

Factors That Limit The Management And Sustainable Handling Of Construction And Demolition Waste In The Municipal Area In South Lima

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ABSTRACT

This research analyzes the situation regarding the comprehensive and sustainable management of construction and demolition waste in the municipality of South Lima. It begins with the problem that the management and sustainable handling of construction and demolition waste from minor works (CDW-M) in South Lima is significantly limited by related factors. Survey respondents acknowledge that their own lack of knowledge, concerns about the sustainability of formal municipal services, reluctance to pay for services, and lack of participation in training programs exacerbate the situation. Furthermore, a lack of incentives, deficient services, and ineffective communication fail to meet citizens' expectations of efficiency and accessibility, pushing CDW-M generators toward informal alternatives. The methodology applied in this study, including content analysis, direct observation, interviews, and surveys, facilitated a proper analysis of the facts. This analysis will be useful for the municipalities involved and others that assume an appropriate role in defining actions, especially ordinances, regulations, policies, and reports that regulate and control construction and demolition waste (CDW). These results, presented succinctly, only highlight the significant lack of awareness regarding municipal obligations, the lack of environmental consciousness, and the unfavorable level of perception and knowledge among residents of South Lima regarding the CDW management service. The study reveals numerous deficiencies, the existence of uncontrolled dumpsites, and damage to public spaces caused by residents of South Lima. However, it does not rule out the possibility that informality could be formalized to support the process and improve service conditions.

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INTRODUCTION

Globally, the construction sector is a significant contributor to the waste problem, being responsible for approximately 30% of raw material consumption and generating about 30% of the waste that goes to landfills. Key challenges include: Massive Volume Control, Poor Management, Environmental and Health Impact, and Cost Mismatch: The actual costs of waste management do not always correspond to what is budgeted for in construction projects, discouraging proper practices.

For Latin America, these challenges are exacerbated by region-specific conditions: Insufficient infrastructure, Incomplete or confusing regulations, level of public and private awareness, legal provisions and alarming statistics regarding the volumes of solid waste generated at the national level.

To address these problems, international organizations such as the UN promote the strategy of **reduce, reuse and recycle** as a cornerstone of waste management. Global initiatives and advanced technologies, such as Advanced Dry Recovery (ADR) to recycle concrete aggregates, seek to transform this challenge into an opportunity for the circular economy.

In some districts of South Lima, the accumulation of construction and demolition waste of municipal competence (RCD-M) in public spaces is observed, which is a visible problem that demands attention. This waste generates various negative impacts, which can be described as follows: Accumulation of solid construction waste that pollutes the environment and is a point of proliferation of vectors and infectious diseases, Deterioration of the urban landscape and additional costs to the commune and users.

The construction sector is promising and its development is favorable for the economy, but this situation has generated problems such as: increased exploitation of resources, generation of emissions, increase in energy consumption, increase in waste generation, among others. Construction and demolition waste, which has very large volumes and can sometimes be hazardous, is one of the environmental problems that result from construction activities (Carbajal, 2018).

In the last twenty years, this constant growth of the construction sector is encouraging for national progress; however, this reality leads to an increase in waste generation and the problem currently posed by the proper

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disposal of waste (Silva, 2016).

In Lima, it is estimated that around 19,000 tons of construction and demolition waste (CDW) are generated daily, of which only 30% is properly managed, while the remaining 70% ends up in illegal dumps or mixed with urban solid waste (Pablo León, 2017). This inadequate management causes various environmental problems such as soil, water and air pollution, proliferation of vectors and certain diseases, the loss of public spaces that in addition to being a risk to public health, affect the quality of life of its inhabitants.

CDW, which is under municipal jurisdiction in the main districts of South Lima, presents problems and challenges for their proper management and management, due to the growing dynamic of improvements and/or remodeling in homes, businesses and other buildings considered as minor works (SEGAT, 2013).

Consequently, it must be taken into consideration that:

"There are public spaces where this waste is usually left abandoned, or is deposited in coastal areas or in areas near rivers, generating negative impacts on the ecosystem and people's health. This is largely due to the fact that there are no adequate infrastructures for their final disposal." (Tapia, 2023).

On the other hand, it is considered that the municipalities suffer from an institutional structure, evidence of serious deficiencies in their planning and a notorious lack of investment in equipment and resources. This operational precariousness prevents them from developing and implementing CDW-M collection services that are consistently timely, efficient and reliable, directly affecting the credibility and citizen adoption of formal ways for the disposal of this waste.

The problem to be solved is *what factors influence the implementation of comprehensive and sustainable management and management of construction and demolition waste at the municipal level in South Lima?*, taking into account aspects such as:

A. What is the perception and level of knowledge of the citizens of South Lima about the formal CDW-M management services and their environmental and urban impacts?

B. What is the willingness of the citizens of South Lima to participate and contribute economically in the formal management of RCD-M? And what are their preferences in terms of incentives and costs?

C. What are the expectations of the citizens of South Lima regarding the efficiency and modalities of a CDW-M collection service and about the informal means of disposal?

D. What recommendations and preferences do the citizens of South Lima have in relation to municipal

actions of inspection and sanction for a better management of CDW?

E. What kind of services, organization, equipment and resources do the municipalities of South Lima have to manage and manage the CDW-M?

This research is relevant due to the growing concern about the environmental and social aspects associated with the inadequate management of waste from the construction and demolition of minor works (CDW-M) in urban environments such as South Lima. By addressing this problem, it is expected to contribute significantly to the development of more effective public policies and the implementation of sustainable practices for the management of the aforementioned waste.

In the practical sense, it is justified by the need to have reliable information to address the problem of inadequate management of CDW-M in the main districts of South Lima, allowing the identification of the main barriers and opportunities to improve their management, thus contributing to the protection of the environment, the improvement of public health and the sustainable development of the city and/or districts.

In this way, it will be possible to: *"Determine the factors that influence the implementation of the comprehensive and sustainable management and handling of construction and demolition waste at the municipal level in South Lima."* In this way, it will be possible to:

A. To analyze the level of perception and knowledge of the citizens of South Lima about the formal CDW-M management services by the citizens of South Lima.

B. To evaluate the willingness of the citizens of South Lima to participate and contribute economically in the formal management of CDW-M and what their preferences are in terms of incentives and costs.

C. To identify the expectations of the citizens of South Lima regarding the efficiency and modalities of a CDW-M collection service and informal means of disposal.

D. To determine what are the recommendations and preferences of the citizens of South Lima in relation to municipal actions of inspection and sanction for a better management of CDW.

E. To analyze the performance of the services, organization, equipment and resources that the municipalities of South Lima have to manage and manage the CDW-M.

