Municipal Solid Waste Management in Brazil: Conditions, Problems and Solutions

Eduardo Castagnari, President of ABRELPE – Brazilian Association of Urban Cleaning and Special Solid Waste Companies – ISWA National Member

CONTACT
Eduardo Castagnari
Av. Paulista, 807 – cj. 207
São Paulo – SP – Brazil
CEP 01311-915
Phone: +55 11 3254-3566
e-mail: abrelpe@abrelpe.com.br

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1. CONDITIONS AND PROBLEMS REGARDING MUNICIPAL SOLID WASTE

1.1 Domestic and Public Solid Waste

Concerning public services which are responsibility of Municipal Governments, data that allows a clear and comprehensive understanding of the achievements in domestic and public municipal solid waste management are presented.

1.1.1 Number of Municipalities with Solid Waste Collection Services

Figure 1 shows that almost all Brazilian municipalities have public services of municipal solid waste collection, which represents a very positive point. However, this quantitative aspect does not characterize that the universalization of these services is about to be attained, as it can be observed in the following item 1.1.2.

![Figure 1 – Number of Municipalities with Solid Waste Collection Services](image)

1.1.2 Coverage of Collection Services

In fact, 2,204 municipalities offer collection services for less than 80% of their households. In the north and northeast regions, as indicated in Figure 2, most of the municipalities, i.e. 1,325 of them have these conditions. However, even in the south and southeast regions, 802 municipalities have this service level. The mid-west region, the less populated in the country, have only 77 municipalities with this service level.
Also, important qualitative factors to be expanded in offered services shall be considered, such as expansion and frequency increase of areas with sweeping services, increase of containered collection and replacement of equipments in precarious conservation conditions.

### 1.1.3 Quantity of Collected Solid Waste per Macroregion

In Brazil, the significant amount of 162,232 tons of municipal solid waste are daily collected, and the southeast and northeast regions together represent three fourths of this amount. Figure 3 shows the whole distribution per macroregion.

<table>
<thead>
<tr>
<th>Macroregion</th>
<th>Municipalities</th>
<th>Percentage</th>
<th>Collection Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>449</td>
<td>28%</td>
<td>72%</td>
</tr>
<tr>
<td>Northeast</td>
<td>1787</td>
<td>44%</td>
<td>56%</td>
</tr>
<tr>
<td>Southeast</td>
<td>1666</td>
<td>21%</td>
<td>79%</td>
</tr>
<tr>
<td>South</td>
<td>1159</td>
<td>39%</td>
<td>61%</td>
</tr>
<tr>
<td>Mid-West</td>
<td>446</td>
<td>83%</td>
<td>61%</td>
</tr>
</tbody>
</table>

Figure 2 – Coverage of Collection Services

**Figure 3 – Quantity of Collected Solid Waste per Macroregion (ton/day)**

### 1.1.4 Growth of Collected Solid Waste Quantity per Macroregion 2000 / 2004

In the past four years, the average growth of collected solid waste amount in the country was of 8.22%, with distribution per macroregion shown in Figure 4. The southeast region with a 8.16% growth is closer to the national average and the mid-west region recorded the highest growth with 12.74%. This is probably due to
the fact that this region, which is featured as the new Brazilian agricultural frontier, has cities going through a period of significant increase of income.

1.1.5 Final Disposal of Collected Solid Waste

That is no doubt the biggest problem to solve in municipal solid waste management in Brazil. 96,550 tons per day of municipal solid waste are dumped into dumpsites and into water bodies. To worsen the problem, approximately half of the almost 65,700 tons daily disposed of in conditions officially considered appropriate, are in fact disposed of in controlled landfills and not in sanitary landfills and, apart from that, a significant number of existing sanitary landfills are close to the end of their useful life.

Figure 5 indicates the qualitative general conditions of collected solid waste final disposal and shows another equally impacting data. The final disposal universalization, using as solution sanitary landfills, will demand global pre-operational investments of about US$ 550 million and will consume another US$
420 million per year in the environmentally appropriate operation of these landfills. This shows that an extremely relevant factor of the solution is to set a long-term economic-financial sustainability.

1.1.6 Adequacy of Final Disposal per Macroregion

Observing the final disposal problem per macroregion in Figure 6, we see that in absolute terms the southeast and northeast regions are those presenting the largest solid waste quantities to be properly disposed of, although the same regions record the most significant indicators of a correct disposal.

