

ZERO WASTE CASE STUDY: STRUCTURING THE SELECTIVE AND ORGANIC COLLECTION AT THE UNIFIED EDUCATION CENTER OF BRASÍLIA, CAMPUS: ``ASA NORTE``

Isabella Ribeiro de Oliveira e Silva

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Abstract: The problem of solid waste has been increasingly debated due to the various negative impacts caused to the environment. Especially in today's society, marked by consumerism and waste, which influence the increase in waste production. Only in 2010 was the law that established the National Solid Waste Policy approved. This law establishes that environmental education is a fundamental instrument for the success of this purpose of changing a culture in relation to waste disposal. As well as the concern with improving the quality of life of human beings, maintaining life on the planet and the survival of the ecosystem as a whole. In this context, this research aims to discuss the importance of raising awareness about the correct disposal of waste, using CEUB, a Higher Education Institution in the capital, as an example. And taking into consideration, the Zero Waste philosophy, which aims to change people's lifestyles and their practices, directing them towards a more sustainable path, in which all discarded material was planned to return as a resource for other uses. To this purpose, at the end of the research, a restructuring project proposal was made for the university's waste shelter, in order to contribute to solid waste management at CEUB. It is necessary that there is the engagement of everyone involved in the institution, students, teachers, staff and visitors, so that they can properly dispose of the waste produced on the campus, ensuring that the waste is sent to continue its life cycle, without becoming trash. What for many is a waste, a disposable material, for others it can mean survival. Waste that returns to the production cycle can generate jobs and income, in addition to positively impacting the environment.

Keywords: solid waste; zero waste; waste shelter.

INTRODUCTION

Solid waste has been a topic of constant debate in environmental management, due to the impact generated by the disposal of these materials on the environment and the economy, especially in today's society, marked by consumerism and waste.

The National Solid Waste Policy (PNRS) defines it as "all discarded material, substance, object or good resulting from human activities in society". And Urban Solid Waste (MSW), covers solid waste generated in urban areas. They are characterized as domestic or residential waste, commercial waste and public waste.

Studies by the United Nations (UN) and the World Bank estimate that 1.4 billion tons of urban solid waste are generated in the world per year and by 2025 this value must reach 2.2 billion per year (UNEP, 2015).

As the volume of waste in deposits grows, the cost and demand for environmentally safe areas for the correct disposal of waste will increase. Therefore, it is necessary to minimize the generation of this waste, through segregation and the implementation of efficient treatment methods, thus promoting health and environmental protection.

It is important to highlight, as Portilho (1997) observes, that although waste production is inherent to human activity, the relationship between one and the other is conflicting. Society, in general, has always related to its waste through attitudes of distancing, alienation, prejudice and stigma.

This way, education plays an essential role in reversing these attitudes. With regard to Higher Education Institutions (HEIs), they can highlight the problem of solid waste through the teaching-learning process, leading students to a critical reflection about them and also becoming a good example with the implementation of sustainable practices.

According to the Urban Cleaning Service of the Federal District (SLU), large generators are all individuals or legal entities that generate a volume of more than 120 liters of waste per day. Higher Education Institutions are among the 15 largest waste generators in the city of Brasília.

Law number 5,610, of 2016, provides for the responsibility of large generators, including waste management, which corresponds to various planning, implementation and management procedures with the intention of reducing waste production, providing a suitable final destination for waste generated. In other words, they become responsible for the adequate packaging, collection, transportation and final disposal of solid waste.

At CEUB: `` *Centro Unificado de Educação de Brasília*`` (UNIFIED EDUCATION CENTER OF BRASÍLIA), the solid waste produced is similar to domestic waste, namely dry recyclables: clean paper and cardboard, plastics, metals, long-life packaging and Styrofoam; organic: food remains, leaves, dirty and/or greasy paper; and undifferentiated items: glass, mirrors, porcelain, toilet paper, disposable diapers, sanitary pads and also waste that has been mixed, both by collectors and users of the institution, who often dispose of it in an inappropriate place. The amount of waste produced at CEUB is very high, as it has several production points, such as the administrative block, classrooms, bathrooms, cafeterias, restaurants, gymnasium and sports courts.

Although nowadays it is possible to separate a good part of the waste produced on campus, it is still a problem due to the lack of awareness among students, the lack of training for employees and the difficulty in separating organic waste from recyclable waste, especially in public squares. of the institution's food supply.

In this sense, this work is expected to serve as a practical contribution to the structuring of the selective collection of recyclable and organic waste at CEUB, based on the awareness of the entire academic population, employees and visitors to the institution, also proposing a restructuring of the project for waste shelter, in accordance with the national solid waste policy and Federal Decree Number: 10,936, of 2022, considering the importance of solid waste management as an indispensable condition for achieving sustainable development.

CASE STUDY

The C.E.U.B. presents waste management administered by Biological Sciences, which is coordinated by a professor.

In the CEUB waste shelter (Figures 1 and 2), dry, organic and unsorted recyclable waste is stored. Currently, there is already an adequate organizational structure with signs with the classification and name of some waste (organic, special waste, paper, cardboard, plastic, canvas), however, in practice, some weaknesses are observed, due to the disorganization of the shelter, which I will describe below.



Figure 1: CEUB waste shelter.

Source: own elaboration, 2022.



Figure 2: CEUB waste shelter.

Source: own elaboration, 2022.



Figure 4: Packaging of paper and cardboard in the CEUB waste shelter.

Source: own elaboration, 2023.

Currently, the institution does not have a good system for separating organic waste, they are produced in large quantities, mainly on weekdays, in pantries, restaurants, cafeterias and corridors. The packaging of this waste in the shelter is done in drums (Figure 3), which are closed containers that avoid problems with odors and insects, however these drums are arranged in a less useful way, as they are not placed in designated places, thus hindering the flow inside the shelter.

Undifferentiated waste is stored in *containers* labeled with the place where the waste was produced (Figure 5), for example: bathroom and cafeteria; however, it does not affirm that the waste placed in them actually comes from the aforementioned locations, given the disorganization observed and the fact that there is no criteria for classifying them for packaging. In this sense, one solution would be to determine specific colors of garbage bags for each location.



