



Management

SELECTIVE COLLECTION AND RECYCLING OF SOLID WASTE CASE STUDY: RECYCLING OF SOLID WASTE IN HULENE KA- MAHOTA DISTRICT

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ABSTRACT

The waste collected daily from household and businesses entities can be utilized for various objectives, serving as raw material for business and other most appropriate purposes. You can, for example, recycle plastic, produce compost and energy, recovering the economic value of such waste. Waste recycling generates jobs and income, reduces the amount of natural resources needed for a new product and also decreases the need to occupy (and pollute) space to deposit materials that have served only once their socio-economic function. And what you can't recycle always has another proper disposal, as a principle which is basic in the concept of sustainable development: Do not transfer the solution of the problem for future generations.

The aim of this study is to evaluate the panorama of the selective collection of household waste from the case study of plastic recycling in the neighborhood of Hulene Dump side, at municipality of Maputo. The methodology used in this research was the bibliographical and documentary analysis, as well as semi-structured qualitative interviews with: representative of Municipal Department of Waste Management, Health and Water Supply in the Maputo municipality; administrative coordinators of four organizations studied (RECICLA and FERTILIZA cooperatives, AMOR and PAGALATA associations). Additionally, technical visits were carried out with written and photographic records, interviews to members of the RECICLA cooperative.

Keywords:

Plastic Recycling; Scavengers Cooperative; Jobs Promotion; Income Generation.

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1. INTRODUCTION

Solid waste management and destination, household and industrial trade, creates problems involving environmental, economic and social issues, which may have serious consequences for the future. You must have proactive and critical positioning, towards this situation, seeking a viable alternative and consistent with the current reality. According to the reality of each region, several alternatives can be used for the management of municipal solid waste: recycling and composting. Parker (1997): "recycling is a result of a series of activities from which materials that become garbage, or are in the trash, are diverted, being collected, separated and processed to be used as raw material in the manufacture of goods, previously made with Virgin raw material." (Parker, 1997, p. 17) . Recycling is a business and should be treated as any other business. It must be structured and planned like any other enterprise. We can consider recycling as a new industry in training, with a great potential.

The Maputo City is the Capital of the Republic of Mozambique; It is located in the extreme south of the country, in the Delagoa Bay, occupying a surface of 346.77 km², including the territories of Catembe and Inhaca Island. It is bounded to the West by the Infulene Valley, which separates it from the Matola Municipality, the East by the Indian Ocean, to the South by the Matutine District and on the North by the Marracuene District. Was elevated to the category of town on 10 November 1887. Was created as municipality in 1997 by Law 2/97; their Bodies (Municipal Assembly and President of the municipal Council) was established with the realization of the first municipal elections in 1998 in 33 Municipalities. With the creation of municipalities, in 1997, was established a new legal framework that entrust the municipal organs to take decisions about management of the area of jurisdiction of the municipality.

Maputo is the largest city in the country, is also the main financial, corporate and mercantile Center. It concentrates approximately 38% of the urban population and produces 20.2% of Mozambique's GDP. The sectors of trade, communications and manufacturing are the most significant, contributing with 29.6%, 29.5% and 12.4% of global output, respectively. The informal sector occupies the largest workforce with 64.4% of total occupied population, followed by the formal private sector with 19.7% of the population (CMM, 2011).

The municipality of Maputo organized administratively into 7 municipal districts namely: KaMpfumo with 100. 000 inhabitants; Ka Nlhamankulo with 150,000 inhabitants; KaMaxaquene with 225,000 inhabitants; KaMavota with 280,000 inhabitants; KaMubukwana, with 290,000 inhabitants; Katembe with 30,000 inhabitants; Kanyaka with 15,000 inhabitants. The most populous is the Municipal District KaMubukwana, followed by KaMavota.

Solid waste management in Mozambique not only by the need to maintain the clean urban spaces, but also by introducing important mechanisms in the sustainability of the system, such as the ability to separate collection and recycling, with involvement of communities, non-government organizations and the private sector.

2. MATERIALS AND METHODS

2.1.GOAL

The objective of this research is to analyze the panorama of the selective collection of solid waste, from a case study, a pilot project for selective collection and recycling, in the neighborhood of Hulene, in the Maputo City. The research describes and analyses in the context of urban sustainability, experience of selective collection and recycling, in particular of partnerships between civil society organizations and the municipality and their impact on the generation of employment and the improvement of the living conditions of low-income families.