![Figure 6 – 1.1.6 Adequacy of Final Disposal per Macroregion](image)

1.1.7 Financial Resources Made Available by Brazilian Municipalities

An important aspect for the problem understanding and development of sustainable solutions is shown in Table 1. Among the 5475 municipalities researched, approximately 80% apply less than 5% of their budget in municipal solid waste management, and another 16% of them apply between 5 and 10% of their budget, both equally insufficient. Only 4% of the municipalities apply values 10% above their budget.
### Table 1 – 1.1.7 Financial Resources Made Available by Brazilian Municipalities

<table>
<thead>
<tr>
<th>Percentage of Budget applied in Solid Waste Management</th>
<th>Municipalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5%</td>
<td>4338</td>
</tr>
<tr>
<td>5% to 10%</td>
<td>872</td>
</tr>
<tr>
<td>10% to 20%</td>
<td>123</td>
</tr>
<tr>
<td>15% to 20%</td>
<td>33</td>
</tr>
<tr>
<td>More than 20%</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>5475</td>
</tr>
</tbody>
</table>

1.1.8 **Municipalities with Specific Charge for Collection or Urban Cleaning Services**

The number of municipalities with specific sources of funds for municipal solid waste management is also small, less than 50% according to Figure 7, which certainly help us understanding why so few municipalities make budgetary resources available in correspondence to what these services need.

![Figure 7 – 1.1.8 Municipalities with Specific Charge for Collection or Urban Cleaning Services](image)

1.1.9 **Reference Data about the Sector (2004)**

Despite the fact that there is still a lot to do, the reference data about the municipal solid waste management sector in Brazil are very expressive, as shown in the following Tables 2, 3 and 4.
Urban Cleaning Services 360,000
Complementary Services 80,000
Total of Direct Job Positions 440,000

Table 2 – Generation of Direct Job Positions

<table>
<thead>
<tr>
<th>Origin</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Fleet</td>
<td>5,600</td>
</tr>
<tr>
<td>Public Fleet</td>
<td>4,000</td>
</tr>
<tr>
<td>Total Fleet</td>
<td>9,600</td>
</tr>
</tbody>
</table>

Compacting Trucks Fleet

Table 3 – Compacting Trucks Fleet

1.1.10 Private Initiative Participation

The participation of specialized private companies in municipal solid waste management activities, which was implemented, grew and was consolidated in the past 30 years, shows to be very significant and represents services offered to 66.5% of the country’s urban population.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Population Served (inhabitants)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Company</td>
<td>94,600,000</td>
<td>66.5</td>
</tr>
<tr>
<td>Public Organization</td>
<td>47,800,000</td>
<td>33.5</td>
</tr>
<tr>
<td>Total</td>
<td>142,400,000</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 5 – MSW Collection Services

<table>
<thead>
<tr>
<th>Contract Type</th>
<th>Medium Term (years)</th>
<th>Population Served (inhabitants)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracting-out</td>
<td>5</td>
<td>70,200,000</td>
<td>74.2</td>
</tr>
</tbody>
</table>

Table 4 – Economic Activity in the Sector
Tables 5 and 6 respectively indicate the private initiative participation and, within this, the significant role played by concession contracts of these public services.

1.1.11 Concessions of Urban Cleaning and MSW Final Disposal Public Services to the Private Initiative

These concession contracts signed until 2004, most of them in the past five years and serving 17% of the Brazilian urban population, present a very diversified and interesting geographical distribution and composition as shown in Table 7.

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Population Served</th>
<th>Quantity per Service type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Urban Cleaning + Final Disposal</td>
</tr>
<tr>
<td>R.G. do Sul</td>
<td>508,369.00</td>
<td>3</td>
</tr>
<tr>
<td>Santa Catarina</td>
<td>943,384.00</td>
<td>9</td>
</tr>
<tr>
<td>Paraná</td>
<td>291,356.00</td>
<td>1</td>
</tr>
<tr>
<td>São Paulo</td>
<td>10,420,087.00</td>
<td>3</td>
</tr>
<tr>
<td>Rio de Janeiro</td>
<td>7,023,260.00</td>
<td>1</td>
</tr>
<tr>
<td>Minas Gerais</td>
<td>227,415.00</td>
<td>1</td>
</tr>
<tr>
<td>Bahia</td>
<td>2,630,778.00</td>
<td>-</td>
</tr>
<tr>
<td>R.G. Norte</td>
<td>766,081.00</td>
<td>-</td>
</tr>
<tr>
<td>Amazonas</td>
<td>1,582,203.00</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>24,392,933.00</td>
<td>18</td>
</tr>
</tbody>
</table>

