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SOCIAL APPROPRIATION STRATEGYFOR SOLID WASTE MANAGEMENTIN A FARMER'S MARKET HOUSE,BUCARAMANGA, COLOMBIA.

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[1, 2]Social Appropriation Strategy for Solid Waste Management in a Farmer's Market House, Bucaramanga, Colombia.

ABSTRACT: In Colombia, farmers' marketplaces are buildings or spaces for the direct marketing of agricultural and livestock products from the farmer to the final consumer; the products marketed include vegetables, legumes, fruits, aromatic herbs, beef and poultry. This commercial activity generates large amounts of organic waste, which in its management process requires a strong training process with the generators at the source, i.e. at the time of marketing, in order to minimize its generation and improve its management, disposal and delivery for collection. The social appropriation strategy was developed in the "Guarin" Market Square in the municipality of Bucaramanga, a proposal that was structured based on the diagnostic information generated by the municipal authority, the target population to be trained was identified, formed by sellers and buyers, selection of training topics and advanced trainers at the project site to teach the population the proper management of waste, from its generation. A significant response was achieved, where 85% of the population received the training and improved their solid waste generation processes at the source.

KEYWORDS: Solid Waste, Training, Integral management, minimization, environmental education.

1. INTRODUCTION

Farmers' marketplaces are a specific site for establishing food trade in a region, which have favored communities for centuries thanks to the social, commercial, economic, etc. ecosystem. Public squares are spaces generated by government entities, in order to organize traders in one place, which promotes mass mobilization to these centers, ultimately favoring both parties involved in the commercial process. (MINAMBIENTE, Ministerio de Ambeinte y Desarrollo Sostenible, Republica de Colombia, 2021)

The market place as a site of economic, social and commercial convergence should be understood as a complex place in which there is a social, environmental and economic microenvironment. In which all of them are related to each other and can be affected directly and indirectly. Taking this into account, it is necessary to establish the factors that can influence an inadequate implementation of the PGIR (acronym in Spanish for "Plan de Gestión Integral de ResiduosSólidos" PGIR, Integral Solid Waste Management Plan), in these sites and to determine the processes to give them a corrective application. (Escobar, Martinez, & Moncada, 2017)

It should be noted that the size of the commercial site is proportionally related to the organization of the same, where issues of organization of sales sites, food preparation, product conservation, storage and disposal of waste of any kind are related. This last characteristic has gained great importance in the last decade due to the environmental impact associated with the issue of solid waste management. (Guzmán & Macía, 12), factors that could alter the ecosystem of the place as such, through the generation of vector-associated diseases, as well as the general change in the quality of air, water, and soil (Espinosa, et al., 2010).

Beyond the regulations for monitoring, the implementation of a PGIR brings benefits, since proper waste management is reflected in environmental quality, food safety, low operational costs, exemption from fines, and waste utilization through recycling. To this end, tools must be available to promote integrated waste management from the source.

It is vitally important that marketplaces comply with current environmental sanitation regulations, which adequately regulate the optimal operation of the integral solid waste management plans (PGIRS), implementing the methodology for the preparation of solid waste management plans. Likewise, resolution 0085 of 2015 of the metropolitan area of Bucaramanga, where direct responsible parties are established in the formulation, implementation, evaluation, monitoring and control of the internal program for storage and presentation of solid waste, in the Guarín marketplace.

The process was developed in the "Guarín" marketplace. The Guarín marketplace is located in the northwestern part of the city of Bucaramanga, specifically between Carreras 32 and 33 between 32nd and 34th Streets. It is a supply center that connects the countryside with the consumer with fresh staple products such as meat, fruits, vegetables, dairy products, as well as different consumer products such as cosmetics, household

items, personal hygiene, and convenience products. It has two main entrances for vehicles and different pedestrian entrances for easy access, on the outside it has a sophisticated lighting system and demonstrations of local art such as murals. The Market Square has 567 commercial spaces to cover the entire product offer.