Background

There are studies such as Sabogal (2022) on "Management of construction and demolition waste (CDW) management in new construction", which made it possible to understand the need for a technical management model through processes of reduction,

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collection, reuse and recovery of construction and demolition waste CDW, in a circular economy perspective, being part of all CDW management on site; or Suárez et al (2019), in their article "The management of construction and demolition waste in Villavicencio: current status, barriers and management instruments", which provides information indicating that in order to reduce waste and improve its management, companies prioritized prevention, identifying the lack of environmental awareness and control in legislation were the main barriers, tax incentives being decisive, according to statistical analysis, the creation of markets and environmental management plans are key instruments to improve the management of CDW and update the regulatory framework", Acevedo & Ruiz (2022) in the research called "Approach to the Management of Construction and Demolition Waste in the Metropolitan Area of the Aburrá Valley", it was possible to obtain information on the great potential for use where currently almost all CDW is directed to final disposal (approx. 99.5%); therefore, more actors are required to enter this ecosystem and that the state sphere provides the conditions to avoid the limitations described in this study"; Ossio (2019), in the document: "Proposals for Chile. UC Public Policy Competition / 2019. Chapter IX: Standardized municipal policies for the sustainable management of construction and demolition waste", in the study, communes that generate and receive CDW in the country's municipalities were identified through an information collection instrument. This classification allows for the design of policies adapted to each commune, ensuring regional well-being. It is proposed to create regional funds for the management of CDW and a municipal CDW department, to consider CDW in building permits and to monitor regulations, among others"; Oviedo and Vega (2022), on "Construction and demolition waste management and circular economy: narrative review", whose study provides information on the possibility of harmonizing and reducing the tension between economic development and the environment. of construction, in a circular economy. It is concluded that government interventions The introduction of advanced recycling technologies requires the certification of recycled products and limitation of speculation, incentivizing those who promote environmental protection, applying innovative techniques. Among national studies there is Calderón Díaz (2020), which in its study has scope on the inadequate management of CDW in construction projects in Metropolitan Lima is attributed to multiple factors, in which illegal landfills proliferate, which exacerbate environmental pollution due to the lack of effective regulations and controls, mainly. Flowers (2020), whose title "Management and Treatment of Construction and Demolition Waste in the

Provincial Municipality of Cusco", which has to be said that in the absence of specific requirements for the management of this waste in construction projects, as well as the absence of sanctions for non-compliance with existing regulations, have allowed the indiscriminate disposal of CDW and the contamination of the environment.

Herrera (2022), from the article "Construction and demolition waste on the marine coast of Metropolitan Lima (Peru): recommendations for its proper management", applying content analysis, the results show the following: "indicates that the inadequate management of CDW in Metropolitan Lima is the result of the lack of effective public policies and the inaction of the competent authorities"

Vera (2020), in his study "Waste Management of Construction and Demolition activities in the city of Huancayo", in his conclusion specified "it could be seen that the management of CDW in the city of Huancayo is incipient, lacks an appropriate public policy"

Base legal.

D.S. No. 002-2022 – HOUSING (2022), which approves the Regulation on the Management and Management of Solid Waste from Construction and Demolition:

This regulation aims to regulate the management and handling of solid waste generated in construction and demolition, through the prioritization of the minimization and recovery of solid waste; ensure the proper disposal of those that are not usable; and, Contribute to urban and rural environmental quality, as well as sustainability and the transition to a circular economy of the construction sector.

The circular economy is an approach focused on eliminating waste and pollution, keeping products and materials in use (at their maximum value), and regenerating nature. Unlike the traditional linear economy of "extract, use, dispose", the circular economy focuses on avoiding the generation of waste from the beginning, relying on renewable energies and materials to decouple economic activity from the consumption of finite resources.

METHODOLOGY

The type of research is descriptive – explanatory, and allowed to identify important characteristics of the processes analyzed, the main conditions of CDW-M management, their relationship with the population, officials and formalized waste operators, with a non-experimental design of an explanatory nature that allows appreciating the facts and determining the causes and consequences of them through systematic observation in a mixed analysis: quantitative – qualitative.

The study included the districts of the southern zone of Metropolitan Lima, as follows:

The districts with the largest number of inhabitants were

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taken into account, with the study population distributed as follows:

Table 1: Sample population

District	Population	Sample
Chorrillos	367 099	19
Santiago de Surco	420 016	21
San Juan de Miraflores	422 197	21
Villa El Salvador	432 170	22
Villa María del Triunfo	448 775	23
Total	2 090 257	106

Source: Authors' elaboration based on data from the National Institute of Statisticians and Informatics (INEI), Peru: Projections of Total Population by department, province and district, 2018 - 2020. Special Bulletin No. 27 (April 2022).

Note: The smallest population is in the district of Chorrillos (367,099), with the largest being in the district of Santiago de Surco (420,016), San Juan de Miraflores (422,197), Villa El Salvador (432,170) and Villa María del Triunfo (448,775).

This methodological approach ensures that the sample obtained is representative, allowing valid conclusions to be drawn about the factors that limit CDW management in the South Lima region. Proportionality in sampling is maintained, bias is avoided and the validity of the conclusions obtained is increased.

Table 2 District of residence (proportion)

District	Populat ion	Sam ple	Executed samples		
			Execu ted	%	Cumula tive
Chorril los	367 099	19	26	18,4	18,4
San Juan de Miraflo res	422 197	21	28	19,9	38.3
Santiag o de Surco	420 016	21	28	19,9	58.2
Villa El Salvad or	432 170	22	29	20,6	78.8
Villa María del Triunfo	448 775	23	30	21,3	100.0
Total	2 090 257	106	141	100,0	

Source: INEI Registry – ENAHO Survey.

Note: The sampling was carried out preserving the

proportionality of the population of the districts in question, so that the sample preserves the characteristics of the population.

TECHNIQUES AND INSTRUMENTS

Research techniques.

In this research, techniques known as surveys, interviews, direct observation were used, even generating primary information.

The techniques and/or instruments applied are:

- **Semi-structured interviews:** To obtain in-depth qualitative information from key actors (public officials and formal service providers (EO-RS)).¹
- **Structured surveys:** To collect quantitative data on the opinion and CAP of CDW-M management.
- **Direct observation:** At the points of accumulation of waste to identify the frequent sites of abandonment of CDW-M.
- **Documentary analysis:** To review relevant regulations, policies and reports that regulate CDW-M waste management.

Table 3. Composition of solid waste from construction and demolition

District	Waste Composition
Chorrillos	Waste material: Stones. Earth.
	Surplus of construction and debris: Concrete. Bricks. Rims. Wood. Ceramic material. Tar remains (Dangerous). Paint residues and solvents (Hazardous).
	Others similar to municipal ones: Plastics.
San Juan de Miraflores	Waste material: Stones. Earth.
	Surplus construction and debris Concrete and derivatives. Bricks. Ceramic material.
	Other waste similar to municipal waste: Wood and derivatives. Weeds. Organic. Plastics. Glass.