Table 7 – Concessions of Urban Cleaning and MSW Final Disposal Public Services to the Private Initiative

Some significant facts call the attention among these concession contracts showing that the “concession” solution is generically applied to various types of municipalities:

- Smaller Municipality: 10,487 inhabitants;
- Bigger Municipality: 10,192,602 inhabitants;
- Municipalities with important tourism activity: 6
• State Capital municipalities: 5
• Coastal municipalities: 7
• Countryside municipalities: 17

However, the most significant fact to be highlighted is that this group of concession contracts gathers private investments of **US$ 1.2 billion** in total.

### 1.1.12 Summary of Main Problems to Solve regarding Domestic and Public Solid Waste

Table 8 presents the main problems to solve regarding domestic and public solid waste.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PROBLEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection Services</td>
<td>• Universalize services for all households.</td>
</tr>
<tr>
<td></td>
<td>• Improve services coverage and quality – Institute an uniform standard;</td>
</tr>
<tr>
<td></td>
<td>• Progressively implement containerization.</td>
</tr>
<tr>
<td>Final Disposal (major problem)</td>
<td>• Universalize the environmentally correct disposal;</td>
</tr>
<tr>
<td></td>
<td>• Replace landfills at the end of their useful lives.</td>
</tr>
<tr>
<td>General</td>
<td>• Implement long-term solutions with environmental and economic-social sustainability.</td>
</tr>
</tbody>
</table>

Table 8 – 1.1.12 Summary of Main Problems to Solve regarding Domestic and Public Solid Waste

### 1.2 Healthcare Waste

The Brazilian federal legislation lays to generators the responsibility for treatment and final disposal of Healthcare waste, which has a significant influence on its conditions in Brazil.

#### 1.2.1 Quantity of Healthcare Waste per Macroregion

For a broad understanding about the Healthcare waste conditions in Brazil, Table 9 shows the generated amounts per macroregion in the country and whether they are treated or not.
<table>
<thead>
<tr>
<th>Macroregion</th>
<th>Quantity of HW (t/day)</th>
<th>Generated</th>
<th>Treated</th>
<th>Not treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Region</td>
<td>56.33</td>
<td>0.00</td>
<td>56.33</td>
<td></td>
</tr>
<tr>
<td>Northeast Region</td>
<td>261.40</td>
<td>40.07</td>
<td>221.33</td>
<td></td>
</tr>
<tr>
<td>São Paulo</td>
<td>210.90</td>
<td>166.67</td>
<td>44.23</td>
<td></td>
</tr>
<tr>
<td>Southeast Region</td>
<td>435.13</td>
<td>176.83</td>
<td>258.30</td>
<td></td>
</tr>
<tr>
<td>South Region</td>
<td>161.94</td>
<td>32.00</td>
<td>129.94</td>
<td></td>
</tr>
<tr>
<td>Mid-West Region</td>
<td>110.03</td>
<td>38.33</td>
<td>71.70</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>1,024.84</td>
<td>287.23</td>
<td>737.61</td>
<td></td>
</tr>
</tbody>
</table>

Table 9 – 1.2.1 Quantity of Healthcare Waste per Macroregion (ton/day)

1.2.2 HW Generation and Treatment versus Treatment Installed Capacity

Complementing this general though very clear information about this segment, Figure 9 compares the amounts of generated and collected Healthcare waste to the treatment capacities regionally installed in the country.

![Figure 9 – HW Generation and Treatment versus Treatment Installed Capacity](image)

1.2.3 Summary of Main Problems to Solve regarding Healthcare Waste

Table 10 presents the main problems to solve regarding Healthcare waste.
### Table 10 – Summary of Main Problems to Solve regarding Healthcare Waste

<table>
<thead>
<tr>
<th>Item</th>
<th>Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW Treatment</td>
<td>• Universalization. However, the responsibility is legally of the generators.</td>
</tr>
<tr>
<td>Management</td>
<td>• Most of the Municipalities, except the São Paulo State ones, don’t assume responsibility for MSW management.</td>
</tr>
<tr>
<td>Legislation</td>
<td>• Incomplete federal legislation causing inadequate state and municipal legislations and actions.</td>
</tr>
</tbody>
</table>

### 1.3 Recycling and Collection of Recyclables

The logical order of these activities was inverted on purpose, placing collection of recyclables in second, because most of the recycling activities in Brazil are carried out in an informal fashion and the expressive figures regarding some recyclable materials are not related to structured programs.