Figure 3: Packaging of waste in drums.

Source: own elaboration, 2023.



Figure 5: Labeled containers.

Source: own elaboration, 2022.

Dry recyclable waste is also produced in large quantities and frequently arrives at the shelter, mainly paper and cardboard, due to the replacement of products for cafeterias and restaurants, stationery stores and stores, especially at the beginning of the month and week. These are packed (Figure 4) in *raffia bags and on top of pallets*, despite being placed in designated locations, they do not have a storage pattern, thus providing a disorganized place.

Regarding the *on-site* visits, it was possible to realize that the structural and packaging organization is not at all appropriate (Figure 6). Since the shelter does not have a sorting table that would facilitate the separation of materials that will be destined for recycling. And due to the difficulty of separating waste, there are several containers that take up a lot

of space and are not arranged in an organized way, in addition to the waste that ends up falling on the floor, creating unpleasant spaces that can compromise the health of employees, as they attract vectors of illnesses. It is therefore important to rethink the current form of storage and the architectural issues of the shelter, such as accessibility, thermal comfort, suitability of the layout, among others.



Figure 6: Disorganized environment in the CEUB waste shelter.

Source: own elaboration, 2023.

It was found that the lack of awareness and information among students, teachers and employees of the institution to carry out the correct separation of waste in the available bins is an aggravating factor for the difficulty of segregating waste, together with the lack of awareness and training of collector employees to that properly dispose of waste in the shelter, and ensure that the place always remains organized and sanitized.

Regarding the responsibility of large generators, it is necessary to hire a collection service, which can be the SLU itself, or another private company. Resolution number: 11/2021 of the Water, Energy and Basic Sanitation Regulatory Agency of the Federal District (ADASA), establishes a collection cost by the public system, per ton of organic and undifferentiated solid waste collected, in the amount of R\$ 178.89. The SLU presents a management system, where large generators

must register, and all undifferentiated waste, which is not possible to segregate, must be paid for collection and landfill. A survey of the cost of transportation to the SLU landfill is carried out, and the amount of R\$133.87 is paid.

It is also the responsibility of large generators to prepare and make available to the Public Authorities the Solid Waste Management Plan in accordance with Federal Law Number: 12,305/2010, Federal Decree Number: 10,936/2022 and other relevant standards. And it is important to highlight that undifferentiated solid and organic waste segregated and packaged by large generators must be kept under their responsibility until adequate collection by the contracted service provider or by the generator's own transport.

Nowadays, the one who collects the CEUB is a company (Figure 7), which was chosen because it presents some attributes that favor collection, such as the availability of a scale that weighs the waste *in situ*, thus presenting a value closer to what is being consumed in terms of waste. For example, during holidays CEUB pays a lower amount, as the flow of people and consequently the generation of waste is much smaller.



Figure 7: ``Novo Rio Ambiental`` company collecting undifferentiated waste from CEUB.

Source: own elaboration, 2023.

The collection period for unsorted waste on the Campus is carried out from Monday to Friday, where the company collects it and sends it to a landfill. It is worth mentioning that despite being a correct destination, it is not the main one, as there are still many impacts behind these solutions, which harm the environment and public health.

OBJECTIVES

MAIN GOAL

Develop a model for requalifying the selective and organic waste collection system on the ``Asa Norte`` campus of the Centro Universitário de Brasília (CEUB) and, together, propose a project for the waste treatment shelter.

SPECIFIC OBJECTIVES

- Survey of the main waste management models in force at the national level;
- Survey of the main shelter models in force at the national level;
- Study, analysis and investigation of the models raised;
- Identify possible contributions of these models to the research object;
- Case diagnosis in the north unit;
- Analyze the feasibility and applicability of new technologies for optimizing the initial waste sorting work;
- Develop new technologies to optimize this screening;
- Exemplify at project level the developed architectural structure, in technical aspects and applied technologies;
- Develop a social awareness program for students, employees and users of the institution's food court;

- Clearly communicate and educate the Brasília University Center community regarding the importance and benefits of adhering to the Zero Waste model.

THEORETICAL FOUNDATION

URBAN SOLID WASTE

CONAMA Resolution Number: 005/1993 defines urban solid waste as: "waste in solid and semi-solid states resulting from activities of industrial, domestic, hospital, commercial, agricultural origin and sweeping services. This definition includes sludge from systems of water treatment, those generated in pollution control equipment and installations, as well as certain liquids whose particularities make their release into the public sewage network or bodies of water unfeasible, or require solutions that are technically and economically unfeasible in the face of the best available technology." (ANVISA, 2006)

The National Urban Solid Waste Policy defines solid waste as:

Article 3rd XVI - Material, substance, object or good discarded resulting from human activities in society, whose final destination is carried out, proposes proceed or are obliged to proceed, in the states solid or semi-solid, as well as gases contained in containers and liquids whose particularities make it is unfeasible to release it into the public sewage system or in bodies of water, or require technical solutions to do so or economically unfeasible given the best available technology. (BRAZIL, 2010a).

Regarding potential risks to the environment and public health, NBR 10.004/2004 classifies solid waste into two classes: class I and class II. Class I waste, known as hazardous, is waste that, due to its physical, chemical or biological properties, may present risks to health and the environment.

They are characterized by having one or more of the following properties:

flammability, corrosiveness, reactivity, toxicity and pathogenicity. Class II waste called non-hazardous is subdivided into two classes: class II-A and class II-B. Non-inert class II-A waste may have the following properties: biodegradability, combustibility or water solubility. Inert class II-B waste does not have any of its constituents solubilized at concentrations higher than water potability standards, with the exception of color, turbidity, hardness and flavor. (ANVISA, 2006)

URBAN SOLID WASTE MANAGEMENT

For Ferreira (2000), waste management aims to produce, handle and dispose of waste in a safe manner, thus minimizing the risk of contamination in the environment, as well as ensuring the availability of natural resources for future generations, through the establishment of new behavioral and cultural patterns dependent on educational work that must be the task of the current generation and the next.