In accordance with the Solid Waste Management Plan, PGIR, an environmental education strategy was organized to train the working citizens of the marketplace in the social interest of the generation, organization, presentation and delivery of solid waste, which the commercial activity of each local of the marketplace generates on a regular basis.

2. MATERIALS AND METHODS

The project was structured under the main idea of developing a strategy for environmental awareness and education, to generate environmental culture among the merchants of the Guarín marketplace, on the issue of generation and responsibility with solid waste.

For its formulation and execution, the participatory action approach was used as a methodological basis, based on the Economic Commission for Latin America and the Caribbean ECLAC (Durston & Miranda, 2002). And work phases were established to identify the work space, structure information to be applied and build results collectively (Eizagirre & Zabala).

a. Work phases

Based on the institutional diagnosis of solid waste generation, prepared by the Municipal Mayor's Office of Bucaramanga and the Municipal Sewage Company of Bucaramanga EMAB, we proceeded to establish intervention mechanisms in the commercial processes to improve the management of their solid waste.

Observation and research.

Taking information from secondary sources, the type of solid waste generated and the population to be intervened were identified.

It was decided to work on training in solid waste management in two ways. One, forming a group of trainers, students from the Environmental Resources Technology and Environmental Engineering programs of the Technological Units of Santander were selected. Two, with the trainers, training in solid waste management for all the personnel of the Guarin public market place on the importance of solid waste minimization, separation at the source, reuse, reuse culture and integrated solid waste management.

Action.

The social appropriation strategy focused its development on training and education actions with the population of the market place, merchants and buyers. For them, three types of activities were established: one, person to person actions, to provide training on the dynamics of buying and selling in the market place; two, specific training workshops on topics and regulations applicable to waste management; three, social activities of recognition and encouragement to the adoption of better ways of solid waste management.

Evaluation.

The follow-up of the results generated by the implemented actions, evidenced the number of participants in each of the established actions and the documented changes in the management of their waste.

b. Participating Population Groups

Leaders of the social appropriation strategy, research teachers attached to the Research Group on Ecosystems and Environmental Services, GIECSA (GIECSA, 2016), as coordinators of the process, trainers and academic accompaniers, on the subject of solid waste, PGIR, environmental education and outreach and training process with the community.

Students of the Environmental Resources Technology and Environmental Engineering programs as trainers in solid waste issues with the labor community of the Guarín marketplace.

The labor community of the Guarín market place, identified as generators of the waste to be managed, focused on 567 stalls distributed among suppliers of agricultural products, livestock, restaurants and cafeterias. The development of this economic activity benefits a population of approximately 3,000 users per week.

3. RESULTS AND DISCUSSION

The training and environmental education process on solid waste focused on the following aspects:
From Colombia's national manual for procedures in solid waste management plans PGIR:

Solid Waste: Solid waste refers to materials that are discarded from their useful life, these materials in themselves generally lack economic value. They include mainly waste materials used in the production, transformation or use of consumer products.

Proper Waste Disposal: This is the process of isolating and restricting hazardous wastes (especially unusable wastes) in selected, duly authorized locations to avoid contamination, damage or harm to human health and the environment.

Waste Classification: Solid waste can be divided into two categories: hazardous solid waste and non-hazardous solid waste. As the name indicates, because of their corrosive, explosive or toxic properties, those wastes that may be hazardous to citizens or the environment are classified as hazardous.

Waste Characterization Procedures: This includes determining the composition of waste in different fractions. Through them, we will be able to know more about the sediment in the selective collection container and take corrective measures on this basis.

Integrated Solid Waste Management: Integrated solid waste management seeks the recovery, transport and differentiated treatment of solid waste according to the type of waste and its potential use (Marín, Maldonado, & Castro del Río, 2015).

The following aspects were taken from Colombia's national environmental education policy:

Environmental Impact: It is a change or modification caused by human actions on the environment.