#### 1.3.1 Evolution of Main Recyclables Recycling Rates in Brazil

Four materials – aluminum, paper, glass and PET – are pointed out as the most recycled in Brazil, and the evolution of their respective rates can be seen in Figure 10.
1.3.2 Evolution of Aluminum Recycling Rates in Brazil and Comparison to other Countries

Considering that the aluminum recycling rate in Brazil is very expressive, Figure 11 compares it to other countries’ rates.

Figure 11 – Evolution of Aluminum Recycling Rates in Brazil and Comparison to other Countries

1.3.3 Evolution of Steel Cans, PET containers, Paper and Glass Recycling Rates

Figures 12, 13, 14 and 15 respectively present the evolution of these materials recycling rates.
1.3.4 Evolution of the Number of Municipalities with Recyclables Collection and Average Composition of Collected Material

The evolution of recyclables collection in Brazilian municipalities, in the past ten years, is shown in Figure 16. Although the graph shows that the number of municipalities quadrupled in the period, the fact that they only represent approximately 4.5% of the country’s total number of municipalities reveals that there is still a lot to be done.
In complementation, Figure 17 shows the average composition in weight of recyclables coming from separate collection.

![Figure 17 – Average Composition in weight of Recyclables from Separate Collection](image)

1.3.5 Sampling of Recyclables Collection Evolution in 16 Municipalities and Comparison of the Collected Material Share in terms of Weight and Revenue

Recent sampling carried out in very expressive municipalities considering that they amount to 31 million inhabitants and correspond to 17% of the Brazilian population revealed (see Table 10) that in these group of municipalities the annual evolution of collected recyclables tonnage was very significant in the past ten years.
### 1.3.6 Summary of Main Problems to Solve regarding Recycling and Recyclables Collection

Table 11 presents the summary of main problems to solve regarding recycling and recyclables collection activities.

<table>
<thead>
<tr>
<th>Item</th>
<th>Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycling</td>
<td>• Most of the recycling activities are informally carried out. They consequently lack management;</td>
</tr>
<tr>
<td></td>
<td>• Restrained demand for various potentially recyclable materials.</td>
</tr>
<tr>
<td>Recyclables Collection</td>
<td>• Small number of municipalities with recyclables collection programs and small collection rates in</td>
</tr>
<tr>
<td></td>
<td>most of them;</td>
</tr>
<tr>
<td></td>
<td>• Municipalities have no or little resources for this activity.</td>
</tr>
</tbody>
</table>
2 SCENARIOS FOR SOLUTIONS DEVELOPMENT

2.1 Legal Scenario

In the past twelve months this scenario presented a remarkable evolution since two new federal laws – Law of Public-Private Partnerships and Law of Public Consortiums – were enacted creating interesting perspectives for municipal solid waste management.

2.1.1 Federal Law No. 11.079 / 2004 – Public-Private Partnerships

The main aspects of this law regarding its applicability to the concerning segment are presented as follows:

- Public-private partnership is the concession contract which one of the modalities is the administrative concession.
- Administrative concession is the services performance contract in which the Public Administration is the direct or indirect user of services.
- The guidelines of public-private partnerships contracts are as follows:
  - Respect to interests and rights of services beneficiaries and of private organizations responsible for their execution;
  - Fiscal responsibility in contracting and executing partnerships;
  - Transparence of procedures and decisions;
  - Objective share of risks between the parties;
  - Financial sustainability and socioeconomic advantages of partnership projects.
- Public-Private Partnership Contracts shall have:
  - Value above R$ 20 million;
Services performance periods from 5 to 35 years.

- Possibility of establishing objective guarantees such as:
  - Binding of revenues;
  - Institution or utilization of special funds foreseen in laws.

Comment: The potentially more positive contribution brought by this law was the ratification of the concept in which the municipality acts as the “only user”, very much used by the segment in modeling concessions. Public services regarding municipal solid waste management cannot be directly offered to households considering that these services are essential and cannot be interrupted and, cumulatively, cannot be stopped due to the lack of payment.