2.2.METHODOLOGY

The methodology used in this study was a bibliographical research, semi-structured interviews to support the pilot project case study of selective collection and recycling of solid waste in the neighborhood of Hulene. The methodological assumptions that guided the case study are based on the concept of integrated management of solid waste, as a new paradigm of urban cleaning, aligned to Agenda 21. Adopting, therefore, as goals the reduction of solid waste generation, increased reuse and recycling, the universalization of delivery services and waste final disposal in sanitary landfill.

The data collection and interviews to different actors, was made from a participatory process based on interactivity, systematic observation and recording. The social group formed by cooperative originated in a context of struggle for survival as trash pickers normally called scavengers. The number of individuals found at the beginning of the experiment were from the region itself, citizens without training, no housing, no income, who settled from the invasion of landfill to off the trash. Conquer the Group of garbage collectors in order to break resistance was essential. More than solid waste management, the work for community organization lacked of social perception and methodology for people approximation in the process of Cooperative of scavengers organization.

Participatory observation was the mode sense as best chance to open the the cooperative members to a confounding element. Provide the technological support and at the same time seek appropriation of space information raised; opinion, interaction, exchange ideas; register all perspectives and data collected in reports and go over to the involved partial findings throughout the work. This was necessary in the pursuit of trust indispensable to exchange and enrichment of individual and group experiences.

3. RESULTS AND DISCUSSIONS

3.1.INTEGRATED SOLID WASTE MANAGEMENT

When it comes to solid waste, refers to something resulting from activities of urban origin. These materials generated in these activities are potentially raw materials for production of new products. Reuse the garbage is to give a better fate in the trash that is produced by using the process of recycling, without that negatively affects the environment. It should be noted that

these initiatives follow the rule of the 3R's Reduce, Recycle, Reuse: (1) Reduce the quantities produced that will be sent to landfills and also save the need to withdraw from nature raw material; (2) Recycle the material collected and/or; (3) Reuse trash giving a second life, as a new object. This process also allows us to add value to the material to be recycled; improve the working conditions of scavengers or classifiers of recyclable materials; increase the lifespan of landfills.

The notion of Integrated Solid Waste Management, recognizes three important dimensions that should be considered when determining and planning a solid waste management system: the actors involved and affected by waste management; the practical and technical elements of the system; aspects of sustainability in the local context (ANSCHULTZ, 2004).

The following criteria are badges of Integrated Solid Waste Management as organized by Lardinois and Furedy (1999): *social/cultural* (solid waste services should be extended to all social strata, regardless of income, social status or ethnic group); *environmental* (implementation of closed-loop systems, waste minimization, recovery and treatment resources in generating source); *institutional/political* (joint responsibility between partners, appropriate regulatory model, democratization of the decision-making processes and professionalization of staff); *financial* (cost analysis, collection rates); *economical* (reduction of poverty through the generation of jobs and income); *technician* (clean and appropriate technology).

3.2.SEPARATE COLLECTION AND RECYCLING PROJECT

Organizations (two cooperatives, and one Association) of selective collection and recycling solid waste in Maputo City, outbreaks of this research, received support from social movements, civil society and religious institutions which have turned into social actors in the process of strategic dialogue and cooperation between the communities and the municipal authorities. Käthe Kollwitz, from these experiments, the recognition of collectors as one of the central elements of solid waste management projects. Recycling organizations present in this research are described below:

- Center of development of plastic waste-RECICLA
- Center of development of organic waste-FERTILIZA
- Mozambican Association of Recycling-AMOR
- PAGALATA recycling center

Gaiger (2003), organizations that arise in the context of solidarity economy, called sympathetic economic enterprises, understand the different forms of economic organization, originated from free association of workers, based on the principles of self-management, co-operation, efficiency and feasibility. Clumping individuals excluded from the labor market, or moved by the strength of his convictions, the collective search for alternatives, the sympathetic economic enterprises in the sectors of activities production or provision of services, marketing and credit. Are under the form of associations, cooperatives and self-management and combine their economic activities with cultural and educative actions, enhancing the sense of the working community and the commitment to the social collectivity that fall (CONCEPTION, 2003; MALIK; 2007; BALL, 2006, DAYS and ALVES, 2008b).

3.3.CASE STUDY OF “RECICLA” COOPERATIVE IN THE NEIGHBORHOOD OF HULENE

In the neighborhood of Hulene located in KaMahota Township, a pilot project was introduced for plastic recycling with the aim of generating household income and improve environmental management, from partnerships between the Municipality, an NGO Caritas of Mozambique and a Scavengers Cooperative (RECICLA). More projects of this nature has been rising in other municipalities, from that activity was shown that solid waste recycling became a good business opportunity with impact on low-income population by generating employment and income for households.