Final Waste Disposal: This is the process of isolating and restricting hazardous waste (especially unusable waste) in selected, duly authorized places to avoid contamination, damage or harm to human health and the environment.

Recycling: The process of converting waste into new products or raw materials for subsequent use.

Use: Used to express a certain type of income or profit, generally related to the development of personal, business or labor activities.

Collection: Solid waste collection, refers to solid waste management behavior, which can eliminate waste in people's living environment. Solid waste must be transported to the final disposal site for treatment from the moment it is generated.

Vectors: These are organisms that can transmit infectious diseases from person to person or animal to person. Many of these carriers are blood-sucking insects, which ingest pathogenic microorganisms along with the blood of the infected carrier (human or animal) and then inoculate the new carrier by ingesting the blood. (MINAMBIENTE, 2003)

a. Environmental education

As stated in the National Environmental Education Policy, environmental education is a process that recognizes values and clarifies concepts focused on fostering the attitudes, skills, abilities, and aptitudes necessary to understand and appreciate the interrelationships between human beings, their culture, and the interrelationship with nature (MINAMBIENTE, 2003). Education is fundamental for acquiring ecological and ethical awareness, values, techniques and behaviors in line with sustainable development and that favor effective community participation in decisions. This is affirmed by the decision-making conference (Rengifo, Quitiaquez, & Mora, 2012).

Objectives of environmental education

Integral and systemic formation of Colombian citizens to know, be and act coherently with sustainable development.

When we speak of education, we do not refer exclusively to schooling or formal education, but to the broad spectrum of scenarios where people learn, know and transform themselves.

When educators are mentioned, they include environmental activists, youth leaders, park rangers, volunteer park rangers, health promoters, rural and urban community leaders and organizations, among others.

When we speak of environment, we do not refer only to natural systems; environmental encompasses the dimensions of cultural, natural, social, economic, political and habitat systems. (MINAMBIENTE, 2003).

b. Environmental impacts associated with solid waste

Human beings in their interaction with the environment have always been confronted with the problem of waste management. This problem increased when people concentrated in urban centers, increasing the amount of waste generated and making it increasingly difficult to dispose of it (Tapia, Valencia, &Saldaña, 2020). The environmental problems directly related to solid waste management affect human beings and their environment in different ways, especially in the following aspects: Environmental factors, such as renewable and non-renewable resources. Social factors, such as public health.Economic factors, such as natural resources (Nanda &Berruti, 2020).

Some environmental factors impacted by poor solid waste management (Díaz, Savage, Eggerth, &Golueke, 2020) (Martínez, 2016) (Rodríguez, 2020) are:

Water Resource.

Water resources include all bodies of water on the planet, both surface water (rivers, lakes, lagoons, streams, oceans, snow-capped mountains, glaciers) and groundwater (wells, springs). The process of contamination of these water bodies, caused by poor disposal of solid waste (Vongdala, Tran, Teschke, &Khanh, 2019), can be by:

a. Organic matter: the presence of organic matter through bacteria, microorganisms and oxygen generates compounds that acidify the water, eliminate vital oxygen for the life of aquatic species and cause water for human consumption to become contaminated and generate health problems.
b. Clogging and damming of flows: the presence of garbage, bags, mattresses, debris, and any element that can dam the normal course of a river or stream can affect the normal flow of water. In very particular cases, such as sudden floods or high winter seasons, as well as the presence of large amounts of waste, these watercourses are dammed, causing flooding and affecting families living near these bodies of water, damaging crops and negatively impacting the area.
c. High treatment costs: when water sources are contaminated by any element, including solid waste, they must undergo a treatment process so that human beings can use it for drinking, crop irrigation or any other activity that requires the use of this resource. Obviously, these treatment processes are highly expensive and the community that demands these resources must pay for them.
d. Impact on coasts, rivers and seas: the presence of waste in recreational and leisure areas affects environmentally, socially and economically the areas with garbage, since environmental deterioration is caused on coasts, shores and beaches, marine and river flora and fauna are threatened, and tourism and related economic activities, such as fishing and recreation, among others, are affected. (Ikhlayel&Huong, 2017)

Atmospheric Resource

In their decomposition process, solid waste generates bad odors and gases, such as methane (CH4) and carbon dioxide (CO2), which help to increase the greenhouse effect on the planet, increasing the temperature and causing the poles to melt [18].

