The Management of Urban Solid Waste in Sustainable Development in A Peruvian Municipality In The Context of The Coronavirus Pandemic (Covid-19)

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Abstract: The purpose of this research article was to determine the relationship between Solid Waste Management and Sustainable Development in a municipality of Lima, Peru in the context of COVID-19. The methodology was quantitative approach, correlational level, cross-sectional and non-experimental design. The population was made up of a total of 274 workers, while through probability sampling a total of 161 workers were obtained. It was used as the survey technique for each study variable, obtaining a reliability of 0.918 for the Solid Waste Management instrument and of 0.663 for Sustainable Development. To measure the correlation between the variables, the Spearman Rho Coefficient was used using the Statistical Package of Social Sciences (SPSS) version 24. Among the results, it was obtained that the Spearman Rho correlation coefficient is weak and significant (r = 0.469, p = 0.000), while for the solid waste management dimension a moderate and significant correlation was obtained (r = 0.626, p = 0.000); finally, for the solid waste management dimension, a weak correlation was obtained and without significance (r=0.135, p = 0.088). In conclusion, a better level of solid waste management will be reflected in a better level of sustainable development in the municipality under study.

Keywords: solid waste management, sustainable development, urban solid waste, COVID-19

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1.   Introduction

The generation of solid waste is a natural consequence of life; in this way, the elimination of these wastes is consistent with the improvement of the quality of life. Initially, solid waste management (SRM) techniques aimed to remove waste from those habitable areas as a means of maintaining public health. Then, with awareness of the dangers of uncontrolled disposal, measures were designed and implemented mainly through landfills. Currently, materials and energy recovery technologies have been devised, coupled with modern global systems (Shekdar, 2009).

The consequence is environmental degradation caused by improper waste disposal. The impact of disposed wastes is composed of the following: contamination of the surface and groundwater through leachate; soil contamination by direct contact with wastes or leachates; air pollution from burning waste; spread of diseases by different vectors such as birds, insects and rodents and uncontrollable release of methane by anaerobic decomposition of waste (Nguyen & Schnitzer, 2009).

In this context, the management of urban solid waste is considered an important concern for public health, the economy and the environment, especially in developing countries (Ferronato et al., 2018). As indicated (Ikhlayel& Nguyen, 2017) that the management of urban solid waste is one of the most important and complex by-products of humanity; its importance lies in the fact that it is a day-to-day topic that we deal with. The significant amount of municipal solid waste generated makes it a complex health, environmental, social and economic problem. All this endangers public health, including residents and workers, due to inappropriate management practices; this happens mainly in developing countries

Peruvian society has experienced vast urban growth in recent decades. In addition to the centralization that has caused social, economic and environmental changes; For this reason, it has been difficult to organize a suitable infrastructure for the population that lives in urban conditions for short periods of time. Thus, solid waste management is one of the fundamental concerns of society, since it also represents the level of urban development (López, 2007).

Due to the aforementioned, it is convenient to know how closely related the Solid Waste Management and Sustainable Development variables are; in such a way that the municipality under study can carry out a better management in this regard, for which the following objectives were proposed:

a. Determine the relationship between Urban Solid Waste Management in Sustainable Development in a Peruvian Municipality in the context of COVID-19.

b. Determine the relationship between solid waste management in sustainable development in a Peruvian Municipality in the context of COVID-19.

c. Determine the relationship between solid waste management in sustainable development in a Peruvian Municipality in the context of COVID-19.

2. Materials and methods

The research was of a quantitative approach and of an applied type, because the variables are measured and it focuses on applying knowledge to contribute to the resolution of a specific problem. According to Hernández, Fernández and Baptista (2014) in the quantitative approach, the collection of information is used to contrast the hypotheses, in such a way that it allows establishing guidelines and verifying theories; Likewise, applied research allows the application of knowledge to solve a practical problem.

