussions when planning programs for OW. Interviewee D reminded that promoting the understanding that the real goal is to reduce the amount of waste generated is the main challenge. Interviewee E said that poor environmental education is a cultural reality in the whole Brazilian society. In addition, interviewee C said the environmental awareness is also an issue inside the secretaries and departments of municipalities, indicating environmental education actions should include these personnel.

Moreover, specialist G said that environmental education to lower income classes and groups in social vulnerability situation has to be executed in different ways, adding that the fact that these groups have less access to information, does not mean they will engage less in programs once they are included in the process. Interviewee G suggested the guide should address the analysis of cultural aspects more clearly.

Addressing cultural and environmental awareness issues, interviewee B reported a current program to be developed in only a few apartment complexes, where environmental education is the main goal, suggesting municipalities can think about “pilot programs”, promoting small tests before larger programs are implemented. In addition, interviewee D also spoke about a “pilot program” conducted in local public schools, which generated valuable data for the municipality. Interviewee A also suggested that the means to promote environmental education in small municipalities can be extremely different from those practiced in larger cities. For instance, “door-to-door” communication actions can be actually feasible in smaller communities.

4.9 Stakeholders

The interviewees agreed that all members and institutions of any municipality are somehow involved when programs for OW are considered. Mapping stakeholders was considered as a simple task of the planning process by interviewees A, E, F and G. A consideration made by interviewees C, E, F and G is that the stakeholders mapping should be conducted before the analysis steps begin. Interviewee E said that when planning programs, the initiative should be made public before all analyses are made, giving the chance for stakeholders to take part in the process from the start. Interviewee G said that even before

elaborating program options, it is important to make a sense of which groups have been actually engaging in programs, or in need of specific programs. Also, that the engagement of stakeholders in the early phases of planning is a success factor. Moreover, interviewee D said that in small municipalities, a close relationship from the government with local community associations is essential to any program's success.

Specialist G suggested that not only the already developed ideas and the objectives of municipal plans should be the source of program options for analysis and further implementation. Informations from local community groups, municipal records of complaints or issues, old reports, etc., can be a good source of relevant problems, and may not be clear in municipal plans.

4.10 Communication accross municipal departments

The interviewees also spoke about the involvement of different agents, departments and secretaries. Interviewees B, C, D, E and F gave examples of how most programs for MSW management end up involving interaction between two or more secretaries. Interviewee E said that this is either due to legal obligation, or sometimes work methods. Interviewee C and E said that City 1 and 2 are examples where poor communication accross departments inside municipalities have already caused damages to programs results, and therefore, need substantial improvements. Interviewee E spoke about how, similarly to what should happen with all external stakeholders, secretaries should participate together, from the start of the planning:

“If you put all of this (planning process) together, and run it inside your group (of public servants)... when it is time to recruit, you won't be able to do that. First of all, because no one will understand what the situations is about. When people see something being imposed to them, they don't listen, don't participate, do not take ownership of the matter. When they take ownership of your idea, when they understand where there are going, they participate.”

Specialist G said there is often a fragmentation among deparments in municipalities, as some secretaries tend to see “waste issues” as a matter whose responsibility is exclusively of environment departments. Public servant C suggested municipalities should seek one professional or group inside the public servants team, which is capable of communicating effectively throughout secretaries, who would be responsible for constantly promoting awareness and information sharing between departments. That is because not only the departments directly involved in the implementation and management of programs should be capacited in terms of environmental education.

During the interview, it was also said that defining responsibilities for one or other public agent was important, but it is necessary to think about the people who will be in the field effectively operating new programs and policies. Interviewees C and F said that qualified professionals are hard to find, so capacitation from the start and over the years is an essential factor to be planned.

