

Workshop on Environmental Management and Sustainability

STUDY ON THE FEASIBILITY OF SETTING UP AN INTEGRATED SOLID WASTE MANAGEMENT SITE IN THE INSTITUTO FEDERAL FLUMINENSE AT MACAÉ

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1 INTRODUCTION

The increased solid waste generation comes up simultaneously to economic development. It is one of the major issues in current society, given today's unsustainable consumption rate, as cited by Ferreira (2000) and Cen (2008). Said authors stress that current society's lifestyle must change if future generations are to exist. Jardim *et. al.* (2000) and Campos (1999) say this waste generation occurs every day and varies in amount and composition per social strata and per economic development level.

In big cities, the solid waste issue swells on account of the excessive number of inhabitants, a faster consumption, as clarified by Feitosa (s/d), and the high volume of produced waste. Small cities and towns, in their turn, usually have a reduced number of inhabitants and a lower volume of produced waste. However, they likewise need to have the assistance of public authorities on waste treatment, destination and final disposal. The lack of effective guidelines for waste handling and the shortage of technical support and financial resources make up a hurdle to be overcome in order to work out the problem, as cited by Schalch *et. al.* (2002).

That said, one notes that managing and treating solid waste is increasingly more significant, in that the lack of an effective management of urban solid wastes outweighs other environmental

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issues. However, devising solutions to the problems brought by solid waste is quite complex, since these problems rely on a variety of materials and call for heterogeneous solutions. Only the integrated management approach can lead to solutions matching the particular conditions of each city/town, according to Gimenez, Schoenhals e Kreutz (2012).

The educational site can be used to design environmental projects targeted at the issue of urban waste and at scientific innovation in many fields. It would be meant to provide society with studies, research projects and technologies to raise environmental conditions and people's life quality. The range of initiatives can be far broader, as this educational site can be the foundation to promote the sustainable development of communities, bring down co-operative costs to maximize profits, facilitate access to new waste-treatment technologies and disseminate know-how and expertise.

2 METHODOLOGY

In this research we have used the empirical method which values ordinary experience. To be more specific, this method can be classified as a phenomenological method that, as noted by Giorgi (1985), starts off with a description – a real-life experience. However, in order to provide the groundings for the study on the feasibility of the educational site, we performed qualified interviews with employees of IFFluminense at Macaé and Macaé City's local administration officers. These interviews were meant to keep records of their daily activities and collect data on solid waste, on the significance of the co-operatives and the role they play in the city of Macaé. We also collected data on the relevance of environmental education as the basis for habit change and the awareness-raising of the city's population, on the design of public policies and on the investments geared towards the solid-waste industry. Our goal was to have a well-grounded debate on solid waste and take a snapshot of current urban solid waste management in the city of Macaé.

3 DEVELOPMENT

3.1 Current Policies and the Legal Basis

The Brazilian Law no. 12,305, in effect as of 2010, established the Brazilian Policy for Solid Waste (PNRS). Article 4 of that law cites a variety of principles, goals, tools, guidelines, targets and actions taken by the Brazilian government, either on its own or in cooperation with States, the

Federal District, cities and towns or individuals, to meet the requirements of integrated management and proper environmental management of solid waste.

To handle solid waste, the State of Rio de Janeiro has passed Law no. 4,191 in 2003 which provides for the state policy for solid waste management (SPSWM). This policy aims to encourage the use of new technologies to treat, recycle and dispose of solid waste; promote studies, projects and programs approaching social, economic and environmental problems; support scientific research on environmental issues and propose new products, processes, models and systems of relevant environmental, economic and social interest.

At local level, said law states that Macaé's administration holds the duty to provide for the clean-up of streets and public areas, collect and dispose of the household waste.

3.2 Brazilian Policy for Solid Waste

The principles of the Brazilian Program for Solid Waste (BPSW) aim at ensuring solid waste management, considering the environmental, social, cultural, economic, technological and public-health variables; the realization that recyclable solid wastes are a valuable asset having a social value, generate job opportunities and income and promote citizenship and continuous technical qualification. The BPSW is meant to ensure the provision of public healthcare and environmental quality, and the use, development and improvement of clean technologies to minimize environmental impacts.

The BPSW provides a few instruments: selective trash collection; the incentive to the creation and development of co-operatives of reusable and recyclable material pickers; the technical/financial cooperation between the private and public sectors to promote the research of new products and methods; management, recycling or reuse processes and technologies; waste treatment and environmentally-friendly end-point disposal of waste; scientific and technological research and environmental education.

3.3 Solid Waste

Brazilian Standard NBR 10,0004/2004 on Solid Waste Classification, issued by the Brazilian Standardization Office (ABNT), states that solid wastes can be classified as the output of industrial, household, hospital, business, agricultural, service and sweeping activities. The Brazilian Program for Solid Waste defines solid waste as the material, substance, object or any disposed of item deriving from human activities in society.

The step-up in the generation of solid waste has been driven by the fast population growth and the higher demand for products and goods. Therefore, giving solid waste an environmentally-friendly disposal and destination is of evident importance. The environmentally-friendly waste disposal methods recommended by IBAM (2001) are recycling and composting because they bring along job opportunities and income, save power and preserve natural resources, while reducing the volume of solid wastes discharged in landfills. Brazilian Law 12,305/2010 states that wastes must have an environmentally-friendly destination and must have an equally environmentally-friendly disposal.