The population consisted of a total of 274 workers from the municipality of the town of Lima, Peru. The sampling was probabilistic and was calculated using the following formula:

$$n = \frac{NxZ^2xpxq}{d^2x\ N-1\ +Z^2xpxq}$$

Where:

N: Population

Z = 1.96 at 95% confidence

p = 0.5

q = 0.5

d = 5% error

Therefore, the following is obtained:

$$n = \frac{274x1.96^2x0.5x0.5}{0.05^2\ 274-1+1.96^2x0.5x0.5} = 161\ workers$$

Once the number of workers to be surveyed had been found, the technique used for both variables was the survey; Thus, for the Solid Waste Management variable, the reference was made to (Valdera, 2020), who operationalized the variable in the solid waste management dimension, including for this a solid waste management plan, characterization, segregation and formalization of recyclers; while for the solid waste management dimension, items on the sanitary landfill, solid waste collection, treatment and management of hazardous waste were included. From this instrument a high reliability was obtained with a value of 0.918. On the other hand, for the sustainable development variable, (Olsson, 2017) was taken into account, who took into consideration 50 items divided into 3 parts: the first part was on economic development, resource consumption, species conservation, human rights, education and infectious diseases; the second part was on the use of natural resources, laws and regulations, society and access to equality at work. In the third part, items on recycling, environmental awareness, respect and support were included. It is important to mention that for the second instrument, the reliability was calculated by the researchers, where a value of 0.663 was obtained, which refers to a high average reliability due to its proximity to the unit. Likewise, for both instruments the content validation was obtained through 5 experts in the field, thus obtaining a very high validation and the value of the Aiken V coefficient of 1.

3. Results

Table 1. Descriptive statistics of the study variables

		Solid wastemanagement	Solid wasteadministration	Solid wastehandling	Sustainabledevelopment
N	Valid	161	161	161	161
Mean		1.69	2.04	1.70	1.98
Standard error of the mean		0.049	0.068	0.044	0.043
Median		2.00	2.00	2.00	2.00
Mode		2	3	2	2
Standard deviation		0.625	0.861	0.557	0.547
Variance		0.390	0.742	0.311	0.299
Asymmetry		0.338	-0.084	0.026	-0.017
Standard error of skewness		0.191	0.191	0.191	0.191
Kurtosis		-0.651	-1.652	-0.563	0.402
Kurtosis standard error		0.380	0.380	0.380	0.380
Percentiles	25	1.00	1.00	1.00	2.00
	50	2.00	2.00	2.00	2.00
	75	2.00	3.00	2.00	2.00

Source: SPSS v. 24

From table 1, it can be seen that with 95% confidence for the variable a higher average in the solid waste management dimension with 2.04 points, while a lower average in the solid waste management variable with 1.69 points; a median is 2 points, which represents 50% of the data for both the variables and their dimensions. There is also a higher standard deviation in the solid waste management dimension with 0.86 points and a lower standard deviation in the Sustainable Development variable with 0.547 points, which refer to variations with respect to the mean. Likewise, there is a higher asymmetry in the Solid Waste Management variable with 0.338 points that represents a positive curve and meets to the left of the mean; In its counterpart, there is a lower asymmetry in the Solid Waste Management dimension with -0.084, which represents a negative curve and meets to the right of the mean.In addition, there is a higher kurtosis in the Sustainable Development variable with a value 0.402 that refers to a curve longer than normal because it is greater than 0 and is known as leptokurtic; in contrast to the solid waste management dimension with a kurtosis of -1.652, which refers to a more flattened than normal as it is less than 0 and is called platicurtic. Finally, in the 25th percentile there is a higher value of 2 points in the Sustainable development variable, which refers to the fact that 75% of the workers surveyed responded on the Likert scale with responses between 3-5 (sometimes, almost always and always) in said variable. At the 50th percentile, the same value of 2 points was found for both the variables and dimensions, which refers to the fact that 50% of the workers responded on the Likert scale with responses between 3-5 and a higher value was obtained at the 75th percentile. in the solid waste management dimension with 3 points, which indicates that 25% responded in this dimension with values between 4 and 5 on the Likert scale.

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Table 2. Levels of Solid Waste Management and Sustainable Development

			Sustainabledevelopment						
			Low	%	Medium	%	High	%	Total
Solid wastemanagement	Low	Recount	22	84.60%	42	37.2%	0	0.0%	64
		% of total	13.7%		26.1%		0.0%		39.8%
	Medium	Recount	4	15.40%	61	54.0%	18	81.8%	83
		% of total	2.5%		37.9%		11.2%		51.6%
	High	Recount	0	0.00%	10	8.8%	4	18.2%	14
		% of total	0.0%		6.2%		2.5%		8.7%
Total		Recount	26	100.00%	113	100.0%	22	100.0%	161
		% of total	16.1%		70.2%		13.7%		100.0%

Source: SPSS v. 24

Table 2 shows both the frequencies and percentages of the study variables, there is a higher percentage in the low level of Solid Waste Management with 26.1%, that is, 42 workers detected a medium level of sustainable development; Similarly, 37.9% (61) of the workers who perceived a medium level of solid waste management, also detected a medium level of sustainable development. Likewise, 6.2% (10) of the workers who detected a high level of solid waste management, also perceived a medium level of sustainable development in a municipality located in Lima, Peru.