4.11 Metrics and indicators

As to indicators, all interviewees agreed that establishing a few well known indicators before implementing any program is important. However, interviewees A, C, E and G said indicators can work as powerful marketing tools, so a few indicators should be designed to promote the engagement of communities in programs. Interviewee E suggested municipalities should avoid using only conventional metrics, and seek to implement indicators that integrate at least two of the pillars of sustainability, explaining these can help people understand the connections between two or more elements of the waste management systems. As civil servant C said:

“[...] People need to see (the results). And need to see how things are working in practice, and then be able to be proud of that.”

Moreover, specialist G pointed that social and environmental aspects should not be evaluated in separate, and that multidimension indicators should be considered. Furthermore, explained that in the Brazilian context, many environmental and social issues are closely related.

5. Proposed guide and discussions

The structured guide presented in Table 4 was developed by the authors from analysis of the results.

Table 4
Proposed structured guide for waste management systems planning

Step	Description	Recommendations
1. Define System	a. Define scope (timeline, limitations, etc.) of the system	Consider budget definition period; Consider election periods and duration of political offices; Define scope as to limit the future number of program options for evaluation;
	b. Define system boundaries	Consult municipal Plan; Consider current available infrastructure; Consider the necessity of further studies (e.g.: waste composition, main generators, system costing) for reliable information
	c. Define overall system objectives (environmental, social and economic)	Consult Municipal Plan for objectives;
	d. Clearly state definitions for key terms	
2. Programs and Policies	a. Determine which programs/policies are under consideration	Consult local community groups and other municipal records; Seek intermunicipal communication for cases; Consider political influences; Limit the number of programs being submitted to analysis, according to available personnel; Prioritize programs according to the

Step	Description	Recommendations
		hierarchy presented in the BSWP
	b. Engage with secretaries and departments	Define minimal political indorsement to conduct next steps; Include other secretaries and departments that might be affected in the process; If possible, identify basic criteria for selection (Step 9)
	c. Evaluate the programs with regards to Steps 3-8 of the framework. Perform detailed assessments, including optimization analysis and simulation analysis, as necessary	
3. Stakeholders	a. Identify stakeholders and their concerns regarding the system	For small municipalities, consider also: religious, sports, and other associations;
	b. Identify impact of programs for socially vulnerable groups	Identify current cooperatives and/or groups interested in being organized; Locate groups of waste-pickers; Start observations for environmental impacts
	c. Perform cultural aspects evaluation for specific groups.	Identify historical data, engagement in past programs, information access, etc.; Consider necessity of education programs towards waste streams characteristics;
	d. Define methods for stakeholders communication, including regular outreach and education; include approaches for integrating their knowledge and concerns	Publicize the planning process to stakeholders as soon as possible; Promote effective communication and engagement immediatly, and throughout the analysis;
4. Requirements	a. Identify and/or define applicable legal requirements	Prioritize programs not depending on approvals of new laws for implementation;
	b. Verify possible supporting legal requirements	Consider elaboration of municipal legislation that could suport programs. Evaluate necessary requirements for elaboration; Consider laws for modification of tax collection for urban cleaning; Consider laws for supporting the continuity of programs; Consult other municipalities for cases;
	c. Identify and/or define other applicable requirements (e.g. institutional)	Clearly identify municipal rules for secretaries and departments;
5. Resources	a. Define required economic resources; consider long-term funding	Perform in-depth analysis; Update projections after analysis on steps 6-7;
	b. Define other required resources (e.g., human resources, specialized skills)	Consider capacitation for less specialized workforce; Predict capacitation of public servants;