That evidences the importance of proper solid waste management. It must start at the end of the generation process and finish at an environmentally-friendly disposal. In the meantime, they must use techniques and develop initiatives for waste packing, transportation, screening, recycling, valuation and reuse.

3.3.1 Urban Solid Waste

Urban household solid waste, as per Netto (1991), are composed of a mix of food, paper, cardboard, plastic, metal, glass, wood and fabric remains. Among the different classes of solid wastes, household wastes are the hardest to manage because they are made up of a variety of components. Managing urban solid waste must include segregating waste at source and, by means of selective trash collection and waste screening, forward it to recycling and composting. That would reduce the impact on the environment and on public healthcare.

3.4 The Integrated Solid Waste Management

The management of urban solid waste, as per Castilhos Junior *et. al.* (2003), must be integrated, including interdependent stages, from initiatives aiming at the generation of no waste at all up to their final disposal. The engagement of the government, the private enterprise and the organized civil society is key. As a whole, the integrated management can be characterized as combined processes, procedures and practices that more efficiently integrate the aspects and objectives of quality, environmental performance, occupational health and safety and social responsibility.

Therefore, one must develop integrated actions, including the actual engagement of society, the public policies of the City of Macaé and the awareness of the solid waste issue. This goal can be achieved by the educational projects provided by the IFFluminense at Macaé, thus converging into social and environmental sustainability.

3.4.1 The Screening and Composting Site

Potentially-recyclable wastes, organic wastes and refuse are segregated at the screening and composting sites. Recyclables are then crushed, bundled and stored to be later marketed. The organic matter is sent on to the composting lay-out area and the output is an organic product that can be used in landscape design and in recovering depleted areas, among other purposes (FEAM, 2006). The resulting waste must be disposed of in a controlled landfill or a regular landfill.

A screening and composting site, as per Pontes e Cardoso (2006), is the intermediate stage in the management of solid waste and allows to control pollution and recover natural and energy resources, mostly by reusing recyclables as the input in industrial plants.

3.4.2 Trash Pickers Co-operative: a social, economic alternative

The basic foundation to organize a co-op is the goal to better the economic condition of its members. It enables them to introduce products and services into the market at more advantageous conditions than those they would have if working independently (SEBRAE, 2014).

A co-operative tends to provide, as per Abreu (2001) and Arcanjo e Marques (2012) the opportunity to recover pickers' self-esteem by means of joint work. It allows them to step up into mainstream society as citizens and productive workers. Thus, the educational site can make social inclusion possible and provide citizens with the chance to have an empowering education by attending vocational programs and training courses.

3.4.3 Environmental Education in the Context of the Integrated Management of Solid Waste

As environmental education strategies to build people's awareness of solid wastes, Bassani (2011), IPEA (2012) and Meira (s/d) recommend showing videos on solid waste, delivering lectures, organizing occasional recyclable-material collection campaigns, workshops on sustainable consumption and educational gatherings aiming to raise people's awareness of social and environmental issues and of the need to preserve natural resources.

In this setting, the educational site must lay the groundwork for environmental education, whose goal is to bring the need and urgency to protect the environment into school communities and teach those engaged in environmental projects to segregate trash and pack waste, providing meaning and relevance for the actual behavioral shift of society.

3.4.4 Current Overview of Solid Waste Management in Macaé City

Today the Public Cleaning Office (SELIMP) is the body of the local administration in charge of coordinating the collection of waste in the city of Macaé, as per Macaé (2012). But the collection itself, covering 100% of urban households, is performed by a private contractor working for the local administration of Macaé. This contractor has an agreement with Macaé's administration that includes the collection, transportation and the end-point disposal of waste into the landfill, as per SNSA (2013). After collection, as per Macaé (2012), the waste is forwarded to the Waste Treatment Center (CTR), sited in the landfill operated by another private company having a service agreement with the local administration as well.

The City of Macaé, as per SNSA (2013), has an urban population of 208,457 inhabitants. In 2011, 81,640 tons of household waste was collected in the city. Based on the previously-referred to data, an average of 6,803 tons of waste is collected a month in the city, or 223.7 tons a day. Considering that, as per Monteiro (2001), in towns and cities having fewer than 500 thousand inhabitants, waste generation achieves around 0.55 kilos per dweller a day, the City of Macaé lies outside this frame of reference, provided that it produces approximately 1.08 kilos of waste per dweller a day.

4 FINAL REMARKS

In the City of Macaé, different pieces of information on solid waste do not match and some data have inconsistencies. Considering that Macaé's local administration charges the population for the waste collection service, pursuant to Complementary Law 053/2005, which provides for the Taxation Code, one recognizes the need to invest and update waste planning and management to achieve environmental, economic and social improvements. The educational site, at its pilot stage, could be used as a model for Macaé's public administration to start off the integrated waste management in the city, thus reducing the costs related to the end-point disposal of wastes into a landfill.

The success achieved by many systems, as per Lelis and Pereira Neto (2001), shows that it is feasible to use screening processes as an alternative to solid waste treatment, based on the actual possibility to reintroduce recyclables into the productive process, which would benefit the economy and drive the engagement of society to enforce citizenship.

In short, one can infer that the integrated solid waste management, as a result of the launch of the educational site, tends to foster social inclusion, with the co-operative, bring on economic benefits and improved environmental conditions to the IFFluminense at Macaé and to Macaé City itself.

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