



(RESEARCH ARTICLE)



Study of environmental risk levels due to organic solid waste on the Andrés Avelino Cáceres Platform in the District of José Luis Bustamante y Rivero-Arequipa

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Abstract

The Nueva Esperanza Market located on the Andrés Avelino Cáceres Platform is a high traffic area, as it is the largest market in Arequipa. The levels of environmental risk due to solid organic waste were studied in the areas of vegetables, fruits, tubers and around the market in these areas. The methodology consisted of three field trips for data collection, carried out through observation and recording of records of environmental impact factors, which allowed the formulation of environmental risk matrices in the natural environment and in the human environment.

According to the results obtained through the use of the various tables and matrices, in the assessment of environmental impacts a value of - 15 was obtained, which indicates an impact that is severe and reversible, if corrective and improvement measures are taken immediately. keep going. In estimating the severity of the consequences of an environmental risk in the natural environment, the vegetable area has the highest risk severity with a value of 16 and a total score of 4, followed by the fruit area and the market surroundings. Regarding the severity of the consequences of an environmental risk in the human environment, the area of vegetables and fruits has a value of 18 and a total score of 5. Concluding that the risks in the identified scenarios of vegetables and fruits have a severity of high risk, followed by the tuber area and surroundings of the market.

Keywords: Environmental Impact; Pollution; Organic Solid Waste; Risks

1. Introduction

In the city of Arequipa there are strategic points where solid waste pollution is freely exposed. Especially in supply centers where solid organic agricultural waste causes a strong impact on the ecosystem; manifesting a lack of environmental culture, which generates an image of underdevelopment and lack of environmental awareness, this situation is endured by thousands of people who go to these supply centers, exposing themselves not only to visual pollution but also to their health, because those mountains of solid waste; since they are a breeding ground for the proliferation of microorganisms such as fungi, bacteria, which give off strong and cacosmophorous odors; also smaller animals such as undesirable rodents, cats, stray dogs that swarm around those places; decreasing the quality of life.

Currently, no one seems to care about this type of situation and this is increasing and if appropriate corrective measures are not taken to this problem, which affects social well-being more every day, the situation could become uncontrollable. Therefore, with this work, the levels of environmental risk due to organic solid waste on the Andrés Avelino Cáceres Platform in the District of José Luis Bustamante and Rivero-Arequipa will be studied; For this purpose, the first thing that was done was to identify and assess the environmental impacts in the Nueva Esperanza Market on the Andrés

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Avelino Cáceres Platform. These data allowed us to identify and evaluate the environmental risks in the Nueva Esperanza Market on the Andrés Avelino Cáceres Platform.

The contribution of this research work is to propose applying the Kayzen cycle that consists of plan, do, verify and act (PHVA) as a first management alternative of this solid waste. In addition, instill a culture of environmental quality in the first place to the sellers of these establishments and promote propaganda and public notices to raise awareness among the authorities and the population, to care for the environment and avoid throw a way solid waste in the surroundings of the market and throughout the city of Arequipa and its districts, in order to promote at the national level, the reuse of solid waste (vegetables, legumes, tubers and fruit) and in the preparation of composting on a large scale and give it added value, which will result in a better quality of life for all involved. Implement organic solid waste containers within reach of users and passers-by.

1.1. Background

Organics solids wastes are residual materials that, at some point, were alive, were part of a living being or come from fossil fuel transformation processes. Among them are putrescible, non-putrescible, synthetic, urban solid waste, agricultural waste, as indicated by González [1]; that generate the detriment of the landscape, a decrease in spaces, pollution of the air, water, soil due to the emanation of odors, health hazards and a decrease in sales, Usca [2]. For their part, Seáe & Urdaneta [3] say that the inadequate management of this waste exacerbates the problem by endangering the health of citizens who attend these supply centers. Added to the lack of management, the little environmental training that the suppliers of the fruit and vegetable supply centers have, generate volumes of unnecessary waste that end up disposed of in landfills, wasting its potential recovery and recycling value, Valderrama López [4].