Step	Description	Recommendations
	c. Ensure required resources are available. Perform detailed cost assessments, such as cost-benefit analysis, as necessary	Clearly map resources that need to be sought externally; Perform constant search for government financing notices and private investments;
6. Responsibilities	a. Define internal (municipal) and external (private) responsibilities	Consider benefits and difficulties of outsourcing parts of programs; Promote growth of municipal technical body when possible;
	b. Define system managers roles and responsibilities	Assign control and management of systems to public servants who are part of the planning;
	c. Define stakeholders responsibilities	Clearly communicate to stakeholders;
7. Environmental impacts	a. Evaluate environmental impacts of programs. Use LCA or another comprehensive approach if possible	Consider outsourcing environmental impacts analysis; Integrate social impacts considerations in the analysis;
8. Measure	a. Identify and define performance indicators. Include environmental, financial, regulatory, social, and stakeholder concerns	Utilize at least three conventional indicators, as suggested by the Ministry of Environment; Additionally, define multidimensional indicators that can also be used as marketing tools for public engagement;
	b. Define methods for ensuring efficient and regular data	Consider adjusting indicators according to feasibility, in terms of available technical body and infrastructure (see Step 1)
9. Select Program / Policy	a. Analyse excluding and/or complementary program options.	Consider suggesting "pilot" programs instead of more complex or long-term programs;
	b. Organize informations according to decision criteria	Consider political influence in decision making; Organize and present financial aspects of analysis (steps 3-7)
	c. Select best program option based on findings from Plan steps	

The results show that interviews generated recommendations and considerations on the issues and limitations encountered by public servants in MSW management. In the few cases where interviewees disagreed, it was mostly due to different personal experiences. In most interviews, central opinions seemed to be coherent amongst interviewees, converging to specific recommendations and clarity on the main issues encountered in Brazil. The fact that specialists were able to specify technical needs and legal barriers, while public servants brought many practical cases as examples, enabled a comprehensive set of recommendations.

Although the logical structure of the main framework presented in Table 1 was not significantly modified, the proposed guide in Table 4 contains different descriptions to steps, and more importantly, recommendations pertinent to the context in which the work was developed. The main structural difference is the presence of "Stakeholders" in the early steps of the planning process. The necessity of dialogue with stakeholders around intervention options, in the beginning of the planning processes, was already cited by Alamgir *et al.* (2012). A few considerations were added or altered mostly to minimize negative effects of political factors illustrated by the interviews. Moreover, recurrent suggestions about indicators,

stakeholders' engagement, outsourcing, and others, are present in the column Recommendations.

Both groups of interviewees saw environmental education and the selective collection of waste as two of the main factors impacting the planning, implementation and maintenance of programs and policies in Brazil, which coincides with the main goals of the BSWP of guaranteeing effective selective collection in all municipalities, and supporting environmental education initiatives. Cultural and political aspects were also frequently cited in all interviews, sometimes mixing one aspect inside another, recurrently being cited as causes or consequences to barriers and difficulties in improving environmental education and selective collection systems. Overall, interviewees indicated that new programs are subject to failure if they don't consider cultural aspects and the current poor environmental awareness status of the population throughout their planning process.

Already present in the base framework presented in Table 1, the effective and constant stakeholder participation in the planning process was a clear demand of interviewees for the framework. The reported cases of even limited success were attributed, among other causes, to strong public engagement and constant information sharing in the programs. Since the continuity of programs is severely affected by changes in political offices, it is important to create a sense of constant pressure from the society towards municipalities, for the continuity of programs and the evolution of MSW systems.

It was possible to observe that a general professionalization of solid waste management inside municipalities, especially small ones, is necessary. This was already cited by other authors in the literature review conducted; signaling the lack of qualified professionals can be a major issue for MSW systems development. Also, even municipalities recognized by their efforts and results noticeably struggle with poor communication across secretaries and centralized political decisions. The professionalization suggested would involve not only contracting more public servants from different areas, but also developing environmental education inside all departments, and constant capacitation to public and contracted employees. This issues cause problems not only inside municipalities, but in the system as a whole, as the lack of valuable information sharing between departments or municipalities is noticeable.

As the high number of cities that hadn't developed their municipal plans for MSW management indicated, allocating resources for MSW management is not a priority in resource allocation periods, and has not been treated so differently after the BSWP inside many municipalities. Eventually, more specific legislation about solid waste programs budget could help to end the clear lack of prioritization of resources to solid waste management overall.