The pilot project consists of selective waste collection: reclaim glass, allowing paper and organic waste recycling and composting. The methodology used in the implementation of these pilot projects is a participatory and inclusive approach in all phases of implementation of the project. For the selective collection and recycling to be effective, it is necessary that the first segregation is made by the consumer/producer of solid waste and, to that this responsibility is assumed by him, it is necessary that he understands and appreciates the importance of this process for the quality of their lives and their city. It is therefore encouraging to creation an entire culture of civic and environmental awareness in terms of householders (Noronha and Brito, 2010).

RECICLA is a cooperative that produces plastic rendered for the local industry. Appeared in March 2006, in Maputo, in an initiative of plastic processing. The recycling centre of treatment and recovery of plastic is a project which has as its motto "new life To plastic waste". The project has environmental implications, economic, social and educational, arousing the interest of other Mozambican cities to assess the feasibility of similar interventions. The motivations for the creation of Recycling were, among others, the need to awaken the consciousness of the people about the importance of recycling and the growing need to contribute in solving the problems of urban sanitation, combined with the possibility of improving the working conditions of the garbage pickers of Hulene RECICLA cooperative.

The organization of cooperatives and associations of garbage collectors, for solid waste recycling, emerged from a supported initiative, mostly by SAGE (Lay Volunteers International Association/International Association of Italian Volunteers), Caritas Mozambique (religious authority), the German Development Agency GTZ (Gesellschaft fuer Technische Zusammenarbeit GmbH), Embassy of the Netherlands in Mozambique and Maputo City Council.

The pilot project had duration of 3 years (2006-2008), aiming to achieve the following objectives:

- Contribute to the improvement of the municipal waste collection system and creation of a system of selective collection of solid waste (plastics and organic);
- Generation of employment for the garbage collectors and income for low-income families;
- Creation of the treatment plant RECICLA for recycling plastic waste;
- Creation of the treatment plant FERTILIZA for recycling organic waste from the waste of the markets of the City;

- Promotion of associations and cooperatives of garbage pickers and populations resident in the neighborhood of Hulene;
- Awareness raising and environmental education in the district and schools in the neighborhood of Hulene.

Main problems identified at the beginning of the project:

- Scavengers lack of employment and precarious living conditions;
- Large amount of solid waste ;
- Deficient waste management, which causes environmental problems;
- Overload of the trash in the neighborhood of Hulene;
- Lack of sanitation.

Cooperative RECICLA processes monthly 15 tons of waste plastic (polyethylene, polypropylene, paper/plastic film and bags). Buys waste from the general public, mainly from collectors, in a simple business relationship. The plastic residue is manually processed, being separated by typology, washed, cut, milled and resold to plastic recycling companies interested in buying plastic recycled material, which use the product as a raw material for the production of new objects, especially household items such as chairs, baskets, bowls, among others. The results obtained so far, in terms of production, are promising, satisfying expectations. Currently, the cooperative RECICLA employ 20 workers, of whom 14 are founding members of the cooperative. The activity of collecting and plastic recycling generates income to pay monthly wage for all staff in equivalent amount of \$ US 100; and payment of operational costs of the activity.

Since the beginning of the implementation of the project, the partners have developed with the direct beneficiaries an introductory training course, to strengthen the prospects for sustainability, not only economic, of the project. Starting from basic training (literacy), began a series of participatory group dynamics, where personal hygiene and health education for the prevention of infectious and non-infectious, with particular attention for the HIV-AIDS virus had a particular focus.

The cooperative RECICLA is managed by a group of 16 people formed in the process of plastic garbage treatment and management. The objectives of its creation are:

- Promote the development of a solid waste recycling market;
- Empowering the informal sector for their integration into the local economy;
- Reduce the amount of plastic waste and protect the environment;
- Promote the inclusion of garbage collectors, from the cooperatives and associations.

The cooperative RECICLA purchases plastic by the pound, population, that collects selectively in the city. The purchase of 16 tons of plastic per month, thus contributing to the safeguarding of the environment and providing an income opportunity to the people involved. The type of recycled plastic and named: polyethylene (PEHD and PELD)-bottles, boxes, bowls; Polypropylene (PP): chairs, tables, buckets, household items, terms, covers; and even Plastic bags and Films.

This dynamic training extended to professional level, covering topics related to the management of micro-enterprises, accounting, personnel management and of course materials recycling techniques.