Most uncollected waste is burned, fed to pigs, dumped into rivers, etc., these situations create environmental and health problems. As an option to solve the problem, the method of collecting and treating solid waste must be optimized, indicated by Zegarra [5]. In relation to the management of solid waste in supply markets, in organic solid waste management programs, the life cycle activities of the waste are identified and evaluated, which include segregation, collection, storage and use processes, Zavaleta Peña [6].

In places with high public attendance, processes related to handling until final storage must be included. Among these operations are the identification of waste in each process, separation at the source, periodic estimation of the proportions of waste according to the totality produced, appropriate techniques for collection, treatment, use and final disposal.

These actions seek to reduce environmental and health impacts. The lack of inflexible surveillance in the handling of food and the management of waste produced in markets is a factor in these centers becoming sources of contamination for sellers and buyers, Francisco & Rodríguez [7].

Analysis and proposal of applicability of methods and techniques for the use, recovery and elimination of urban solid waste in Tabacundo, Pedro Moncayo Canton. Quito. It constitutes a contribution to the solution of the environmental problem generated, Meza Olmedo [8].

It is important that market traders take responsibility for the proper management of the waste generated in their establishments. Improper waste management can generate a series of health and environmental problems, De La Torre RA. Massa [9].

The conversion of organic solid waste such as paper-cardboard, plastics, glass, metals, even the production of compost, can help sustainability, improve income and the responsible reuse of solid waste and contribute to the improvement of the environment and human health, Huamaní Montesinos [10].

An environmental education program is proposed. This program is the most important so that all other programs can be sustained ensuring their success. Quispe indicates that it is necessary to work on training and raising awareness among market vendors, Quispe [11].

2. Materials and Methods

The present research is of a quantitative exploratory type, based on the observation, description, registration, analysis and interpretation of the variables, factors and indicators, to determine the risk levels raised in the Nueva Esperanza Market. To do this, it was considered to divide it into two parts; First part: Identification and assessment of

environmental impacts in the Nueva Esperanza Market of the Andrés Avelino Cáceres Platform. Second part: Identification and evaluation of risks in the Nueva Esperanza Market of the Andrés Avelino Cáceres Platform.

2.1. Field Work

It began with the identification of the study area, where this research project was carried out, the study area was the Nueva Esperanza Market, it is within the “Mariscal Andrés Avelino Cáceres Dorregaray Platform” of the José Luis District Bustamante and Rivero, see (figure 1).

To collect data for this research, primary sources were collected through ocular inspection of all spaces and places of stalls selling vegetables, potatoes and fruits at the Nueva Esperanza Market. During three specific dates: October 31, November 17 and December 17, the area of influence was recorded along with the factors and characteristics that impact the area under study (see figure 1).

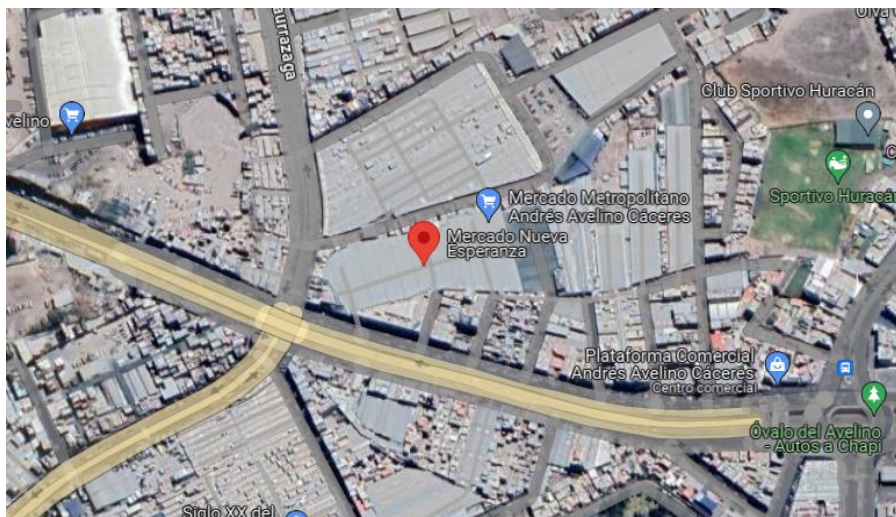


Figure 1 Location map of the area of greatest impact by solid waste in the district of J. L. Bustamante y Rivero. Arequipa, Peru

Source: Google maps.