It should be noticed that during the observation of all steps, users of the proposed guide should easily identify specific needs for human resources not currently available, and understand their importance in the process. For example, a public servant trained to write program documents aiming to access specific financial resources. Moreover, it should be considered that programs assessed with the aid of the proposed guide do not necessarily exclude other program options, and are subject to modification. It is expected that after the due analysis, informations gathered can clearly show all issues that need to be considered.

6. Conclusions

From the results of interviews and discussions, a practical guide for the elaboration of new sustainable programs and policies by Brazilian municipalities interested in developing the management system of OW was developed. A feasible structured guide was created due to the combination of three major factors: the utilization of a comprehensive framework that considered the most important elements for waste management systems cited in the literature reviewed; the consideration of national policies, its principles and guidelines; and the inputs from specialists and public servants with different curriculum and experiences in MSWM.

Many of the recommendations proposed were made as general recommendations. Therefore, although significant results about OW topics were presented, the guide contains steps, descriptions and recommendations that the authors suggest apply to other waste streams, and possibly larger municipalities. Moreover, it is important to highlight that interviews were conducted with the clear contextualization of small municipalities and OW fraction, and therefore, the proposed framework was intentionally biased by that context.

The validation of the proposed guide in municipalities of different economic, populational, and political scenarios, may lead to important conclusions and improvements to MSWM practices in Brazil. It is expected that new channels for information sharing amongst Brazilian municipalities are needed so that improvements can reach a larger number of municipalities struggling with MSW nowadays. Also, a similar study focused in other types of waste, regarding specific legislation could present different sorts of recommendation to another possible framework.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the last pages of this document, after the references.

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Appendix A. Supplementary material

Interview structure and trigger questions.

Passo	Possíveis perguntas
Define system	<ul style="list-style-type: none"> • Are all the necessary information to elaborate new programs, generally available in the Municipal Plans? • How must the informations be obtained? • What is important that should be done at this stage?
Define scope and objectives	<ul style="list-style-type: none"> • How must the scope of new programs be defined? By who? • What should be usually the total planning process time?
List program options	<ul style="list-style-type: none"> • How should this step be conducted? • Who must be involved? • How do municipalities generate ideas to be considered and developed? • What are the solutions known for OW problems?
Legislation	<ul style="list-style-type: none"> • Is the actual legislation enough for creating and mantaining new and existing programs? • How is the general understanding of the BSWP inside municipalities? • Which laws are limitants, and which help to elaborate new program solutions? • How should the elaboration of new laws to support local programs be conducted?
Identify resources	<ul style="list-style-type: none"> • How is the usual availability of resources inside municipalities? • Which type of resource is more important? • Where and how to seek resources for new programs?
Define reponsibilities	<ul style="list-style-type: none"> • How are responsibilities defined nowadays? • What should be the hierarchy between the people involved for new programs? • What type and level of knowledge must the main responsible manager have?
Environmental Impacts	<ul style="list-style-type: none"> • What are the most common environmental impacts observed? • How is it done actually, and how should be conducted this analysis?

Passo	Possíveis perguntas
	<ul style="list-style-type: none"> • Do municipalities normally conducted a detailed assessment?
Stakeholders	<ul style="list-style-type: none"> • Which groups in society are mostly affected or interested in OW problems? • How are they, and should they be mapped? • What is the importance of mapping these groups?
Social impacts	<ul style="list-style-type: none"> • How is the municipality relationship with wastepickers and local cooperatives? • What type of problems are encountered to assess and deal with the issues in these groups? • What is the best way of conducting programs with the involvement of these groups?
Indicators and metrics	<ul style="list-style-type: none"> • Which should be the indicators for OW programs and how should they be defined/chosen? • How is the control of indicators and data gathering conducted?
Evaluate options and define program	<ul style="list-style-type: none"> • Usually, how does the definition of which program to develop happen?