The National Solid Waste Policy (PNRS), established by Law Number: 12,305/2010, includes distinct concepts of waste management in its definitions. For management, it brings the concept of “integrated management”, defined as:

[...] the set of actions aimed at seeking solutions for solid waste, in order to consider the political, economic, environmental, cultural and social, with social control and under the premise of sustainable development. (BRAZIL, 2010a)

The Management of Urban Solid Waste (MSW) in the country, its conception, the consideration of generation, storage, collection and final disposal, has been a constant challenge posed to municipalities and society. The existence of a National Solid Waste Policy is essential to regulate integrated

management, contributing to changing production and consumption patterns in the country, improving environmental quality and the population's living conditions, as well as to the more effective implementation of the Policy.

National Environment and National Water Resources Policy, highlighting its strong democratic, decentralizing and participatory components. Concern about environmental issues makes waste management a process of extreme importance in preserving the quality of health and the environment. (ZVEIBIL, 2006).

Integrated waste management must prioritize non-generation, minimization of generation and reuse of waste, in order to avoid negative effects on the environment and public health. The prevention of waste generation must be considered both within industries and within projects and production processes, based on analysis of the life cycle of products and clean production to seek sustainable development. Furthermore, public policies for national and regional development must incorporate a more proactive vision with the adoption of strategic environmental assessment and the development of new environmental indicators that allow monitoring the evolution of society's eco-efficiency. It is also important to identify socio-environmental-based tools or technologies related to sustainable development and total responsibility, as well as trends in sectoral voluntary codes and public policies emerging in developed countries, related to the systemic vision of production and integrated management of solid waste. (ZVEIBIL, 2006)

RECYCLING

Recovering materials from garbage is an ancient practice. In England, for example, at the beginning of the 15th century, waste - then predominantly organic - was sold to farmers and gardeners, who used it for animal husbandry and crops. Composting has been practiced since before classical antiquity. Recovery practices are also ancient in Brazil. News from *Jornal do Commercio*, dated 5/11/1896, already mentions the scavenging activities of Portuguese and Spanish people at the landfill on Sapucaia Island, in Guanabara Bay, to supply reuse industries and reusing companies. (EIGENHEER and FERREIRA, 2005).

However, it was from 1960 onwards that broader programs, including national ones, aimed at recovering packaging, began to be implemented, with a view to contributing to the management of solid waste (garbage). As an example, we have *Keep America Beautiful* in the USA. (EIGENHEER and FERREIRA, 2005).

Thus, what we call recycling and reuse activities are an economic activity that was originally imposed from economic and social primaries, notably scarcity, and not as a premise of urban cleaning or environmental protection. Collecting materials to sell has always been an activity for people in need - which did not prevent, until some time ago, even middle-class children from earning a few bucks selling materials collected as a family in scrapyards. Brazil is today a major recycler, due to the huge number of needy people who dedicate themselves to the task of scavenging, on the streets and in landfills, rather than to broad and organized solid waste management programs. On the contrary, the large recycler has alarming negative indicators in waste management. The activity of collectors, whether carried out in landfills, landfills and/or public places, is, it must be said, widely

practiced in Latin America and undeveloped countries. (EIGENHEER and FERREIRA, 2005).

Under Federal Law 12,305/10, recycling is the “process of transforming waste involving the change of its physical, physicochemical or biological properties, with a view to transforming it into inputs or new products” (BRAZIL, 2010).

Furthermore, recycling must be part of everyday life, since using raw materials from previously used product packaging to make new products, in addition to providing financial savings, also contributes to the removal of this waste from the environment, thus improving the quality of products. ecosystems.

COMPOSTING

Urban organic waste is made up of food waste and waste from gardens and green areas. Currently, the majority of organic waste generated in Brazilian cities is being disposed of in landfills and dumps, and less than 1% of the collected mass of urban solid waste ends up being recycled in composting units, which is equivalent to approximately 300 thousand tons per year. (PROENÇA, RODRIGUES and LANA, 2021).

Composting is an aerobic method of recycling and treating organic waste that seeks to reproduce some ideal conditions observed in the natural process of degradation of organic matter, as well as ensuring safety in the process. Good composting depends on controlling humidity, temperature, oxygen level and nutrient balance (carbon and nitrogen).

The control of these factors favors microorganisms, such as earthworms, insects and small mammals, as well as microorganisms, such as fungi and bacteria, to act in the accelerated degradation of organic matter, ensuring the elimination of

pathogens and preventing the presence of disease vectors. The end of the process results in the so-called organic compound, which has characteristics suitable for different uses, such as biofertilizer and bioremediation, helping to recover degraded areas.

In nature, composting occurs naturally through the biological degradation of organic matter. It has been practiced by farmers and horticulturists over the years. The first reports of the use of this natural degradation process originate from China, where small farmers piled up agricultural remains and waste for a certain period of time, until they reached sufficient stability for their subsequent application to the soil.

For composting to be done effectively, it is important that the waste is separated at source, and it must occur into at least three fractions:

1. organic waste: food waste and green waste.
2. dry recyclable waste: plastic, paper/ cardboard, metals, glass, which must be sent to selective collection, voluntary delivery points or to waste picker organizations.
3. rejects: other waste that cannot be recycled.

When organic waste is separated at source, composting can be done at various scales and technological models. Small amounts of organic waste can be treated at home or in community composting yards, while large quantities can be treated in larger yards, managed by the municipality, or in private yards. (PROENÇA, RODRIGUES and LANA, 2021).

The composting process is, in turn, an effective and economical way of treating organic waste, reducing its volume and stabilizing organic matter by giving it a useful destination and preventing its accumulation in landfills.

SELECTIVE COLLECT

Federal Law Number: 12,305/2010 establishes the collection of solid waste previously separated according to its constitution and composition, and must be implemented by municipalities as a way of directing actions aimed at complying with the principle of hierarchy in waste management.

Selective collection is a procedure that facilitates industrial recycling, but not only that but also the reuse of the organic fraction through composting, the generation of energy from waste and even the reuse of countless materials. (EIGENHEER and FERREIRA, 2005).

An indicator that industrial recycling, and not solid waste management, is the priority for selective collection in Brazil, is the fact that it is primarily focused (still in the tradition of collectors) on recyclable materials. There are few experiences of systematic collection of the organic fraction of waste and even the reuse of numerous materials. (EIGENHEER and FERREIRA, 2005).