¹ EO-RS Solid waste operating companies registered with MINAM. IJDDT, Volume 16 Issue 13s, 2026

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District	Waste Composition
Santiago de Surco	Absence of RCD-M during field evaluation
Villa El Salvador	Waste material: Stones. Earth.
	Surplus of construction and debris: Concrete. Fiberglass.. Bricks Ceramic material. Paint residues and solvents (Hazardous). Remains of linters and/or pitch (Dangerous).
	Others similar to municipal ones: Woods and derivatives. Weeds. Metals and derivatives. Organic. Papers. Plastics. Rags and textiles. Glass.
Villa María del Triunfo	Waste material: Stones.
	Surplus construction and debris Concrete. Bricks. Woods. Ceramic material.
	Other waste similar to municipal waste: Plastics.

Source: Consolidated Register of Municipalities

Note: The table describes all the CDW that can be seen in each district, except in Santiago de Surco where the presence of CDW is not appreciated.

RESULTS

Table 4: Synthesis of results obtained

Procedure	Population	Result
Semi-structured interviews	City officials Representatives of CDW-M Operating Companies	Identify critical areas that need improvement, such as oversight or communication between actors
Structured surveys	Citizens	On the perception of efficiency in waste collection and disposal
		Compliance
Observation	Sectors of the	Estimation of m3

	locality	waste
		RCD Location – M.
		Composition of RCD – M.
		Presence of hazardous waste
Content Analysis	Municipal records	Data on CDW management – M.
	Regulatory documents	Analysis and recognition of the norms and generation of ordinances.

Source: Prepared by the researcher.

Municipal solid waste management

Evaluation of the municipal public cleaning service

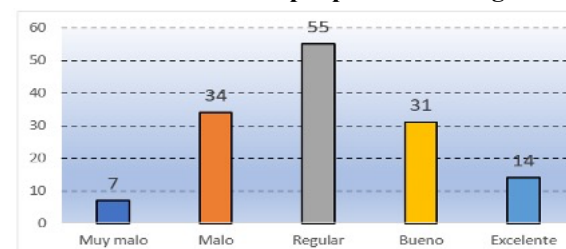


Figura N° 1. Opinión del servicio de limpieza pública.
Fuente: Tabla 4.

Table 5. Public cleaning service opinion

Rating	Frequency	Percentage
Very bad	4	2.8
Bad	34	24.1
Regular	45	31.9
Good	34	24.1
Excellent	24	17.0
Total	141	100,0

Source: Applied survey.

Note: The evaluation of the municipal public cleaning service reveals a predominantly **regular** perception with 31.9% (45) of the opinions. A full 26.9% (38) of respondents rate the service as bad or very bad, suggesting a significant need for improvement. In contrast, 31.9% (45) consider it good or excellent. The detailed distribution of these opinions is presented in Figure 1. In the original Spanish language.

Table 6. Reason why the population perceives the public cleaning service

Criteria	Frequency	Percentage
Cleaning frequency	42	29.79
Some places clean / some not	28	19.86
Dirt in the streets	31	21.99
Late harvesting	6	4.26
Timeliness in collection	5	3.55
Infrequent collection	22	15.60

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Few containers	5	3.55
There are no collection points	2	1.42
Total	141	100.00

Source: Applied survey.

Note: According to the table, the reasons for them range from Frequency in cleaning with 29.79%, Sectorized with 19.85%, Dirt in the streets with 21.99%, Unpunctuality in collection with 4.26%, Punctuality in collection with 3.55%, Infrequent collection with 15.60%, Few containers with 3.55% and There are no collection points with 1.42%. The table shows the degree of knowledge regarding the service provided by the municipality for the collection of CDW-M in their jurisdictions.

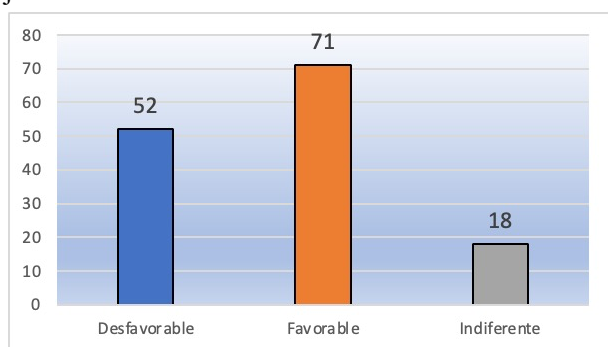


Figure 2. Opinion of the tricyclers, cargo motorcycles, vans and others (informal services) to get rid of or dispose of the clearing. In the original Spanish language.

Source: Researcher's studies.

Note: It can be seen that for 52% it is unfavorable, for 71% it is favorable and for 18% they are indifferent.

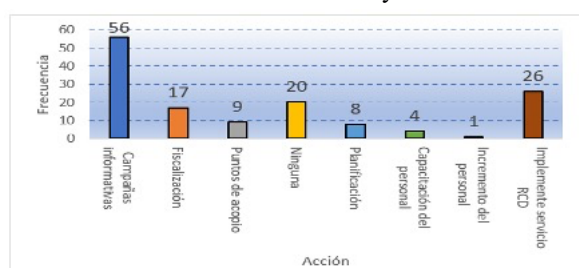


Figura 9: Recomendaciones a la municipalidad para mejorar el recojo de desmonte RCD-M
Fuente: Tabla 21.

Table 7. Recommendations to the municipality to improve the collection of RCD-M waste

Action	Frequency	Percentage
Information campaigns	56	39,7
Supervision	17	12,1
Collection points	9	6,4
None	20	14,2
Planning	8	5,7
Staff training	4	2,8
Staff increase	1	0,7
Deploy RCD Service	26	18,4
Total	141	100,0

Source: Applied survey.

Note: Regarding the Recommendations, it is understood that 39.7% consider that they are the Information Campaigns, for 12.1% that it is the Inspection, for 6.4% that it is the Collection Points, for 14.2% it is None, for 5.7% the Planning, for 2.8% it is the Training of the personnel, for 0.7% and for 18.4% it is that the CDW service is Implemented. In the original Spanish language.

Table 8. Systematization of Surveys to Officials: Management of CDW – M.