2.2. First Part: Identification and Assessment of Environmental Impacts in the Nueva Esperanza Market

For the “Identification and assessment of possible environmental impacts” arising, in a timely and objective manner, (vegetable, fruit, tubers inside and surrounding areas) due to the inadequate management of municipal solid waste inside the Nueva Esperanza Market, was carried out using the methodology cited in the Guide for the Characterization of Municipal Solid Waste, of the Ministry of the Environment [12] and by Espinoza [14] using the formula for the assessment of environmental impacts, in correlation with the classification of the impacts; applying formula (1).

Impact assessment according to Espinoza [14]:

$$\text{Total Impact} = - C \times (P + I + O + E + D + R) \quad (1)$$

Where: C= Character; P= Disturbance; I= Importance; O = Occurrence; E= Extension; D= Duration; R= Reversibility

2.3. Second Part: Identification and Evaluation of Risks in the Nueva Esperanza Market

For the identification and evaluation of environmental risks, the standardized method was applied, mentioned by Chafloque [15], who establishes that before calculating the risk, the Threat and Vulnerability of the receiving environment must be considered using formula (2).

$$R = A \times V \quad (2)$$

Where: R = Risk

A = Threat

V = Vulnerability

Formula (3) was used to calculate the Threat, for this the criteria that are considered in formula (3) had to be evaluated. Chafloque [15].

$$A = p * i * d * e * r \text{ (3)}$$

Where: p = Probability

i = Intensity

d = Duration

e = Extension

r = Recurrence

To calculate Vulnerability, formula (2), during the evaluation, values were assigned to each of the scenarios according to the probability of occurrence. Based on the values given by the UNE 150008 2008 standard, mentioned on page. 25 by Chafloque [15] and to calculate the estimation of the severity of the consequences of a risk, the guidelines described in Table 1 were applied.

Table 1 Forms for Estimating the Severity of the consequences of an environmental risk.

Gravity	Environment limits	Vulnerability
Natural environment	Quantity + 2 × danger + extension	Media quality
Human environment	Quantity + 2 × danger + extension	Affected population
Socioeconomic environment	Quantity + 2 × danger + extension	Assets and productive capital

Source: Based on UNE 150008 2008 standard - Environmental risk assessment cited by Chafloque [15]

3. Results and Discussion

3.1. First Part

The identification and assessment of the environmental impacts caused by the inadequate management of municipal solid waste in the Nueva Esperanza Market. It was carried out in a timely and objective manner, in the area of vegetables, fruits, tubers, in the interior part and surroundings of the market. By applying impact assessment formula (1), the impact classification and classification criteria were correlated; where the character is negative (-1). The Value found for disturbance is high. The risk of occurrence is very probable. The extension area is local. The duration over time is average, as long as they manage their waste. Finally, the reversibility is 1 because it is reversible; Therefore, the total impact was -15, which corresponds to a severe impact according to Espinoza [14], as can be seen in Table 2.

Table 2 Identification and Assessment of impacts in the Nueva Esperanza Market.

Impact classification	Classification criteria		
	Character (C)	Negative (-1)	Neutral (0)
Disturbance (P)	Important (4)	Regular (2)	Scarce (1)
Importance (I)	High (3)	Medium (2)	Low (1)
Occurrence (O)	Very Likely (3)	Probable (2)	Unlikely (1)
Extension (E)	Regional (3)	Local (2)	Punctual (1)
Duration (D)	Permanent (3)	Medium (2)	Short (1)
Reversibility (R)	Irreversible (3))	Partial (2)	Reversible (1)
TOTAL	18	12	6
Impact rating: Total impact = - 1x (4+3+3+2+2+1) = - 15 (severe impact)			

