



A glance at the world

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This column comprises notes and info not subjected to peer-review focusing on waste management issues in different corners of the world. Its aim is to open a window onto the solid waste management situation in any given country, major city or significant geographic area that may be of interest to the scientific and technical community.

Evolution of Integrated solid waste management systems in Brazilian cities under the National Solid Waste Policy

Background and method

The National Solid Waste Policy (PNRS) in Brazil has established some instruments and guidelines that must be applied by cities regarding integrated solid waste management systems (ISWMS), such as targets for reuse and recycle and percentages of biodegradable organic matter, along with incentives for new treatment techniques, better final disposal and energy generation from the biogas produced from the degradation of waste.

According to Marshall and Farahbakhsh (2013), developing countries such as Brazil need to invest in the scientific, theoretical and practical growth aspects of solid waste management, allowing the creation of participatory, contextual and adaptive strategies that enable real progress of the country's infrastructure. Unfortunately, in Brazil the basic sanitation sector is still deficient, heterogeneous and presents regional contrasts, mainly concerning solid waste management, posing a huge challenge for municipal managers.

The aim of this study was to verify if evolution has occurred in integrated solid waste management systems, besides quantifying the effectiveness of these systems through the ICGRm, proposed and validated in that work. The ICGRm starts from the premise that the management of solid waste in a city cannot be evaluated only by the final disposal situation. Important aspects such as street sweeping, collection, environmental education and forms of storage by citizens should be considered. The present study evaluated ten of these twenty cities in order to obtain comparative results and quantify both positive and negative evolution according to the ICGRm score.

The ICGRm tool has a unique characteristic conception that the management of waste in cities should be evaluated as an integrated system. From an initial diagnosis, Environmental Condition Indicators (ICAs) and Environmental Performance Indicators (IDAs) were selected according to ISO 14.031, related to solid waste management, which allowed preparation of the ICGRm worksheet, as shown in Fig. 1.

After evaluating the indicators through the service levels (scores), the points are summed to obtain the subtotals of each item.

Results

In 2016, ten cities were studied in order to verify the evolution obtained in a period of eight years between the initial study and this one. The activities carried out consisted of visits and research in the cities selected about the treatment and final disposal units for the application of the index worksheet (ICGRm), whose results are shown in Table 1.

The present study compared the situation of waste management in ten cities in the state of Rio de Janeiro in 2007–2008 with the current situation. Unfortunately, it was found that although six years had passed since the establishment of the National Solid Waste Policy (PNRS), little improvement was observed, and in most cities the situation was actually worse. The only verified effect of this policy was the relative reduction of the irregular disposal of waste in cities.

There was a great difficulty of all the cities surveyed in improving the ways of charging for services, since only the city of Petrópolis, in 2008, was financially self-sufficient in waste management. In 2016, this economic sustainability was no longer presented, because of the problems in the management of collection between the municipal government and the independent public company responsible for waste management. Another finding was that two of the ten cities studied do not charge any fees related to public cleaning services, being totally dependent on budget allocations from the general fund. Also, actions aimed at environmental education focused on the correct separation of solid waste by residents into recyclable, non-recyclable and organic waste and minimization of waste generation are incipient or absent.

Most of the analyzed cities outsource part of the activities of the waste management system, thus requiring control and regulation, and items are still incipient and flawed. Often the contracts overseen by different government bodies lack a standardization of the collection and regulation forms.

Indicator	Sub-item	Rating	Weight	Score	Indicator	Sub-item	Rating	Weight	Score
	System of standardization for reverse logistics of the products of article 33 of the NPSW	yes, for all	4			Use of specific vehicles for hard to reach areas such as tricycles, motobikes and etc	yes/not required	3	
		some products	2				no	0	
		no, no one	0						
	Professionals involved in management effective post of waste and with training in the area	yes, for all	3			Systems of barriers to protection of watercourses and maintenance of the same	yes, in all	4	
		some products	1				some points	2	
		no, no one	0				∅	0	
	Contingency plan for workers' strike of cleaning service	yes	3			Adequate collector available for pre-collecting storage	yes	3	
		no	0				no	0	
	Employ allocation according to age and cond. Physical	yes	2			Removal of waste materials such as furniture and other	yes	2	
		no	0				no	0	
	Information system on waste management in specific website or specific page	yes, implanted	4			economic incentives and / or tax credits for non-taxable generation, reduction, reuse and recycling	yes	4	
		some informations	2				incipientes	2	
		no information	0				no	0	
	Fleet control system for GPS and/ or GIS	yes	3			Sorting and repair operation of construction waste	yes	3	
		no	0				no	0	
	geotechnical monitoring and environmental of waste disposal irregular area disabled	yes or do not have	4			filling in the information of Of the National Waste Information System (SNIR)	yes, all	4	
		has some type	2				some	2	
		does not monitor	0				no, no one	0	
	specific public collectors for some type of segregation in generation	yes	4			Geotechnical monitoring contract and environmental of landfills	yes, including post-closing	5	
		In part of the municipality	2				yes, in the operation phase	3	
		no	0				No or no landfill	0	
	waste sorting operation licensed and functioning properly	yes	3			Data on the costs of the landfill destination	yes	2	
		no	0				no	0	
	Alternative collection times for reducing the impact in urban traffic	yes/not required	3			Hiring of responsible insurance for hazardous waste generators (Art. 40. NPSW)	yes	3	
		In few neighborhoods	1				no	0	
		no	0						
	Collection and / or use of biogas generated in the final disposal of waste	collection+ power generation	5			sub-total 4	maximum	73	
		collection and burn	3						
		without collection	0						
Sum of points (Sub-total 1+2+3+4)							#REF!		
ICGRA = Sum of points / 20,3							ICGRA	#REF!	
ICGRA							Rating		
0 A 7.9							Inadequate management		
8.0 A 10.0							Proper management		
Rating									

Fig. 1. ICGRm evaluation worksheet.

Table 1
Results of the evaluation of waste management in the cities of the state of Rio de Janeiro in 2016.

Cities	ICGRm (2007–2008)	ICGRm (2016)	Comparison	Percentage of ICGR evolution (%)	Result
Bom Jardim	4.46	4.62	Improvement	4	Inadequate management
Cachoeiras de Macacu	3.62	5.85	Improvement	62	Inadequate management
Cantagalo	6.54	7.08	Improvement	8	Inadequate management
Silva Jardim	3	3.62	Improvement	21	Inadequate management
Petrópolis	7.54	6.31	Deterioration	-16	Inadequate management
São José do V. do Rio Preto	6.08	3.23	Deterioration	-47	Inadequate management
Teresópolis	5.23	3.62	Deterioration	-31	Inadequate management
Nova Friburgo	7.69	7.08	Deterioration	-8	Inadequate management
Sumidouro	6.15	4.38	Deterioration	-29	Inadequate management
Casimiro de Abreu	5.54	2.92	Deterioration	-47	Inadequate management

References

Marshall, R.E., Farahbakhsh, K., 2013. Systems approaches to integrated solid waste management in developing countries. *Waste Manage.* 33, 988–1003.

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