District	Proposal	Results
Chorrillos	Prior evaluation and route to the formalization of informal services	Mixed service of own management and private management, 200 m3 of CDW – M are operated per month, public spaces that are approximately 250 tons are permanently cleaned, they are destined for Huaycoloro, personnel and users are trained and it is supervised and sanctioned, no incentives are granted and formalization is being managed.
Santiago de Surco	Final disposition of CDW. A Defined Path to the Landfill	It is also collected in a mixed way, the response for specific collection is 72 hours, 220 tons are collected per month, the CDW – M is collected, destined for Huaycoloro and Kurumi, that people are trained, but part of it goes to informal dumps, it is inspected and sanctioned, they do not propose to formalize the informal ones, but to eradicate them and the budget is for all management and not specific.
Villa El Salvador	Suspended service and vision towards the formalization of informal	Formal service for inactive CDW-M, it is estimated that RRSS are collected as common up to 2640 m3, destined for the private dump San Bartolo, the population is trained, there is no inspection program, but

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District	Proposal	Results
		they are carried out on demand and are sanctioned from warnings to fines, there are no incentives and it is proposed to formalize the informal ones and there is a budget but not disaggregated.
Villa María del Triunfo	Free service and challenges with informality	The service is free of charge, there is a CDW-M collection service, it is free and is carried out permanently, and 30 tons a month are collected, users are trained, there is no inspection program, but it is carried out on demand and the eradication of informal services is considered because they are harmful.

Source: Researcher's systematization.

Opinion of the operating companies

The opinions of operating companies that provided the service of collection and transport of construction and demolition waste (CDW) of minor works have been collected, in which the most relevant aspects shared are commented:

- Operating conditions in which all the conditions and specifications proposed in the municipalities were met.
- Equipment used for all needs such as dump trucks and front loaders, complemented with hand tools such as shovels, blankets and dustpans.
- Budgetary limitations, the municipalities, with the exception of Santiago de Surco, do not have a specific budget assigned for the management of construction and demolition waste, this is what mainly generates difficulties in terms of timely payment of services.
- Municipal management problems that refer to staff turnover, and affect the service, in addition to neighborhood complaints or media complaints, and affect preventive planning.
- Communication is weak communication between the municipality and the population, there are no effective channels to request municipal services related to this waste.
- Relationship between continuity of service and urban cleanliness, continuity of service denotes cleanliness, discontinuity leads to the accumulation of

abandoned CDW-M in public spaces.

Interview with the Metropolitan Municipality of Lima: Metropolitan Role (MML): Head of the Solid Waste Division.

A. Limited role in RCD-M of minor works, it only authorizes the operators, recognizes them, but the operational, supervision or inspection is the responsibility of the district municipalities.

B. Update of the municipal ordinance: Updated would deal with:

- To grant greater administrative and legal tools to the district municipalities,
- Promote the implementation of private dumps,
- Economic-financial analysis and execution of more effective and efficient budgets,

d. Inclusion in the Comprehensive Environmental Management Plan (PIGARS), strengthening the management of social networks and especially CDW-M.

Analysis or systematization of interviews with municipalities in South Lima on CDW-M management

The interviews conducted with the deputy managers of Public Cleaning of five municipalities in South Lima (Santiago de Surco, Chorrillos, San Juan de Miraflores, Villa El Salvador and Villa María del Triunfo) reveal a diverse panorama, but with common patterns in the management of Construction and Demolition Waste of minor works (RCD-M).

1°. Heterogeneity in the supply and cost of the formal service: There are free and paid services, mixed services (municipalities and operators), without permanent monitoring of the volumes generated.

2°. Control and protection of public spaces, all municipalities address this problem on a permanent basis, preferably weekly, management financing that requires improvements, destination of what is collected to landfills.

3°. The sanitary landfills are: Santiago de Surco and Chorrillos have their CDW in Huaycoloro or Kurumi, guaranteeing environmentally adequate management, however there is a district dump in San Juan de Miraflores known as El Estadio that is a focus of local contamination and Villa el Salvador that has a private dump on the borders with the district of San Bartolo that can generate conflicts.

4°. Efforts are being made in training and inspection, but with limitations, through face-to-face means, social networks and environmental promotions house by house or work by work.

5°. All of them supervise, in one way or another, some already have programs, promoters or attend to complaints, and all apply sanctions of different amounts and nature, it is necessary to standardize the management

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in this case.

6°. There is no effective process of incentives and varied perspectives on informal ones, some support them to train them, others would like to eradicate them definitively, in the media the most favorable thing would be to formalize them and thus control them.

Citizen perspectives and institutional in the management of CDW-M in South Lima

This integration includes the conclusions of the surveys (the citizen perspective) with the conclusions of the interviews with municipal officials (the institutional perspective).

The management of CDW-M in South Lima is marked by a primary challenge: the generalized lack of knowledge of formal collection and disposal services. This research, by integrating the voice of the district population with the reality of the municipal offer, reveals both the current limitations and the immense opportunities for the formalization and improvement of the service.

The citizen perspective is overwhelming: the residents of South Lima are highly aware of the problem and its severe impacts (pollution, loss of public spaces, creation of dumps). They are not indifferent and demonstrate a marked willingness to be an active part of the solution. This will is manifested in:

1°. Economic disposition: There is a clear willingness to pay for the formal service, with an acceptable average price of S/ 15.00/m³.

2°. Participation: A high percentage of citizens are willing to participate in training on the proper management of CDW.

3°. Efficiency expectations: They demand an efficient formal service, with expectations of fast pick-up (median of 1 day) and flexible hours (preference for the night).

4°. Support for regulation: They strongly support the supervision and application of economic sanctions (fines) for those who fail to comply with the regulations.

5°. Communication channels and incentives: The population identifies social networks as the most effective means of communication and suggests tax discounts as a tangible incentive.

Operational and management reality of CDW-M in South Lima.

It presents a complex picture that largely explains the persistence of the problem:

1°. Incomplete or inactive services, free or not, are partial or incomplete, and as in the case of Villa El Salvador it is not sustainable.

2°. The final disposal is critical, only two districts allocate it to authorized landfills: Surco and Chorrillos channel CDW to authorized landfills, San Juan de Miraflores allocates it to an informal district "dump", and

Villa María del Triunfo mixes it with common waste and Villa El Salvador to a private dump on the beach.

3°. Deficiencies in measures and supervision, there are no records of the volumes for San Juan de Miraflores and Villa María del Triunfo, which does not allow planning, much less formulating sustainable plans.

4°. Incentive gap, no municipality incentivizes users.

5°. Management of informality Although municipalities differ in their dealings with informal workers, they agree that informal workers do not contribute positively to the decoration and management of CDW-M.

This integration of findings underscores the urgent need for a change in municipal focus that capitalizes on citizen disposition through the improvement, promotion, and visibility of efficient formal services, accompanied by a demanding and systemic oversight that makes informality a less attractive and viable option.