This decomposition process can be controlled by proper disposal of solid waste through technified incineration, landfilling and/or specialized landfills. Solid waste can also affect the air when burned in an uncontrolled manner, because it generates smoke and particulate matter that affect the respiratory system of human beings and contribute to the greenhouse effect, among other negative effects. (Ramachandra, Bharatha, Kulkarnia, & Sheng, 2017)

Soil Resource

Soil is the resource that is most directly affected by inadequate solid waste management, since over the years humans have disposed of the solid waste they have generated in the soil (Vongdala, Tran, Teschke, &Khanh, 2019).

Soil contamination occurs through different elements, such as leachates that filter through the soil, affecting its productivity and killing the microfauna that inhabit it (earthworms, bacteria, fungi and mosses, among others).

This leads to the loss of soil productivity, thus increasing the process of soil desertification. The constant presence of garbage in the soil prevents the recovery of the flora of the affected area and increases the presence of pests and animals that cause diseases, such as rats, pigeons, cockroaches, flies and mosquitoes (Sharma, Kumar, & Rajiv, 2018).

Landscape Resource

Although it is not one of the most frequently mentioned resources, the landscape is one of the most affected by the incorrect disposal of solid waste, since the constant presence of garbage in exposed places deteriorates the landscape and affects human health by generating stress, headaches, psychological problems, attention disorders, decreased work efficiency, and bad moods (Martínez, 2016). The increasing urban development and, therefore, the large population concentration in the country has generated a deterioration of the landscape and quality of life due to the lack of culture regarding solid waste management. (Rodriguez, 2020)

In the Colombian context, various ways have been used to define the terms "residue" and "waste". According to Decree 4741 of 2005, a solid waste or waste is any object, material, substance, element or product that is in a solid or semi-solid state, or is a liquid or gas contained in containers or deposits, whose generator discards, rejects or delivers it because its properties do not allow it to be used again in the activity that generated it or because the legislation or regulations in force so stipulate. On the other hand, Decree 2981 of 2013, and in the context of the provision of the public sanitation service, defines solid waste as any object, material, substance or mainly solid element resulting from the consumption or use of a good in domestic, industrial, commercial, institutional or service activities, which the generator submits for collection by the person providing the public sanitation service. Solid waste is also considered to be that which comes from the sweeping

and cleaning of public areas and roads, lawn mowing and tree pruning. Solid waste that does not have hazardous characteristics is divided into usable and non-usable.

c. Waste classification

Waste can be classified according to its source of origin (household, industrial, hospital, construction), its biodegradability (organic and inorganic), and its composition (for management purposes: paper and cardboard, glass, for example).

Waste according to its origin (Díaz, Savage, Eggerth, &Golueke, 2020):

Household waste: waste resulting from the daily activities of a household, commonly referred to as "garbage".

Municipal waste: materials resulting from street cleaning, garbage removal, pruning for the maintenance of parks and gardens.

Industrial solid waste: Material that is discarded from an industrial or semi-industrial process.

Hospital waste: waste of a special nature. These include infectious waste, medical and surgical material, sharp objects, remains of human tissues, and remains of drugs.

Construction wastes: These are practically inert wastes resulting from construction activities.

Waste according to its biodegradability

Organic waste: material derived from vegetables, animals and foodstuffs.

Inorganic waste.not composed of organic elements.