According to IPEA (2012), recyclable collectors essentially work in the collection and resale of recyclable materials from post-consumer waste. However, there are no obstacles for them to provide or be able to provide private post-industrial collection services. Therefore, the recycling commercialization chain begins with the recovery of recyclable materials present in urban waste. This waste can be generated as waste from production processes or due to the obsolescence of machines and tools, in this case being classified as post-industrial, or generated as a discard of material left over from the consumption of a good or service – in this case, called post-consumption. The different positions occupied by collectors when collecting recyclables are visually presented in Figure 8.

ZERO WASTE

The *Zero Waste International Alliance* - ZWIA defines zero waste as “conservation of all resources through the responsible production, consumption, reuse and recovery of products, packaging and materials, without burning and without discharges into soil, water or waste. air that threatens the environment or human health.” It can be translated as a production model and/or a lifestyle that does not generate any waste of resources, money, time and energy.

Besides for ZWIA (2009) Zero Waste “is an ethical, economic, efficient and visionary goal to guide people to change their lifestyles and practices in order to emulate sustainable natural cycles in which all discarded materials are designed to become resources for others. The Zero Waste model includes the perspective of *redesigning* products, systems, processes and techniques to systematically avoid the generation of waste, as well as to eliminate or reduce the toxicity of the materials used, conserving and recovering all resources, without using waste. burning (incineration, pyrolysis, gasification, “energy recovery” ...) or landfilling to destroy them.”

Since the determination of the 2030 Agenda, the 17 Sustainable Development Goals of the United Nations - UN have made the dissemination of the zero-waste model become something of importance for all participating nations since this concept includes the concern with ending poverty and so that populations can enjoy peace and prosperity. As *Zero Waste Europe* - ZWE [Zero Waste Europe] quotes:

It is necessary to protect the true definition of Waste Zero: a holistic approach, led by community, which focuses on creating systems that do not generate waste in the first place and that contribute largely to the creation of jobs and the increased social integration.

According to consultant Fran Biazini, from

the Instituto Lixo Zero Brasil, he says it is a path of no return. “Companies are moving away from the concept of a linear economy, which is one that extracts, produces, consumes and throws away, towards the concept of a circular economy, where throwing away becomes a return of what is left in raw materials and waste, as raw material in another cycle or in the same production cycle.”

INTERVIEW WITH PROFESSOR ANDREA MARILZA LIBANO

To deepen my studies, my advisor introduced me to Professor Andrea Marilza Libano, responsible for coordinating the Biological Sciences and waste course at CEUB. In the conversations we had, she informed me about CEUB's responsibilities as a large generator, among the responsibilities is hiring a collection service, which in the case of CEUB, was the company: “*Novo Rio Ambiental*”.

Furthermore, the teacher also informed me about the amounts charged by SLU to carry out the collection. R\$178.89 must be charged per ton of organic and unsorted solid waste. And in this case, private companies can compete with SLU, then at a free market price. The value of the SLU is high so that there is competition with private companies, and thus, they are chosen.

The SLU presents an SGI (Management System), where large generators must register, and all waste that is not separated must be paid twice, the collection and

the landfill, which would be unsorted waste. A cost survey is carried out for this transportation to the landfill, which is the SLU landfill, and the amount of R\$133.87 is paid for landfilling. At CEUB, the collection of unsorted waste is contracted for a collection period that takes place from Monday to Friday. As it is a highly produced waste, its collection needs to be more recurrent.

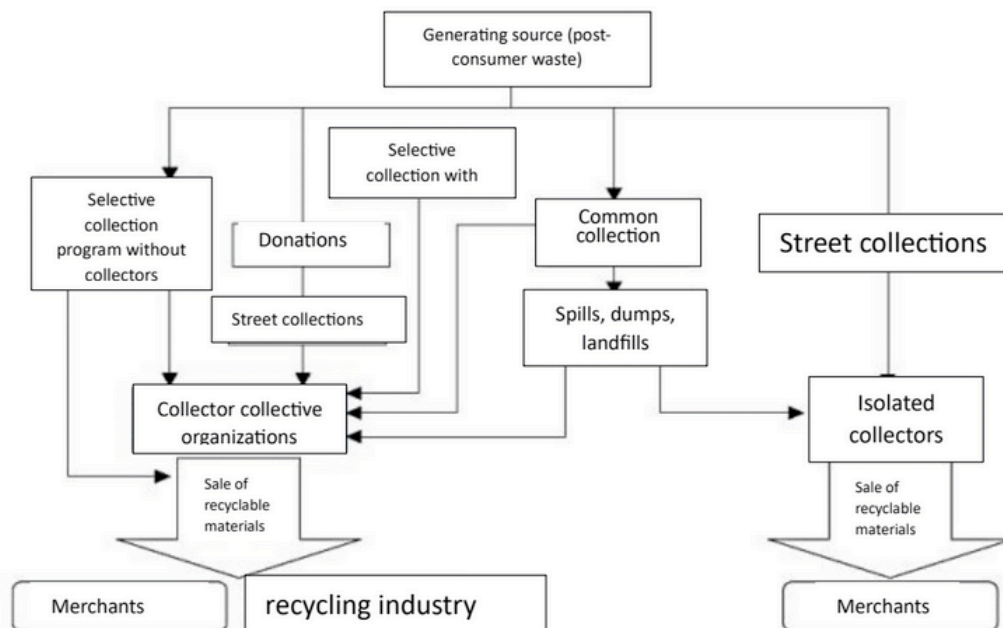


Figure 8: Position of collectors in the recovery of recyclable materials from post-consumer waste.

Source: IPEA, 2012.

POSITIVE SOLID WASTE MANAGEMENT MODELS

The Italian Embassy in Brasília (Figure 10), for example, was the first diplomatic mission in the world to receive the “Zero Waste” certification from the Instituto Lixo Zero Brasil. Italy is a great reference for us Brazilians, as it is a country that has marked several areas of knowledge, in the most varied aspects: cultural, economic and socio-environmental. And on the topic of sustainability it couldn't be any different. Italy, which is considered a Zero Waste leader in Europe, was one of the first countries to begin separating solid waste, in the 1980s, with collection carried out in containers on the streets.