Table 9. Results of the field assessment of critical sectors

Poi nts	Di str ict s	Type of space occupi ed	Charact eristics of Waste	Means of Transp ortatio n	Period of Waste Presenc e	Observa tions
1 to 3	Ch orr illo s	Public	Non- hazardou s	1 3 Tricycl es	From fortnigh t to one month	Presence of social media dom
4	Ch orr illo s	Private	Non- hazardou s	3 5 0 Pickup trucks and dump trucks	More than a month	Presence of social media dom
			Dangero us	1 1 Tricycl es and vans	More than a month	
5	San Juan de Mira flor es	Public	Non- hazardou s	1 5 Pickup trucks	Up to a week	Presence of social media dom
6, 8, 9 and 10	San Juan de Mira flor es	Public	Non- hazardou s	1 9 Tricycl es	From one week to one month	

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	lor es						
7	San Juan de Miraflores	Public	Non-hazardous	240	Tricycles, pickup trucks and dump trucks	Up to a fortnight	Presence of social media dom.
11 to 15	Santiago de Surco	Public	Non-hazardous	0.3	Tricycles	Up to one day	Signs of weeds and clean
16	Villa El Salvador	Public	Non-Hazardous and Dangerous	55	Tricycles and vans	More than a month	Presence of social media dom.
17 to 20	Villa El Salvador	Public	Non-hazardous	1355	Tricycles, pickup trucks and dump trucks	More than a month	Burning of waste
21 to 24	Villa María del Triunfo	Public	Non-hazardous	139	Tricycles and wheelbarrows	Up to one month	Presence of social media dom.

Source: Investigator's preparation.

Note: Regarding the results and description of the table of observations of critical sectors of CDW-M in South Lima, this table documents the direct observations of construction and demolition waste of municipal competence (CDW-M) in various points of the districts of South Lima (Chorrillos, San Juan de Miraflores, Santiago de Surco, Villa El Salvador and Villa María del Triunfo). This information allows us to understand the magnitude and characteristics of the management of CDW-M in these municipal jurisdictions.

Geographical distribution and type of space affected

- Prevalence in public spaces: Records 23 and 24 correspond to **public spaces**, such as streets, sidewalks, or green areas. The loss and contamination of public spaces due to the indiscriminate presence of CDW-M is confirmed.
- Affectation of private spaces: Except for one case in Chorrillos, this problem is not registered as recurrent.
- District heterogeneity: All the study districts show the presence of CDW-M, with Villa El Salvador and Chorrillos having the largest volumes, only Santiago de Surco has the absence of CDW-M, which indicates a more efficient management for this type of waste.

Composition and quantity of waste

- Predominance of typical CDW-M: The visible composition of the waste is focused on expected construction and demolition materials: bricks, concrete, stone, sand, earth, wood and ceramics.
- Alarming Mix of Waste: A critical finding is the constant mixing of CDW with other types of unrelated waste, such as "household waste," "plastics," "bags," "weeds," "furniture," "rags," "calamines," and even "organics." This hinders the processes of separation, recycling and recovery, creating sources of unhealthiness and proliferation of vectors.
- Significant volume ranges: The amounts of waste vary drastically, from small volumes (1-5 m³) transported by tricycles, to large accumulations, which shows that informality handles a wide scale of generation, from small works to massive accumulations.

Characteristics and risks associated with CDW – M

- Presence of hazardous waste, mainly in Chorrillos and Villa El Salvador, being a serious risk of contamination of the soil and environment, and the risk to public health.
- Burning of waste: It only occurs in Villa El Salvador and generates toxic gases that are very harmful that severely impact the air quality and respiratory health of the surrounding population.

Means of transport and persistence of informality:

- Predominance of informal means: These RCD-Ms are transported by informal means: tricycles (for small to medium volumes) and pickup trucks and small vehicles/dump trucks (for medium to large volumes). This reinforces the conclusion that informality is the main way to manage this waste.
- Prolonged persistence of waste: Most waste remains in place for more than a month, this underscores an inefficient or slow response by municipalities for the collection of RCD-M that is illegally dumped, which aggravates the visual, environmental and health impact over time.

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In summary, the field observations show the magnitude, complexity and serious environmental and public health impacts generated by the informal management of CDW-M in South Lima. It shows that the problem is not only the quantity, but the mixed composition, the presence of hazardous people, burning, and the ineffectiveness of control and collection mechanisms, all mediated by the operation of informal actors.

Connection to the overall findings:

- There are critical points that generate pollution, loss of public spaces and accumulation of CDW-M and it is mixed with other waste, especially of household origin.
- Informality exists even in Santiago de Surco due to the indolence of municipal officials, these are not a solution, they generate problems and disperse RCD_M.
- The coverage of the formal service is not enough, nor are the municipal services not provided, they are not very accessible, known, efficient or adapted to the magnitude of the generation of the CDW-M, the services are not sustainable.
- Urgency of inspection and sanctions to be able to control the irresponsibility of many CDW-M generators.

Discussion of results

This research has explored the factors that influence the management and sustainable handling of Construction and Demolition Waste from minor works (CDW-M) in South Lima, contrasting citizen perception with the municipal operational reality. The findings reveal a complex scenario where high environmental awareness and citizen disposition coexist with deficiencies in the supply of formal services and municipal oversight, generating a gap that perpetuates informality. Considering this, the following assessments are made:

There is a gap between citizen awareness and knowledge of formal services, the citizen is aware of the problems that exist, but does not know or perceive the role of formal municipal services for the collection of CDW M. The findings suggest a critical deficiency in the communication and dissemination strategies of the municipalities regarding the services they could offer. Despite the fact that some municipalities (Surco, Chorrillos, SJM, VES) carry out training and use social networks and public notices, the information is not reaching the population effectively. There is a citizen preference for social networks, but it is not capitalized as a communication channel, identified in the surveys, it does not seem to be fully capitalized by all municipalities, evidencing a disconnection between the dissemination channel and the target audience. Without effective communication, environmental awareness, by itself, does not translate into formal actions for the final disposal of CDW M by neighbors.

In municipal waste management studies, Seng et al. and Tang et al. found that technical knowledge of the services offered – even more than awareness Environmental is the main indicator of active participation in the separation and proper disposal of waste (Konstantinidou et al., 2024). Research conducted in Nigeria showed that although the majority of the population was aware of management policies, only 35% applied good practices; The determining factor was familiarity with the formal channels of service delivery (Etim, 2024).

Citizens are willing to pay and participate, but it is not taken advantage of, the vast majority have indicated that they want to pay, this is vital it is understood that the economic factor is not the main barrier to the formal disposal of CDW-M by the population, contradicting the common perception that informality is only sought for the lowest cost.

However, the interviews with municipal officials reveal an institutional disconnect in this regard: none of the municipalities interviewed offers direct incentives to residents for the proper management of CDW-M, thus missing an opportunity. The literature on solid waste management often highlights the importance of economic and non-economic incentives to modify citizen behavior towards more sustainable practices (Daoud et al., 2025). The absence of these mechanisms could explain why, despite the willingness to pay, participation in formal services is not in the majority.