Table 3. Correlation between the study variables

			Sustainabledevelopment
Spearman Rho	Solid wastemanagement	Correlationcoefficient	,469**
		Sig.	0.000
		N	161
	Solid wasteadministration	Correlationcoefficient	,626**
		Sig.	0.000
		N	161
	Solid wastehandling	Correlationcoefficient	,135
		Sig.	0.088
		N	161

**. The correlation is significant at the 0.01 level (bilateral).

*. The correlation is significant at the 0.05 level (bilateral).

Source: SPSS v. 24

From table 3, it can be seen that Spearman's Rho correlation coefficient is weak and significant (r = 0.469, p = 0.000), while for the solid waste management dimension a moderate and significant correlation was obtained (r = 0.626 , p = 0.000); Finally, for the solid waste management dimension, a weak correlation was obtained and without significance (0.135, p = 0.088). It is important to mention that according to (Martínez, Tuya, Martínez, Pérez, &Cánovas, 2009) the Spearman Rho correlation values between 0.51-0.75 are considered moderate, while values between 0.26-0.49 are considered weak and between 0.00-0.25 are considered scarce.

4.   Discussion

The general objective was to determine the relationship between solid waste management and sustainable development, from which an r = 0.469 and p = 0.000 was obtained, which refers to a weak and significant correlation.

The specific objective 1 was to determine the relationship between solid waste management and sustainable development, whose value was r = 0.626 and p = 0.000, which represents a moderate and significant correlation.

The specific objective 2 was to determine the relationship between solid waste management and sustainable development, whose value was r = 0.135 and p = 0.088, which reflects a scarce correlation and no significance.

The results obtained coincide with (Gilardino, Rojas, Mattos, Larrea, & Vásquez, 2017) who, through the use of operational research, managed to reduce the number of collection sites by installing and using the available container capacity, at the same time that the maximum walking distance for citizens in the Comas district was met without mixing recyclable and general waste. In addition, with (Ianoş, and others, 2012), who inquired about the low participation in the collection of solid waste, thus obtaining a direct correlation between low motivation, the fact that participation is not mandatory and inappropriate ecological behavior.

Likewise, it is pertinent to mention (Troschinetz&Mihelcic, 2009), who obtained the factors that influence the sustainable recycling of solid waste management in developing countries, which are the following: government policy, public finances, waste characterization, I collect and waste segregation, home education, home-economy, solid waste management, environmental education of workers, solid waste management plan, technological and human resources and availability of land.

According to (Adeniran, Nubi, &Adelopo, 2017) The organic waste generated could be managed through the formation of compounds or integration with the wastewater management system. Likewise, strategic policy and community participation is necessary for source reduction and waste recycling improvement. The characterization of waste provided a better understanding of the generation of waste on the University campus and how it should incentivize it based on a better decision on the sustainable strategy in waste management on campus.

5.   Conclusions

• The development of the research allowed to know in greater depth about solid waste management and sustainable development through the bibliographic review, as well as the relationship between the study variables.

• The research results provide transcendental information for a municipality located in Lima, Peru regarding solid waste management and sustainable development, which can serve as a basis for future research.

• The correlation between the study variables was weak and significant with r = 0.469 and p = 0.000, which means that the changes made to a greater or lesser extent in the management of solid waste will be weakly reflected in the level of sustainable development perceived by workers.

• The correlation between solid waste management and sustainable development was moderate and significant with r = 0.626 and p = 0.000, which means that changes made to a greater or lesser extent in solid waste management are they will be moderately reflected in the level of sustainable development perceived by workers.

• The correlation between solid waste management and sustainable development was scarce and without significance with r = 0.135 and p = 0.088, which means that the changes made to a greater or lesser extent in the management of solid waste, they will be poorly reflected in the level of sustainable development perceived by workers.

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