And, showing its concern and respect for the impact caused by the headquarters of an international mission on the environment where it is located, the Italian Embassy in Brasília became the first Zero Waste Embassy in the world.



Figure 10: Italian Embassy in Brasília.

<https://benditacidania.com.br/consuladoda-italia-endereco-telefone-e-email/>,

Source: accessed in July 2023

In 2010, it was recognized as the first Green Embassy in Brasília, for adopting several measures to reduce its environmental impact, such as reusing water and replacing old machinery and equipment with unsatisfactory energy performance. With the installation of photovoltaic panels, for example, the Embassy currently produces 30% of its energy consumption through solar energy, with the goal being to reach 100% by 2023. (SABATINI and WANDERLEY, 2021).

The Letter of Commitment for Zero Waste Certification from the Italian Embassy in Brasília was signed on November 30, 2020. Among the measures taken in the process for Zero Waste Certification, the Embassy replaced its single-use plastic cups with compostable cups (Figure 11), which are sent directly to *on-site composting* after use.

And these are cups to be used by visitors, because all employees received reusable cups and cups. As a result, 28,000 disposable plastic cups were no longer consumed per year. (SABATINI and WANDERLEY, 2021).



Figure 11: Compostable cups.

Source: <https://certificacaolixozero.com.br/noticias/2021/04/19/embaixada-da-italia-em-brasilia-apfirst-in-the-world-to-receive-the-zero-waste-certification/>, accessed in July 2023.

In addition to replacing disposable cups, trash cans were eliminated from all rooms and waste bins were installed in their place, for the correct separation of dry recyclable waste. And for the organic waste from food leftovers consumed there, mixed with organic waste from landscaping, five metal compost bins were built in the garden (Figure 12), for thermophilic composting, which consists of the biodegradation of organic waste in an aerobic environment (with the presence

of oxygen) during which high temperatures are generated. For all the planning and implementation, the embassy disposes of 6% of its waste in the landfill.



Figure 12: Embassy compost bins.

Source: Eliete de Pinho Araujo, 2022.

The diplomatic headquarters obtained Zero Waste Certification on April 12, 2021 and today has an exemplary rate of 97% of its waste diverted from landfill. And plans for the coming years include improving and introducing even more sustainable practices. (SABATINI and WANDERLEY, 2021).

Another example of a company that seeks sustainability in its activities is Hotel Intercity (Figure 13), located in the Águas Claras/Taguatinga region in Brasília. The Hotel stands out for being very well equipped, for having a complete leisure structure, in addition to bringing a lot of convenience and comfort to guests.



Figure 13: Intercity Hotel in Águas Claras.

Source: https://www.tripadvisor.com.br/Hotel_Review-g7923450-d7724413-Reviews-Hotel_Intercity_-_Led_Aguas_Claras-Aguas_Claras_Federal_District.html, accessed in July 2023.

Sustainable practices are also a focus of the Hotel. In 2021, they won the Eco Responsible Seal from the Brazilian Institute for the Defense of Nature and the Green Stay Seal from HRS Global Hotels Solutions. There were some actions that led to the Hotel receiving these awards, such as the use of renewable energy, the reduction of plastic waste, composting and organic gardening, social equity actions, among others.

At the beginning of 2022, under the concept “Sustainability is an attitude”, ICH - ‘‘Intercity Hotéis’’, represented by manager Rafael Sena, signed a partnership with Simbiose IA, a company that is a reference in the market for implementing policies and models aimed at for Sustainability with an emphasis on operational efficiency and brand positioning on this topic.

This partnership aims to assist in the management model that seeks to associate the entire operation and its impacts with paradigm shifts, enabling the organization to achieve its goals and so that managers can make the best decisions aimed at increasing performance in line with sustainability.

For Gustavo Raeli, CEO of Simbiose IA, “What we can see is that by taking on this role of guiding people to transform organizations, Intercity will obtain even more return financial

and immeasurable gains due to the positive impact it will have on the entire business chain. The next few years will be watersheds in the lives of organizations”.

A gastronomic complex that features great chefs and menus like every R2 project, it was designed based on a major sustainability strategy, in connection with the 17 Sustainable Development Goals (SDGs), a global UN (United Nations) think of Mané restaurant (Figure 14). agenda towards a better world. 2030



Figure 14: Mané Mercado in Brasília.

Source: <https://www.bloco.arq.br/comercial/mercado-mane/>, accessed in July 2023.

Considered the most sustainable gastronomic market in the country, its initiatives consist of being the first Positive Waste Market in the world, allocating more than 90% of the waste generated for composting and recycling. To make this happen, educational bins, compostable packaging and a waste separation center were adopted.

The Brazilândia collectors’ cooperative, ACOBRAZ, is responsible for managing the recyclable waste generated by the action. They collect and dispose of recyclable materials, and receive profits from the sale of this material. Organic waste and compostable packaging will be transformed into fertilizer in a carefully selected composting plant in the Federal District.

“Everything at Mané is designed taking into consideration, sustainability criteria, from the crockery to the food. The goal is to divert 110% of the amount of waste generated from landfill, with 90% of Mané’s waste + 20% of recyclables delivered by the population.” Comments Francisco Nilson Moreira, Director of Sustainability at Group R2.

Furthermore, in partnership with the online food delivery company, Ifood, Mané will be the first Gastronomic restaurant with plastic-free delivery in the country. And all used oil is sent for recycling, thus avoiding water pollution.

Besides, aiming to encompass social responsibility and inclusion, the market is fully accessible, whether in its infrastructure or in the services for people with disabilities offered (PCD bathrooms, lowered counters, menus in Braille, ramps, tactile flooring, exclusive parking lots and qualified service). The social inclusion policy also guarantees the hiring of trans people, people with disabilities and the elderly.

After carrying out an on-site visit to the Mané restaurant complex, it was possible to understand how the storage of waste produced on site works. Firstly, the process begins with the bins that are spread throughout the complex at strategic points, in an attempt to help and assist both the waiters and the employees who clean the tables.