2.1.2 Federal Law No. 11.107 / 2005 – Public Consortiums

The highlights of this law are presented as follows:

- The Consortium can:
  - Set covenants, contracts and agreements;
  - Receive social and economic support, contributions and subventions;
  - Promote expropriations and institute free passages;
  - Issue charging documents and collect tariffs and other public prices;
  - Grant concessions.
- Strengthens the union among federate bodies and facilitates the solution of common problems.
- Creates reciprocal rights and duties among federate bodies.
- Allows economies of scale gains through shared solutions.
- Have no economic purposes, aiming at the services improvement.

Comment: Solutions for municipal solid waste management many times depend on economies of scale to express economic-financial feasibility. This law allows the Municipalities to get united, also with States and the Federation, in juridical-legal conditions of commitment to allow the structuring of concessions to the private initiative providing security and guarantees to the investor. It equally combines with the public-private partnerships law.

2.2 Political and Social Scenario

A proper combination of factors, detailed as follows, set a favorable scenario for solutions implementation.
2.2.1 New Municipal Administrations

- The mandates started in 2005 which for a while allows the implementation of consistent solutions;
- A significant amount of new mayors is showing to be aware of the necessity for implementing integral solutions for MSW.

2.2.2 Environmental Control and Public Health Organizations

- Pressure on municipal administrations is continually intensifying.

2.2.3 Non Governmental Organizations, Press and Society in General

- Denounces about improper MSW management are constant;
- Congresses and seminars promoted by sectoral NGOs frequently debate the MSW issue.

2.3 Market Scenario

As well as the political and social scenario, the marketing scenario is positive for the implementation of solutions based on private investments, as shown as follows.

2.3.1 Private Initiative

- In face of the prognosis of more consistent and safe business models, the sector’s companies show enthusiasm in carrying out bigger investments with longer repayment periods.

2.3.2 Financial Institutions

- Caixa Econômica Federal (CEF) and Banco Nacional de Desenvolvimento Econômico e Social (BNDES) offer financing lines with special conditions for environmentally friendly projects;
- World Bank and IFC and other foreign institutions also offer financings with attractive conditions.

2.3.3 Clean Development Mechanisms - CDM
• The commercialization of carbon credits due to the Kyoto Protocol means extra and important revenue to make MSW final disposal projects feasible.

3 PREDICTED SOLUTIONS AND PATHS

3.1 Domestic and Public Solid Waste

In face of the main problems identified and of the existing scenarios for the implementation of sustainable solutions for domestic and public solid waste management, the following solutions are prognosticated:

- The Concession of services to the Private initiative shall be imposed as the main solution to solve the problems related to larger coverage, quality of urban cleaning general services and universalization of proper solid waste final disposal.
- The Public-Private participation will occupy a significant portion of these concessions.
- Public Consortium among Municipalities will contribute to make solutions with better economies of scale feasible.

3.2 Healthcare Waste

In consideration of the sector’s characteristics determined by federal legislation, for the desired universalization the following solutions and paths are prognosticated:

- Legislations similar to the already existent in the State of São Paulo, which is being reinforced by the State Policy of Solid Waste now being analyzed by the State Congress, shall be enacted by other federation states making mandatory the effective treatment of MSW.
- Slowly, municipalities of various states are assuming totally or partially the management of MSW. The intensification of these procedures is the trend.
- The National Policy of Solid Waste, elaboration in progress, shall contain MSW management instruments inspired by São Paulo State Policy of Solid Waste.

3.3 Recycling and Collection of Recyclables
It is acknowledged that informal initiatives prevail in recycling activities, which poses serious limitations. In parallel, without specific resources, the necessary collection of recyclables promoted by municipal governments will not progress. For the desired increment of these activities, the following solutions and paths are prognosticated:

- Policies adopted in reference cities, such as São Paulo, Curitiba and Porto Alegre, indicate that the recycling promoted and managed by the Public Power gains space over the still predominant informal chain.
- New legislations in elaboration present a strong trend of instituting instruments based on the polluter-payer principle, which will create revenues for increasingly support the recyclables collection activities.
- Alterations in Tributary Policy aiming at the reduction of recyclables related taxes, consequence of a more and more strong pressure of the organized society, will increase the demand for the utilization of a larger amount and a broader diversity of these materials.

3.4 Municipal Solid Waste in General

The concept of adopting integrated solutions is gaining space day-by-day among public and private managers and, therefore, it is perfectly valid to prognosticate the following path for municipal solid waste in general:

- Solutions already adopted or with adoption in progress by several Municipalities indicate a clear trend for an increasing use of the concession model comprehending the integral management of municipal solid waste, including domestic and public solid waste, Healthcare waste and recyclables collection and recycling.