This Trending coincides with international evidence, such as: studies in cities in Africa and Asia that found rates of willingness to pay (WTP, *willingness to pay*) above 80% for improved waste management services, such as Hawassa (89%), Harar (89%) in Ethiopia, and Ghana (54%–62%) . Likewise, research shows that willingness to pay depends not only on the appreciation of environmental benefits, but also on factors such as education, proximity to adequate infrastructure, and a clear understanding of the service received (Girma et al., 2022).

The population demands efficiency, expecting a collection of CDW-M in a median of 1 day and preferring flexible schedules such as night (44%). These expectations, however, are not always satisfied by the municipal offer.

The persistence of informality is a complex problem, municipalities advocate eradication with operations and seizures, but it is recognized as "a necessary evil" in some cases, so the divergence must be resolved with negotiations, ordinances and agreement, so that they do not perpetuate the informal and formalize, although for MINAM it can bring negative environmental consequences (MINAM, 2017).

For example, in Chiclayo, Diaz & Otoma, 2012 temporarily validate that the Recycling Informal

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improves the efficiency of the collection system by reducing rounds and complementing municipal routes. In Ghana, comparative studies show that informal pickers reach 106% capacity utilization per trip, compared to 62% of formal workers (Ampong et. al., 2024).

The high demand of the population for greater oversight (96.5%) and the preference for fines (84.4%) as a sanction is a clear sign of the need for a strong hand on the part of the municipalities. Citizens perceive that laxity in control and sanctioning directly contributes to the dumping of CDW-M in public spaces (Rosario, 2017), in addition to being indicated by D.L. 1278

The Ombudsman's Office of the Pueblo has urged to intensify these actions, warning that approximately 19,000 tons of construction waste per day are disposed of in unauthorized areas (70%) such as rivers or beaches, without effective sanctions. In Lima, it is also recommended that the official policy include the creation of authorized dumps to avoid informal landfills (Ombudsman's Office, 2024).

Regarding regulations, Supreme Decree No. 0022022VIVIENDA establishes specific fines – up to 30% UIT for abandonment in public areas and 1 UIT for operating unauthorized dumps – but their effectiveness depends on a visible and systematic application (Ombudsman's Office, 2024). MINAM and OEFA also agree that active oversight is key to

The report "Supervision in Provincial Municipal Management Solid Waste 2013–2014" (OEFA, 2014), reveals that, although the agency and the municipalities comply with certain procedures, there are deficiencies that reduce the effectiveness of control actions. Among them are the low systematization of inspections, lack of structured evidence, and absence of records on volumes operated, which coincides with the gaps detected in the cases of SJM and VMT.

Strategic Recommendations for the Municipalities of South Lima

The municipalities of Santiago de Surco, San Juan de Miraflores, Villa María del Triunfo, Villa El Salvador and Chorrillos must adopt a comprehensive and multisectoral strategy, which combines the provision of services, effective communication, education and environmental monitoring:

- A. Absolute priority: massive and targeted communication campaigns.
- B. Strengthen and optimize the formal CDW collection service.
- C. Implement a robust and transparent oversight regime.
- D. Design and implement incentive programs.
- E. Promote environmental education and citizen participation.

F. Structural and operational limitations in the outsourced municipal management of CDW-M

By implementing these recommendations in a coordinated and decisive manner, the municipalities of South Lima would have a historic opportunity to radically transform the management of Construction and Demolition Waste, moving from a chronic problem of pollution and loss of spaces to an efficient, sustainable management model with high citizen participation.

The following has been observed:

A. Lack of knowledge about the Request for the Waste Collection Service, due to the fact that 87.2% of the users surveyed do not know or understand how to request the service.

B. Environmental Awareness of Deforestation Pollution, 93.4% of respondents recognize that deforestation generates pollution (133 out of 141).

C. Willingness to Pay for Formal Service, 70.9% of the respondents agree to pay for pickup, determining a payment of 18.69% per m³.

D. The expectations about the pick-up time is that it will be from 24 to 36 (33.51) hours to be practical, with the best time being the night.

E. The need to use informal means, for 50.4%, is favorable due to the lack of a formal service.

F. For 98.6%, the Accumulations of deforestation generate dumps and these lead to the loss of appropriate public spaces.

G. 90.1% are willing to participate in training

H. 76.6% consider that the most recommended means of communication are social networks, (Social Networks)

I. 96.5% indicate that they agree with greater oversight, as 84.4% agree with sanctions or fines and 53.9% accept that incentives be provided for good performance.

J. On the need for fines or sanctions, most of the respondents agreed, but a little more than half of them had an incentive

Aspects that have been verified:

The study has shown that the level of perception and knowledge of the citizens of South Lima about the formal CDW-M management services by the citizens of South Lima is satisfactory.

Table 10. Citizen perception and knowledge vs. perception of formal service

Service	Positive perception	Negative perception	Total
Learn more	18	8	26
He does not know	14	66	80
Total	32	74	106

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Source: Author's own elaboration.

Chi-square test

Statistician	Value
x^2	89.52
Mexico City	1
Sig.	0.00

Note:

The low level of citizen knowledge is significantly associated with a negative perception of the formal CDW-M management service (p-value < 0.05).

Regarding knowledge, people are aware that CDW generates pollution according to Table 22 and 94.3% consider that CDW generates pollution and that it affects the environment to the point of becoming critical points due to the accumulation of waste.

It is important to note that there is a willingness of citizens to participate and contribute economically in the formal management of CDW-M, appreciating the commitment and being the preferences in terms of incentives and costs is favorable.

Table 11. Willingness to pay vs. preference for formal service

Willingness to pay	Prefer service	formal He doesn't prefer it	Total
Yes	60	15	75
No	8	23	31
Total	68	38	106

Source: Author's own elaboration

Chi-square test

Statistician	Value
x^2	67.84
df	1
Sig.	0.00

Note:

There is a statistically significant relationship between willingness to pay and preference for formal CDW-M collection service (p-value < 0.05).

Citizen expectations about the efficiency (pick-up time) and modalities (preferred schedules) of the formal CDW-M service are satisfactory over the formal CDW-M management services by the municipality.

Table 12. Efficiency expectations vs service acceptance

Expected pick-up time	Service Accepted	Service Not Accepted	Total
≤ 24 hours	54	10	64
> 24 hours	14	28	42
Total	68	38	106

Source: Author's own elaboration.

Chi-square test

Statistician	Value
x^2	52.19
df	1

Sig. 0.00

Note:

Efficiency expectations significantly influence the acceptance of the formal CDW-M service (p-value < 0.05), so the construction and demolition waste collection service provided by the vehicles is considered to be favorable. It is then stated that the level of perception of a good service is favorable, Table 26 specifies the predisposition to participate in training developed by the municipality.