Waste is removed from the bins and sent to the complex’s waste shelter. Previously, waste separation was done on site, using a sorting table (Figure 15), however, as waste production is large, there began to be a problem with an excess of flies, which bothered customers.



Figure 15: Sorting table at the waste shelter in Mané.

Source: Eliete de Pinho Araujo, 2022.

Currently, waste is organized in containers (Figure 16), and separation is carried out at the cooperative itself, which collects four times a week. At Mané, waste is separated into garbage bags with different colors for each type of waste, by the employees of each restaurant/cafe in the complex. However, not all employees cooperate with this, and end up mixing waste.



Figure 16: Disposal of waste in containers at the Mané waste shelter.

Source: Own elaboration, 2023.

The waste produced is mostly organic, recyclable, which would be packaging, and undifferentiated, which would be greasy and dirty paper. And each restaurant has a drum that stores fryer oil. The generation of plastic waste is very occasional, as there is a concern that the packaging is mostly composted and recycled.

To solve the organic problem, the complex has a vegetable garden (Figure 17) where all the composted fertilizer produced in Mané's own composting plant is taken there.



Figure 17: Mané's vegetable garden
Source: Eliete de Pinho Araujo, 2022.

This on-site visit to Mané was extremely important to assist in the production of the CEUB waste shelter project, as it was possible to analyze the operation and layout of the shelter, which presents similar and different demands to those of CEUB.

As an example of an international model, since 2009 the British Virgin Islands, which are part of a volcanic archipelago in the Caribbean Sea in Central America, have become a great example in waste recycling. The archipelago covers 4 main islands and many smaller ones, the territory is well known for its beaches and beautiful landscapes.

It is in Tortola, capital of the British Virgin Islands, that an environmental organization works in partnership with the government to raise awareness and mobilize the population

around waste recycling, so that waste generated on the island does not reach the ocean.

The environmental organization responsible for this initiative is Green VI (Figure 18), a non-profit organization that aims to demonstrate, facilitate and catalyze environmentally friendly systems through practical projects, education and innovation, focusing on waste, energy and water.



Figure 18: Recycling center in the British Virgin Islands.

Source: <https://greenvi.org/waste/>, accessed in July 2023.

One of the most prestigious programs is *We Recycle*, done in collaboration with the Government of the Virgin Islands to determine the best recycling system for the Islands to protect the health of the population, create jobs, provide materials for local entrepreneurs to manufacture products, and demonstrate the better waste management. To achieve this, Test Recycling centers operate on both Tortola and Virgin Gorda, the third largest island in the British Virgin Islands dependency. The hard work of implementing partnerships, infrastructure, education programs and monitoring/evaluation tools is being done. Long-term financing mechanisms are being implemented. Testing recycling centers will compile critical data on system vulnerabilities, best practices, and costs.

This will be shared with the Government as it moves towards creating Recycling Centers on each main island in line with the new Solid Waste Management Strategy.

All plastic collected in the Island's 33 communities goes to a central facility, where it is separated into 7 different types. After being compacted, part of the material is used to build containers for depositing waste. Residents are also encouraged to compost organic waste for use in family farming. When producing their own food, the population avoids industrialized products packaged with plastic.

To date, 9 million plastic water bottles have been recycled, 8,351 tons of waste recycled and there are 55 recycling points in Tortola and VG.

LEGISLATIONS

Solid waste management is the subject of law and, to understand the company's obligations, it is necessary to have knowledge of the legislation to be followed. The Federal Constitution, in its article 225, deals with sustainability and provides for sanctions when activities are considered harmful:

“Article 225 - Everyone has the right to the environment ecologically balanced, common use of the people and essential to a healthy quality of life, imposing the Public Power and the community have the duty to defend it and preserve it for present and future generations.

(...)

§ 3 - Conduct and activities considered harmful to the environment will subject offenders, natural persons or legal to criminal and administrative sanctions, regardless of the obligation to repair the damage caused.”

The Federal Law Number: 12,305 /2010: Establishes the National Solid Waste Policy, amends Law Number: 2,605 /1998 and provides other measures;

Federal Law Number: 9,795 /1999: Provides for Environmental Education, establishes the National Environmental Education Policy and provides other measures;

District Law Number: 5,610 /2016: Provides for the Responsibility of Large Solid Waste Generators and other provisions;

District Law Number: 5,418 /2014: Aims to establish the District Solid Waste Policy; District Law Number: 3,232 /2003: Provides for the District Solid Waste Policy and other provisions;

Decree number: 10,936/2022: Regulates the National Solid Waste Policy, established by Law n ° 12,305/2010;

Decree Number: 37,568 /2016: Regulates Law Number: 5,610 /2016, which provides for the Responsibility of Large Solid Waste Generators, amends Decree Number: 35,816 /2014 and provides other measures;

Decree Number: 35,972 /2014: Approves the Internal Regulations of the Urban Cleaning Service of the Federal District - SLU, and provides other measures;

Decree Number: 5,940 /2006: Establishes the separation of recyclable waste discarded by bodies and entities of the direct and indirect federal public administration, at the generating source, and its allocation to associations and cooperatives;

ADASA Resolution 11/2021: Amends Resolution 14/2016, which establishes the public prices to be charged by the provider of urban cleaning and solid waste management services in the Federal District when carrying out waste management activities from large generators, events, civil construction and other measures;

The CONAMA Resolution 275/2001: Establishes the color code for different types of waste, to be adopted in identifying collectors and transporters, as well as in information campaigns for selective collection;

The ABNT, rule: NBR 13.221/2010: Specifies the requirements for land transport of waste, in order to minimize damage to the environment and protect public health; ABNT NBR 10.004/2004: Classifies solid

waste according to potential risks to the environment and public health, so that they can be managed appropriately; ABNT NBR 12.235/1992: Establishes the required conditions for the storage of hazardous solid waste in order to protect public health and the environment; ABNT NBR 11.174/1990: Establishes the conditions required to obtain the minimum conditions necessary for the storage of class II - non-inert and III - inert waste, in order to protect public health and the environment;

Normative Instruction Number: 89/2016: Regulates procedures within the scope of the SLU and provides for the standards to be observed by Large Solid Waste Generators and transport and collection service providers, as well as those responsible for holding events in areas, roads and public places.

