

Accumulated Garbage in the City of Parana: Analysis of the Implementation of a Material Recycling Facility (MRF)

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Summary— Paraná is the capital city of the province of Entre Ríos. It has a large population and is continuously growing, resulting in a very high population density. Therefore, it faces significant pollution issues due to the accumulation of garbage in various parts of the city. Improperly managed waste accumulates in different areas, causing pollution, blockages, and other problems that directly impact the living beings in the vicinity. The aim of this project is to analyze the implementation of recycling facilities with MRF technology to address the problems stemming from this waste accumulation while also maximizing resource utilization. The primary objective is to raise awareness about the garbage-related issues in our surroundings and find efficient solutions for them.

Keywords: garbage recycling plant, accumulated garbage, implementation of a Material Recycling Facility (MRF), MRF technology.

Resumen— Paraná es la ciudad capital de la provincia de Entre Ríos, cuenta con una gran cantidad de habitantes y está en constante crecimiento, por lo tanto, la densidad de población es muy alta. Esto lleva a que sea una ciudad con un alto grado de contaminación por acumulación de basura en los distintos puntos de esta. La basura que no es tratada como corresponde se acumula en los distintos sectores de la ciudad generando contaminación, atascamientos y demás problemas que afectan de lleno a los seres vivos a su alrededor. El propósito de este proyecto es analizar la implementación de una planta de reciclaje con tecnología MRF para solucionar los problemas que genera esta basura y a su vez aprovechar al máximo los recursos. El objetivo principal es dar a conocer los problemas que tenemos a nuestro alrededor por culpa de la basura y poder corregirlos de una manera eficiente.

Palabras clave: Planta de reciclaje de basura, basura acumulada, instalaciones de reciclaje de materiales (MRF), tecnología MRF

I. INTRODUCTION

The constant expansion of the density of the population of Paraná has led to the fact that, in certain areas, there is accumulated garbage. This affects both the cleanliness of the public spaces and the health of animals, people, and other living beings.

To deal with this problem, we have studied a recycling system, in which everything that is separated is classified and packed in a more efficient way so that

recyclable items can be marketed by urban recyclers and cooperatives to reintegrate into the productive system. Said recycling system uses machinery called Materials Recovery Facility (MRF).

The purpose of this work is to analyze the problem of garbage accumulation in the city of Paraná, with its causes and consequences. This presentation also suggests a solution by means of the implementation of an MRF.

To achieve this purpose, this work is structured as follows. Firstly, the context of the waste accumulation in Paraná is going to be outlined. Secondly, the issue is going to be depicted along with images illustrating the inadequate waste management and society's negligence towards this matter. Thirdly, the underlying causes are going to be identified. Furthermore, the impact of these consequences on health and the environment is going to be discussed. Lastly, a proposed solution is going to be presented, analyzing all aspects related to its implementation.

II. PROBLEM DEFINITION AND ANALYSIS

A. Description of the Context

The problem to be analyzed is in the city of Paraná. This city is located in the province of Entre Ríos, Argentina, as Fig. 1 shows. It has around 1.426.426 inhabitants.



Fig. 1. Argentina, Entre Ríos Province [1]

Paraná is the capital city of the province, which is why the city is expanding, as Fig. 2 shows, and there is an increasing number of citizens. As there is greater demand for services and needs, the city must be constantly growing. This, as it can be expected, brings about several drawbacks. One of them is the accumulation of garbage that occurs in different parts of the city, as it is presented in the following section.



Fig. 2. Paraná City [2]

Problem Statement

The problem of waste management in the city of Paraná is a growing and highly relevant concern. As the urban population increases and consumption patterns evolve, an uncontrolled accumulation of garbage has been generated, posing risks to public health and the environment.

The main challenge lies in the lack of an efficient system for waste collection, transportation, and final disposal of garbage. The existing infrastructure is collapsed and unable to cope with the ever-increasing amount of waste generated daily in the city. This leads to consequences of waste accumulation in the streets, overflowing containers, and clandestine landfills, creating a favourable environment for disease proliferation, soil and water pollution, and degradation of the urban landscape.

B. Description of Scenes that Help Picture the Problematic Situation

To effectively visualize the problematic situation, this section presents several images of the problem in the city of Paraná.

In the center of Fig. 3, there is an overflowing garbage container. There is also an excess of accumulated trash. Many of the bags that contained the garbage are ripped, and the garbage has scattered around. In the background of the image, on the left side and behind the containers, we can see one of the most famous fast-food chains. Some people buy food there and throw the paper bags in those containers or in the street.



Fig. 3. Garbage in the center of Paraná [3].

In Fig. 4, in the background to the right, there is a river. The Paraná River is located by this city. In the foreground of the image, we can observe the pollution, which is not only present on the land, but it also reaches the water of the river.



Fig. 2. Contamination of the beach in Paraná [4].

In Fig. 5, there are people sorting garbage in the center. Some recycle it, while others simply look for food or what they need. In the background, to the left, I can see three men resting and possibly chatting. In the front of the photo, I can see three men collecting and sorting garbage. In the background on the right, I can see a lot of garbage accumulated in the shape of a mountain.



Fig. 5. Open-air landfill [5]

C. Identification and analysis of causes or factors that give rise to the problem:

In Paraná, there are many causes that contribute to the accumulation of garbage. Among them, this work highlights three of them.