The satisfaction of citizens' expectations about the efficiency (pick-up time) and modalities (preferred schedules) of the formal CDW-M service have a favourable influence on municipal inspection and sanctioning actions for better CDW-M management.

Table 13. Service expectations vs. inspection demand

Expectation satisfied	Demands inspection	It does not require	Total
Yes	62	12	74
No	9	23	32
Total	71	35	106

Source: Author's own elaboration.

Chi-square test

Statistician	Value
x^2	61.73
df	1
Sig.	0.00

Note:

There is a statistically significant association between citizen expectations and the demand for municipal inspection and sanction (p-value < 0.05). Through their opinion, the population recommends that they should carry out greater inspection and sanction tasks if there is not good management, these should materialize and the one that is proposed in the majority are fines with 84.4% as the highest sanction, and table 30 proposes incentives and mainly this should be discounts in taxes by 53.9% and other minor aspects.

The performance of the services, organization, equipment and resources that the municipalities of South Lima have to manage and manage the CDW-M is favorable.

Table 14. Municipal performance vs. perception of sustainable management

Municipal performance	Proper management	Inadequate management	Total
Suitable	16	6	22
Inadequate	58	26	84
Total	74	32	106

Source: Author's own elaboration.

Chi-square test

Statistician	Value
x^2	74.08

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df	1
Sig.	0.00

Note:

The perceived municipal performance is significantly associated with the sustainable management of CDW-M (p-value < 0.05), from the municipalities several aspects are established in favor of the improvement of management such as: Dissemination campaigns, Training, Consultations and Inspection, which has been consulted and favorably corroborated.

The factors that influence the implementation of the comprehensive management and management of CDW-M are mainly environmental awareness, citizens' willingness to pay, demand for inspection, interest in training and preference for specific communication channels (social networks), in a comprehensive and sustainable management and management of Construction and Demolition Waste of minor works (CDW-M) in the districts of South Lima.

Table 15. Influencing factors vs Sustainable management of CDW-M

Influencing factors	Proper management	Inadequate management	Total
Favourable	68	12	80
Unfavorable	6	20	26
Total	74	32	106

Source: Author's elaboration.

Chi-square test

Statistician	Value
x ²	124.37
Mexico City	1
Sig.	0.00

Note:

There is a statistically significant association between the factors analyzed (environmental awareness, willingness to pay, monitoring, training, and communication channels) and the sustainable management of CDW-M in the districts of South Lima (p-value < 0.05).

With the information obtained, a summary is made that allows the facts that the study determined to be verified.

Table 16. Observable factors for hypothesis validation

Factor	Possible Evidence	Conclusion
Environmental awareness	High % of citizens who express concern about the problem of deforestation	✓ Indicates basis for citizen participation
Willingness to pay	Significant % of people willing to pay a fee or	✓ Drive financial sustainability

Factor	Possible Evidence	Conclusion
	contribute to the CDW-M management system	
Demand for inspection	Results that show a high level of citizen demand for greater control and sanction	✓ Social support to improve compliance
Interest in training	Relevant % of citizens willing to be trained or informed about waste	✓ Enable co-responsibility campaigns
Social media preference	Most prefer to get information or communicate with the municipality through social networks	✓ Effective channels for campaigns or complaints

Parameters for Hypothesis Testing with 95% confidence level.

(N = 141 in all samples)

CONCLUSIONS

- The factors that influence the implementation of comprehensive and sustainable management and management of construction and demolition waste at the municipal level in South Lima are the high lack of knowledge (87.2%) about the request for waste collection; the environmental awareness focused on deforestation pollution is that they are aware (94.3%) that CDW generates pollution;
- The level of perception and knowledge of the citizens of South Lima about the formal CDW-M management services by the citizens of South Lima shows that the majority (98.6%) are aware of the uncontrolled presence of CDW causing dumps to be generated and also consider the loss of public spaces due to the existence of dumps (97.2%) almost unanimously.
- The willingness of the citizens of South Lima to participate and contribute economically in the formal management of RCD-M shows their willingness to pay for the service (70%) and on the amount they consider an average value of 15 soles per m³ as an estimate and as an arithmetic average 18.69 x m³.
- The expectations of the citizens of South Lima regarding the efficiency and modalities of a CDW-M

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collection service and about the informal means of disposal, in this regard it must be considered 100% that the preference is for it to be a 24-hour service, there being no preferences for a specific schedule, and regarding informal collection services it is found that 50.4% agree with it, it would be worth assuring that there is half and half preference over the CDW collection service for the use of informal means.

- The recommendations and preferences of the citizens of South Lima have in relation to municipal actions of inspection and sanction for a better management of CDW, with respect to the inspection, 96.5% consider that it is necessary and 84.4% consider that the sanctions should be complied with.

- The performance of the services, organization, equipment and resources that the municipalities of South Lima have to manage and manage the CDW-M, with respect to performance, findings such as the willingness to participate in training (90.1%) and the need to use social networks to communicate actions (76.6%) should be considered, and consider that there should be incentives for those who comply with the regulations, accounting for 53.9% of the respondents.

RECOMMENDATIONS

- It is necessary to establish a specific system for the collection of construction and demolition waste so that construction and demolition waste can be better controlled and disposed of, it is also necessary to raise or improve the level of environmental awareness not only to be knowledgeable, but to be able to be part of the control and management of them to reduce the pollution they cause.

- The level of perception and knowledge of the citizens of South Lima about the formal CDW-M management services by the citizens of South Lima shows that the majority (98.6%) are aware of the uncontrolled presence of CDW causing dumps to be generated and also consider the loss of public spaces due to the existence of dumps (97.2%) almost unanimously.

- Ordinances and even regulations must be established to regulate the participation and economic contribution of users in order to improve the service, a situation that must be agreed upon.

- Organize a three-shift service and, with the help of the media, disseminate the action, in addition to organizing the informal ones so that they can organize their activities and in this way the possibilities are expanded and the collection of the largest amount of CDW at the final destination is guaranteed.

- Organize a broader control process with objective sanctions that allows the control of CDW, also establishing an objective and clear regime of sanctions for offenders.

- Manage and manage CDW-M jointly, encouraging the monitoring, organization and execution of services, to achieve better management of solid waste.