METHOD

The present research was based as a methodology on the bibliographic study of physical and digital books and scientific articles, research on specific websites that contributed to the proposed theme. Clarifying the main factors and tools used during the research, substantiating them with the thoughts of the cited authors.

In this study, a qualitative approach was chosen, using action research methods, which, according to Elliot (1997, p.17), action research is a process that continually changes in spirals of reflection and action, where each spiral includes: clarifying and diagnosing a practical situation or a practical problem that you want to improve or solve; formulate action strategies; develop these strategies and evaluate their efficiency; expand understanding of the new situation and proceed with the same steps for the new practical situation.

TYPIIFICATION

indicates the nature of the research, the approach to the problem, the technical procedure(s) to be used;

- A) Nature: Applied Research.
- B) Qualitative approach.
- C) Type: Descriptive.
- D) Technical Procedure: Bibliographic, documentary, case study and action research.

CHARACTERIZATION OF THE RESEARCH LOCATION:

- A) The research was carried out at *``Universidade Centro de Ensino Unificado de Brasília``* - CEUB, Campus: *``Asa Norte``*, DF.
- B) The area covered in the research was environmental.

STUDY OBJECT:

The. Zero Waste Model at CEUB, Campus: *``Asa Norte``*, DF.

DELIMITATION AND UNIVERSE OF THE SAMPLE:

- A) The sample qualifies as students and employees from the CEUB community, from the *``Asa Norte``* campus, members of associations and cooperatives and outsourced companies that manage the solid waste collection and sorting system;
- B) Anyone who does not meet the requirements mentioned above does not qualify as a sample.

DATA COLLECTION OR GENERATION INSTRUMENT:

A) Note: analysis of the model applied at the Italian Embassy in Brasília, DF;

B) Observation: analysis of the model applied and the structuring of the waste shelter at the Mané restaurant complex in Brasília, DF;

C) Observation: analyzes of models applied at international and national levels;

D) Observation: analyzes of the current structuring and operation of the CEUB waste shelter, Campus: ``Asa Norte``, DF.

Interview: questions directed to professor Andrea Libano, coordinator of the Biological Sciences Course at CEUB, about the current operation of the university's waste shelter.

METHODOLOGICAL PROCEDURES:

Firstly, a survey of data related to the topic was carried out in the bibliographic reference, this step was relevant to have a more in-depth contact with the topic of solid and organic waste, and to obtain theoretical bases for the study of the project. Once this stage was completed, a study of projects and urban techniques was carried out in each one, looking for examples of Zero Waste models in the international and national context, mainly in the city of Brasília, DF, analyzing the technical formulations and social responses of each one in their urban and social contexts. This stage of the research resulted in the analysis of alternative construction models and consolidated or not consolidated construction solutions. In order to present a repertoire of solutions, for incorporation into the project of the object of study.

Subsequently, an on-site visit was carried out to the waste shelter at CEUB's ``Asa

Norte`` Campus, thus making initial contact with the local problem.

On this first visit, it was possible to see how the shelter works: how the waste is packaged, the identification of each type and the absence of a sorting table, which would allow for a thorough and adequate separation of the materials that will be destined for recycling.

In other visits carried out to the CEUB waste shelter and together with meetings with Professor Andrea Marilza Libano, coordinator of the Biological Sciences course, diagnostic techniques were studied which consist of understanding: CEUB's responsibilities as a major generator, the values spent on services related to solid waste management, the frequency with which the company collects waste, the types of solid and organic waste that are produced on the university campus, what are the points of production of this waste and the main types of waste that frequently arrives at the shelter and, finally, the analysis of processes at collection points.

After analyzing the data and bibliographical reading of the auxiliary materials, a communication plan was developed through a video with the aim of publicizing the subject of the project and raise awareness among students, professors, employees and university visitors about the importance of correctly using CEUB's garbage collectors. After defining this plan, a social agreement strategy for engaging people in this model was designed together with professor Eliete de Pinho Araujo, which will take place through lectures and a round table at the VI International Seminar on Cities and Housing: Modernities and Technologies, on the topic of solid and organic waste and the Zero Waste model.

In an attempt to bring the Zero Waste philosophy/model to CEUB, a waste proposal was considered as a suggestion for application at the university. The idea consists of adapting some furniture that is out of use at the college

and featuring shelves, doors, where students and staff can deposit materials that will no longer be used, such as: sheets of paper, Styrofoam, cardboard, cardboard, so that other students and staff may find new use for these materials.

As a final part of the research, the design of the object of study, the CEUB waste sorting shelter, was developed. This stage is the result of all the bibliographical and field research carried out in the initial part of the research development. The elaboration of the architectural/product management project is, therefore, the result of a series of surveys and analyzes carried out on other projects studied, in order to generate a model final product, incorporating successful techniques and proposing new formulas for inputs found in models already implemented, respecting current legislation and the socio-environmental variables that were found.

RESULTS AND DISCUSSION

The work allowed us to verify that in the city of Brasília, there are good examples to be followed of establishments and companies that have adopted Zero Waste strategies in their day-to-day activities, thus achieving sustainable measures in terms of waste management following the guidelines of the Policy National Solid Waste.

The on-site visit to Mané was extremely important to assist in the production of the CEUB waste shelter project, as it was possible to analyze the functioning and provision of the shelter that presents similar and different demands to those of CEUB.

Based on the meetings and conversations held with professor Andrea Marilza Libano, coordinator of the Biological Sciences and waste course at CEUB, it was possible to understand in more depth about the university's responsibilities as a major generator and the amounts spent on services

related to management of solid waste. Such as the collection period that the contracted company carries out and the attributes it presents that favor collection. These meetings enriched the production of the CEUB waste shelter project, by helping to understand the main demands and the functioning of the shelter.

Based on studies and visits to the current waste shelter, it can be considered that the lack of awareness among students, teachers and staff about the importance of recycling is one of the reasons for the difficulty in correctly separating waste in the shelter. In addition to the lack of training of the employees responsible for collecting this waste, they end up mixing the types of waste within the shelter.