Waste by composition

Paper and cardboard. Glass, scrap metal and metal. Paints and oils. Plastic.PET plastic bottles.HDPE plastic bottles.Batteries and batteries (Escobar, Martinez, &Moncada, 2017).

Characterization of solid waste

Waste characterization is a study by means of which a sample is collected and its source, characteristics and amount of waste generated are identified. Waste characterization allows us to plan actions for waste management, as well as to find the most appropriate solutions to the problems that arise in the basic operations of storage, collection, transportation and final disposal, avoiding the deterioration of environmental quality and people's health (Díaz, Savage, Eggerth, &Golueke, 2020).

In general talks to the community, we explained the proper handling of waste, its classification and the optimal conditions it should have to be recycled and used, in order to inculcate in the population the essential terms that were worked on throughout the project.

In on-site training, as shown in Image 1, emphasis was placed on the proper separation of solid waste generated in the workplace in order to recover reusable or recyclable materials and thus achieve environmental, economic and social benefits, facilitating the interpretation of the correct separation of waste in the market stalls, as well as in the collection point or storage room.

The optimal conditions in which the collection center should be kept were explained, in order to avoid the presence of leachates, vectors and bad odors that may affect people's health, as well as the landscape resource.

Image 1.On-site training process at points of sale for agricultural products

In Image 2, a socialization was held on the storage conditions of a butcher's shop, emphasizing the importance of handling and disposing of meat, the importance of meat when it is discarded as a by-product, as well as the hygiene and sanitation measures in the workplaces. The different uses that can be given to organic

waste or residues were highlighted, that is, the use of organic waste, such as compost, which produces a large amount of nutrients to fertilize the soil and therefore the crops.

The composition of the compost was explained, as well as its treatment and ingredients, and the conditions that it must have to present optimal results, all this to encourage people to make better use of the waste generated in the workplace, such as the market place.

Image 1. On-site training process at points of sale for meat products

90% of the Guarín Market Square's bidders have received the training developed during the process, activities that are organized and developed by UTS students. Continuous improvement in the disposal of solid waste generated by the different commercial activities.

Talks were held with the stallholders who attended in which the general reason for the activities that are carried out on a daily basis in the Guarín Market Square were explained, including separation at the source, use, waste reduction, and a space was created in which ideas from each of them were presented.

The activity of sensitization of the stalls was carried out satisfactorily, since a high percentage of the stall holders showed interest in the programs mentioned, achieving a training of 90% of them. The information provided was simplified to make it better known.

Waste separation at the source is being carried out by 78% of the beneficiaries, therefore the results for this activity are very positive, however, it is evident that in the transportation of solid waste to the collection room the waste is mixed. It is evident that the bidders who have greater participation in the activity are those who have their commercial activity stalls located in the northern part, therefore, we focus our work efforts in the southern area, socializing the benefits that such separation brings as a positive consequence for them and for the image of the Guarin Market Square.

4. CONCLUSION

More topics or activities should be included that have some type of incentive to motivate the merchants to participate in the activities and attend the content of the talks that are given during each visit.

The topics or activities given to the beneficiaries should be simple and easy to solve, since they do not have much time available. In this activity there was a high rate of participation on the part of the beneficiaries, since the topics taught were simple and easy to solve.

The trained population substantially improved their knowledge and commitment to solid waste management in the market place, although the contrast survey was conducted for 100 users, this is a significant number of traders and this leaves evidence that progress has been made in a good number of population, from which it is expected to replicate the teaching to other traders to gradually improve the number of people involved and therefore increase the percentage of solid waste correctly generated in the market place. It is important that the environmental education activity be repeated periodically, so that with each new exercise a greater impact is achieved.

In general, the image of the plaza shows a favorable visual impact for those who pass through it, although the organization of the market spaces, in all the products that are marketed, are perceived as more organized, even if only solid waste was worked on, the collection of their waste has led to an enhancement of the products that are marketed and a better impression of the buyers.

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