3.4.PRODUCTIVE CYCLE OF PLASTIC RECYCLING

The collection of recyclable materials sent for screening has been carried out by the organizations. Two screening plants are located near the city dump (Pagalata and Recycle). The recyclables have been collected at sales points and voluntary surrender and subsequently directed to screening plants.

In the process of sorting, pressing and marketing of recyclables, all responsibility has been working in groups, without interference of the municipal organ. The environmental education and information campaigns have been carried out by individual organizations with little or no participation of the municipality.

At cooperative RECICLA, the production cycle in plastic recycling processes is as follows:

Acquisition: The plastic waste is bought, collected and taken to the Center. The waste is selected, weighed and paid on the basis of the quantity and the type of plastic material. Although they have not been installed in several decentralized acquisition points neighborhoods of the city, RECICLA also collects production residues of companies previously requesting their services, this way processed and reinstated in the productive circuit.

Storage: the waste is subdivided by color and type of plastic and stocked in warehouses to ensure protection against atmospheric agents that could deteriorate its quality.

Washing: the objects are dipped in tanks filled with water, so that impurities deposit on the bottom. Then, the waste will be transferred to other tank where they are washed by hand using brushes and domestic detergents. RECICLA does not have to wash the recyclable electrical equipment, thereby saving time, detergent and water.

Cut: the scale of plastic objects is reduced by manual cutting.

Plastic transformation: after cutting and washing, with the reduction in size, producing ground and/or granular plastic, through the use of a milling machine of densification (for plastic light) and extrusion (through a process of partial melting of plastic that allows to obtain the granular, superior quality relative to the ground).

Packaging and sale: the ground and/or granular is packed in bags, stored and then marketed to businesses and local craft centers that recycle producing new objects.

The processing of this plastic generates 3 products (**product A:** plastic cut and washed separately by type and color; **Product B:** Plastic ground washed and separated by type and colors; **Product C:** Dirty Plastic mixed whole or ground) that were sold as raw material for local plastic industry.

The Cooperative RECICLA, has an income equivalent of \$ US 20.000 per year, which shows that the recycling of plastic can be a viable business opportunity for micro and small businesses; and for low-income families and garbage collectors an employment opportunity and income generation. Thus, in 3 years were commercialized the following products: washed recycled plastic 20,7 tons, dirty selected 216,3 tons Plastic, Plastic ground 63,0 tons. Total Processed Plastic 300,1 tons; Total Income Generated was (\$ US 60,000).

The Cooperative RECICLA, during 3 years of the pilot project, empowered 12.500 waste collectors, with jobs and income generation; buy 329 tons of plastic for processing. This plastic processing generated 3 products that were sold as raw material for local industry; having earned an income equivalent of \$US 60.000,00, which shows that the recycling of solid waste can be a lucrative opportunity for micro and small businesses, and can generate jobs and income for low-income families.

4. CONCLUSION

Recovery of recyclables market attracted new actors, private and public, attracted by the value and demand for recyclable materials. The reuse of materials aims to optimize the losses, since much of the material that makes up the urban waste is reusable. Given this, a way to recycle this material rationalizing the waste generating employment, income and profit. The process basically consists in the separation of organic and inorganic material. The organic material consists of leftover food and vegetables; already the inorganic material is basically composed of recyclable materials such as glass, paper, plastic and metal.

The experiences of recycling projects, despite its small scale, generates economic benefit (a guarantee of stable income to the families involved), the environmental benefit (recycling of various materials) and social benefit, since the work provides opportunities for social integration of people who have always been marginalized.

The pilot project of selective collection and recycling of plastic in the neighborhood of Hulene, capacitated 14 waste collectors to self-organize the Cooperative of Scavengers (RECICLA) to buy and processes plastic waste and generate jobs and income for all members of cooperative; provide direct jobs to 6 people; created opportunity for income generation to 12,500 people that collect plastic and sell to RECICLA cooperative.

The recycling process produces 3 products that are sold to companies that produce plastic articles, which in the past imported raw materials for its factories. Recycling made about 2 million of meticaís, enough to cover operating costs and salaries for all members and employees of the cooperative.

The successful experience of this pilot project shows that the partnership between non-governmental organizations, the municipality and the community there is great potential to be explored for the benefit of low-income families that allows business with social inclusion. The change of attitude from prevailing practices requires greater public sensitivity and demands a more participative and administration which includes the values based on solidarity and shared management of solid waste. In these cases, the Local Government strengthens its role as

facilitator and stimulator of a joint responsibility of society to channel a best possible resources and deploy polices and social projects centered on the new paradigm of social inclusion.

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