Firstly, the growing number of people who come to live in the city causes city's population density to increase excessively. As there is a lack of awareness about garbage disposal, tourism worsens the usual situation. Besides, the limited control that exists over this situation leads to garbage accumulation in public and green areas.

Secondly, maintenance should be mentioned. The lack of maintenance in streets, drains, and sewers results in a significant amount of garbage accumulated in different parts of the city.

Lastly, a major contributing factor is the inadequate handling of the collected garbage. The absence of a proper post-disposal process is highly significant, and it is not carried out correctly within the city.

D. Identification and Description of the Consequences

There are many consequences of garbage accumulation in Paraná. I observe, firstly, the impact on the health of people and animals living in environments close to public and green spaces that have accumulated garbage. There is also a deterioration of plants that meet this waste.

As a second consequence, the accumulation of garbage in the streets leads to traffic interruptions or hazards

in certain areas. Additionally, it results in the obstruction and malfunction of drains and sewers, causing blockages and even flooding.

Thirdly, it is essential to highlight that burning garbage represents a considerable threat to the environment. This practice releases a variety of dangerous pollutants into the atmosphere, such as greenhouse gases and toxic particles, which contribute to climate change and air quality degradation. In addition, burning garbage can also cause damage to terrestrial and aquatic ecosystems, affecting wildlife and biodiversity.

III. THE WAY FORWARD

A. Problem approach

A potential solution to the problem mentioned above could involve the implementation of a garbage treatment plant utilizing MRF (Material Recovery Facility) technology. This facility could be strategically located in the city of Paraná.

With this technology, everything that is separated can be efficiently sorted and baled. This makes it easier for recyclables to be marketed by urban recyclers and cooperatives, ultimately reintegrating them into the productive system.

As a first step, the recyclable materials are discharged into the feeding hopper. From there, a journey begins that does not last more than three minutes until reaching the end of the work line. Part of the process is mechanical, while the other part is manual. The first step is carried out by the reclaimers: they select and remove the waste with the largest volume from the conveyor belt, which could hinder the process.

The remaining elements are passed through an automatic separator for cardboard, glass, and non-ferrous metals. In the subsequent stages, papers, and PET containers (the plastic commonly used in bottles) are separated.

Afterwards, the recyclers are responsible for sorting aluminium, Tetra Packs, and other plastic items into different compartments. Finally, the metals are classified through an automatic separator. Raw materials that cannot be sorted (a smaller proportion of everything that enters the plant) are compacted and will ultimately end up in a landfill [6].

B. Strengths and Weaknesses of the Proposal

An MRF offers various features and advantages which will be mentioned below.

Firstly, it functions as a semi-automatic facility for receiving, sorting, and preparing dry materials collected by urban recyclers. It receives materials from green collection points, eco-campaigns, and urban recovery teams. Furthermore, it significantly increases processing capacity compared to manual ecological centers and improves the working conditions of operators.

Additionally, it has the capacity to process approximately 120 tons per day, effectively increasing material handling capacity and enhancing quality by reducing impurities. This fulfills the requirements of the cooperative, which previously relied on manual separation and sorting of waste.

In addition, materials that were previously sold in bulk can now be processed at the MRF, improving market conditions for the members of the cooperative who were previously involved with the green center or marketed materials there.

Regarding the disadvantages, one of the most important ones is the investment costs. Establishing and maintaining an MRF can be costly due to the initial investment in advanced equipment and technology.

Secondly, it is important to consider material contamination. Sometimes, MRFs may not completely remove contamination from recyclable materials, which affects the quality of the recycled product.

Third, there are energy requirements. The operation of MRF facilities requires energy, which can contribute to the carbon footprint if renewable energy is not used.

Finally, there is a need for education and awareness. For an MRF system to work effectively, it is necessary to educate the community about proper separation of materials and raise awareness about the importance of recycling.

Therefore, MRF recycling systems offer significant benefits in terms of efficiency and resource conservation but also have challenges related to costs, pollution, and public awareness.

An example that shows that this technology has already been successfully implemented in Argentina is a recycling plant located in Barracas, Buenos Aires. Significant improvements and advancements have been observed in recycling practices after its implementation.



Fig. 6. Recycling plant in Barracas, Buenos Aires [7]

IV. CONCLUSION

In conclusion, the lack of garbage treatment and its underutilization is a significant problem that affects society. The attention given to an issue as vital as garbage pollution is inadequate, both from the citizens themselves and the institutions responsible for meeting the basic requirements for a good quality of life. The purpose of this work has been to provide information about the wide-ranging impacts of garbage, offering context for each situation that the city of Paraná faces with specific examples. Additionally, it aims to provide information about the possible implementation of the facility described in the work, with the goal of improving waste treatment and, in turn, enhancing the quality of life for all citizens. The positive and negative aspects of this implementation have been detailed, along with examples already implemented in Argentina.

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The present project is a skills integration activity in Inglés I at Universidad Tecnológica Nacional, Facultad Regional Paraná, carried out by EFL engineering students. The yearlong project requires students to delve into a problem in the city where they live and to address it by means of a simple project in English. Should the reader have any questions regarding this work, please contact Graciela Yugdar Tófaló, Senior Lecturer, at gyugdar@frp.utn.edu.ar.