Based on these identified problems, a proposed suggestion was to adapt an existing piece of furniture (Figure 19), which features shelves and doors. A space would be determined on each shelf where students and teachers could deposit papers, cardboards, Styrofoam, stationery materials in general, which will no longer be used by them, so that other people can use them, thus finding a new function for these materials and causing the waste to be sent to continue its life cycle, without becoming trash. The idea of these residues would be a plan for stimulation through a larger example, which could start with the architecture blocks, as it is a course that uses a lot of material, and later, adopt it in the blocks of other courses as well.

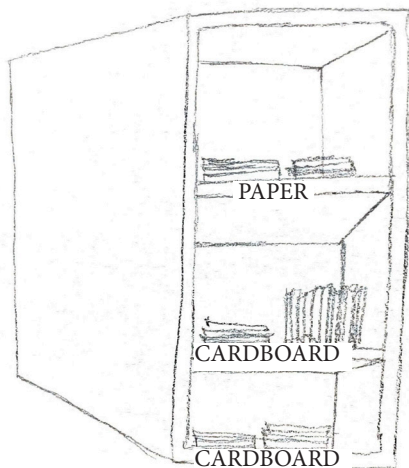


Figure 19: Adaptation of a piece of furniture for waste

Source: own elaboration, 2023.

The waste shelter must be sized according to the volume of waste generated, with a storage capacity compatible with the collection frequency of the local urban cleaning system. It must be built in an exclusive environment, having, at least, a separate environment to accommodate the storage of group A waste containers together with group E and an environment for group D (Figure 20).



Figure 20: Shelter of waste from groups A, D and E.

Source: http://www.resol.com.br/cartilha11/gerenciamento_etapas.php, accessed in August 2023.

As a final proposal, the design of the shelter for storing waste was carried out (Figures 21 and 22), following standards NBR 10004/2004 and NBR 12235/1992.

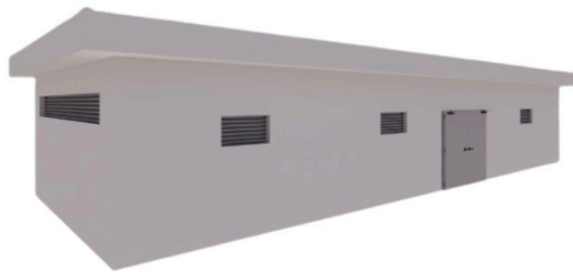


Figure 21: External view of the waste storage shelter.

Source: Own elaboration, 2023.



Figure 22: Internal view of the waste storage shelter.

Source: own elaboration, 2023.

THE PROPOSED PROJECT IS PRESENTED IN FLOOR PLAN, VIEWS AND SECTION IN APPENDIX A

The NBR 12235/1992 standard establishes the requirements for the storage of waste, defining the dimensions, operating conditions and precautions to be taken. The construction of the shelter must take into account some essential items: easily accessible place for collection external; the environment must only be used for the storage of waste; the environment must meet adequate physical structural conditions, preventing the action of the sun, rain, winds etc. and that unauthorized people or animals have access to the site; there must be a place to sanitize carts and containers; the environment must contain floor and walls covered with smooth, waterproof, washable and easy to clean material; openings

for ventilation of at least 1/20 of the floor area and with insect protection screen; door opening outwards, protection screen against rodents and vectors and wide compatible with external collection containers; lighting and water points, socket electrical, the fall of the floor must be at least 2%, to the side opposite the entrance; wastewater drainage channels directed to the EAS sewage network and drain siphoned with a lid that allows it to be sealed.

And finally, a video was also made (Appendix B), on the university premises, with the intention of publicizing the research carried out, explaining the importance of correct waste segregation, and consequently raising awareness among the entire community of CEUB about the positive impacts generated by the correct disposal of waste produced on campus.

FINAL CONSIDERATIONS

The problem of solid waste generation associated with inadequate waste and waste disposal practices is worrying both nationally and globally. Although some initiatives, such as the creation of laws and inspections, have been implemented in recent years, in order to try to solve these problems, it was possible to realize that there is still a lack of actions to encourage public policies and waste management to raise awareness among society in regarding this topic that is so important.

The National Solid Waste Policy is a milestone for solid waste management in Brazil. However, since 2010, the year it was sanctioned, most of the problems related to collection, inappropriate disposal and treatment of waste have not been resolved. This fact demonstrates the fragility of the effective application of public policies and environmental legislation in force in the country.

It can be concluded that although the generation and incorrect disposal of solid waste

represent one of the biggest environmental problems today, it is possible to minimize them through the practice of environmental management, through the appropriate disposal of waste, avoiding the use of inappropriate locations, and consequently, the degradation of preserved areas, contamination of the soil, atmosphere and surface and underground waters. Together with the implementation of environmental education programs, which contribute to raising society's awareness of the importance of reducing consumption, reusing products, recycling and environmentally appropriate disposal.

In relation to the objectives achieved, it was possible to carry out the study and analysis of waste management models at national and international levels, which helped in the development of the CEUB waste shelter project. Regarding the awareness campaign, the previous proposal was to create a playful and instructive booklet, with the focus of instructing and informing about urban solid waste and the importance of recycling and selective collection, however, with the development of the research, it was thought about disseminating and raising awareness through an informative video, as it is a more sustainable alternative, as it is not wasting any type of material, and is more objective.

The objectives were to include interviews with the employees responsible for collecting and transporting waste at CEUB, and with university students, aiming to better understand the problem regarding the segregation of this waste and understand the reason for incorrect disposal in the bins arranged by CEUB. However, these interviews were replaced by observation of the employees' services at the waste shelter and conversations with professor Andrea Libano: Furthermore, as the research developed, it was realized that the plan to replace the campus's trash bins with waste is unfeasible due to the cost

of implementation and maintenance. As well as the idea of the compost bin, as it requires the services of third parties, to carry out maintenance, for example.

Based on the proposals presented and as the subject is developed and internalized

in the institution, it is extremely important that other solutions are incorporated, and that other projects can take part in the practical implementation of this theme, and in supervision, if the shelter proposal is implemented.

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