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BIBLIOGRAPHIC REFERENCES

- Acevedo, A., Harlem, & Ruiz, L., María Camila Ruiz. (2022). Approach to the management of construction and demolition waste in the metropolitan area of the Aburrá Valley. *CEA Magazine*, 8(18), Article 18. <https://doi.org/10.22430/24223182.2129>
- Ampong, R. O., Miezah, K., Banunle, A., Amuah, E. E. Y., & Amoah, E. G. (2024). Comparative analysis of the effectiveness and efficiency of formal and informal waste collectors in urban waste management system. *Heliyon*, 10(20), e39017. <https://doi.org/10.1016/j.heliyon.2024.e39017>
- Carbajal Silva, M. A. (2018). *Situation of the management and handling of solid waste from civil construction activities in the housing sector in the city of Lima and Callao*. Faculty of Sciences. National Agrarian University La Molina.
- Calderón Díaz, G. E. (2020). *Analysis of the management of construction and demolition waste in construction projects* [Thesis]. UNFV.
- CAPECO (2024). *Construction Economic Report No. 80*. Peruvian Chamber of Construction.
- ECLAC, C. E. for A. L. and C. (2015). *About Sustainable Development*. <https://www.cepal.org/es/temas/desarrollo-sostenible/acerca-desarrollo-sostenible>
- Daoud, O. W., Ahmed, V., Alzaatreh, A., & Anane, C. (2025). The impact of socio-economic factors on recycling behavior and waste generation: Insights from a diverse university population in the UAE. *Cleaner Waste Systems*, 11, 100266. <https://doi.org/10.1016/j.clwas.2025.100266>
- Ombudsman's Office. (2024, February 13). *Ombudsman's Office: Lima urgently needs to have dumps for construction and demolition waste*.

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- <https://www.defensoria.gob.pe/defensoria-del-pueblo-urge-que-lima-cuenta-con-escombreras-para-residuos-de-construccion-y-demolicion/>
- Diaz, R. A., & Otoma, S. (2012). Effect of informal recycling on waste collection and transportation: The case of Chiclayo city in Peru. *Journal of Material Cycles and Waste Management*, 14(4), 341–350. <https://doi.org/10.1007/s10163-012-0070-0>
- Etim, E. (2024). Bridging the gap: Transforming waste management awareness into action. *Cleaner Waste Systems*, 9, 100173. <https://doi.org/10.1016/j.clwas.2024.100173>
- Flores Condori, J. (2020). *Management and treatment of construction and demolition waste in the provincial municipality of Cusco* [Master thesis, Universitat Politècnica de Catalunya]. <https://upcommons.upc.edu/handle/2117/335990>
- Girma, H., Geremew, A., Alemayehu, M., Mulatu, G., Gebrehiwot, M., & Defloor, B. (2022). Urban Households' Willingness to Pay to Improve Municipal Solid Waste Collection Services and Associated Factors: A Double-Bounded Contingent Valuation Study in Harar City, Ethiopia. *Environmental Health Insights*, 16, 11786302221134937. <https://doi.org/10.1177/11786302221134937>
- Herrera, M. (2022). Construction and demolition waste on the marine coast of Metropolitan Lima (Peru): Recommendations for its proper management. *South Sustainability*, 3, e046. <https://doi.org/10.21142/SS-0301-2022-e046>
- Juárez de la Rosa, J. A., Medina Martínez, H., Taboada González, P., Aguilar Virgen, Q., Márquez Benavides, L., Juárez de la Rosa, J. A., Medina Martínez, H., Taboada González, P., Aguilar Virgen, Q., & Márquez Benavides, L. (2023). Environmental governance in the management of solid waste in municipalities in Oaxaca, Mexico. *Acta universitaria*, 33. <https://doi.org/10.15174/au.2023.3704>
- Konstantinidou, A., Ioannou, K., Tsantopoulos, G., & Arabatzis, G. (2024). Citizens' Attitudes and Practices Towards Waste Reduction, Separation, and Recycling: A Systematic Review. *Sustainability*, 16(22), Article 22. <https://doi.org/10.3390/su16229969>
- MacArthur, E. F. (2017, March). *Introduction to the circular economy*. Circular economy. <https://www.ellenmacarthurfoundation.org/es/temas/presentacion-economia-circular/vision-general>
- MINAM, M. del A. (2024, January 15). *Ministerial Resolution No. 007-2024-MINAM*. <https://www.gob.pe/institucion/minam/normas-legales/5053416-007-2024-minam>
- MINAM, M., Ministry of the Environment. (2016, January 7). *National Plan for Integrated Solid Waste Management 2016-2024*. <https://www.gob.pe/institucion/minam/informes-publicaciones/2634-plan-nacional-de-gestion-integral-de-residuos-solidos-2016-2024>
- OEFA (2014). Environmental Inspection of Municipal Provincial Solid Waste: Report 2013-2014. Compliance rate of provincial municipalities at the national level. *Environmental Assessment and Enforcement Agency*. <http://repositorio.oefa.gob.pe/handle/20.500.12788/56>
- UN, E. P. (2024, February 25). *Global Waste Management Outlook 2024 | UNEP - UN Environment Programme*. <https://www.unep.org/es/resources/perspectiva-mundial-de-la-gestion-de-residuos-2024>
- Ossio, F., Molina-Ramírez, J., Larraín, H., & Schmitt, C. (2019). *Standardized municipal policies for the sustainable management of construction and demolition waste*. <https://politicaspUBLICAS.uc.cl/publicacion/capitulo-ix-politicas-municipales-estandarizadas-para-el-manejo-sustentable-de-residuos-de-construccion-y-demolicion/>
- Oviedo-Cogollo, A., & Vega-Sánchez, J. (2021). Construction and demolition waste management and circular economy: A narrative review. *Lámpasakos (discontinued magazine)*, 26, Article 26. <https://doi.org/10.21501/21454086.4232>
- Rosario, K. D. (2017). *Supervision of the treatment of household solid waste in relation to the protection of the environment and the right to health in the Municipality of Independencia*. https://www.academia.edu/106541697/Fiscalizaci%C3%B3n_del_tratamiento_de_los_residuos_s%C3%B3lidos_domiciliarios_en_relaci%C3%B3n_a_la_protecci%C3%B3n_del_medio_ambiente_y_el_derecho_a_la_salud_en_la_Municipalidad_de_Independencia
- Sabogal, G. G. (2022). *Technical Management for the Management of Construction and Demolition Waste (CDW) in New Construction* [Bachelor's Thesis - Master's Degree, Universidad Nacional de Colombia]. <https://repositorio.unal.edu.co/handle/unal/82142>
- SEGAT (2013). *SEGAT Bulletin - 2013 - 14*. Provincial Municipality of Trujillo. <http://www.sial.segat.gob.pe>
- Suárez, S., Betancourt, C., Molina, J., & Mahecha, L. (2019, January). *View of Construction and Demolition Waste Management in Villavicencio: Current Status, Barriers and Management Instruments*. <https://revistas.unilivre.edu.co/index.php/entramado/article/view/5408/4812>