Source: Assessment of environmental impacts criteria used, Espinoza page 136 (2007)

3.2. Second Part: Identification and Evaluation of Risks in the Nueva Esperanza Market

To calculate the severity of the consequences of the risk caused by the accumulation of municipal solid waste in the Nueva Esperanza Market, both in the natural environment and also in the human environment; given that these workers work around 12 hours a day or more at certain times of the year. The standardized method, mentioned by Chafloque [15], formula (2) and (3) was applied. To do this, it was necessary to delimit the identified scenarios: vegetable area, fruit tubers area and market surroundings in these four identified scenarios. Then the risk scenarios were identified. In each of them, the priority guidelines were chosen that allowed us to consider evaluation criteria such as quantity, which measures the volume of solid waste emitted into the environment, the danger to both the environment and the person, the extension, that is, the space of influence. The quality of the medium has a low value, it can be reversible and finally the severity is high in the vegetable area with a value of 16. To end up with a total risk score, for each identified scenario. All the results of these records allowed the elaboration of two matrices. one referring to the natural environment and the other to the human environment of the Nueva Esperanza Market. (See table 3 and 4).

Table 3 Estimation of the severity of the consequences of an environmental Risk-Natural environment in the Nueva Esperanza Market

Identified Scenarios	Nº	Factor and/or Aspect	Risk scenario	Amount	Dangerousness	Extension	Media Quality	Gravity	Total score
vegetable area	1	Vegetable supply service	Waste littered on the floors	4	4	3	1	16	4
fruit area	2	Fruit supply service.	Waste littered on the floors	3	3	4	1	14	3
Tuber area	3	Sale of tubers	Inorganic waste from tubers and others	2	2	2	2	10	2
Market surroundings	4	Stores	Waste accumulation	2	3	1	1	10	2

In table 3, the vegetable area presents the highest risk severity with a value of 18 and a total score of 5, followed by the fruit area and the market surroundings.

In table 4 of estimation of the severity of the consequences of environmental risk in the human environment in the Nueva Esperanza Market, the vegetable and fruit areas have the highest risk severity with a value of 18 and a total score of 5, followed by the area around the market.

The risks to the environmental surroundings and the human environment affect the socioeconomic surroundings of the workers in the Nueva Esperanza Market. Therefore, it is urgent to treat this solid waste using different techniques for different applications. The most viable and fastest would be for the municipality to implement the practice of composting service, municipal or private, as indicated by MINAM [12]. This will allow adding value to these organic solid waste; applied the stipulations of Legislative Decree No. 1278 of the MINAM [13].

Table 4 Estimation of the severity of the consequences of an environmental risk - Human Environment in the Nueva Esperanza Market.

Identified Scenarios	N ^a	Factor and/or Aspect	Risk scenario	Amount	Dangerousness	Extension	Affected population	Gravity	Total score
vegetable area	1	Vegetable supply service	Waste littered on the floors	4	3	4	4	18	5
fruit area	2	Fruit supply service.	Waste littered on the floors	4	3	4	4	18	5
tuber area	3	Sale of tubers	Inorganic waste from tubers and others	3	2	2	3	12	3
Market surroundings	4	Stores	Waste accumulation	4	4	4	4	16	4

4. Conclusions

The “Andrés Avelino Cáceres” Platform is one of the main sources of pollution and accumulation of agricultural organic waste and according to the environmental impact assessment table, a value of -15 is obtained, which indicates that the impact is severe and reversible if mitigating measures are taken immediately.

The first management alternative that must be applied is the Kayzen cycle (Plan, Do, Check and Act) to present some alternatives for the management of this waste:

- More continuous garbage collection.
- Implement organic solid waste containers within reach of users and passers-by.

Instill a culture of environmental quality, first of all, in the sellers of these establishments and promote propaganda and public notices to raise awareness among the population, to care for the environment and to avoid voting solid waste in the surroundings of the market and throughout the city of Arequipa and its districts, in order to promote at a national level the reuse of this organic waste in the production of composting on a large scale and give it added value, which will result in a better quality of life for all those involved.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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