

POLICY ANALYSIS ABOUT THE
APPROACH OF THE HOUSEHOLD
SOLID WASTE MANAGEMENT AND
HANDLING IN METROPOLITAN LIMA
– PERU

SALLY CORINA FABIAN LLANTOY

SEPTEMBER 2021

WORD COUNT: 11,901

Presented as part of, and in accordance with, the requirements for the Final Degree of
MSc in Environmental Policy and Management at the University of Bristol, School of
Geographical Sciences, September 2021.



School of Geographical Sciences

CERTIFICATION OF OWNERSHIP OF THE COPYRIGHT IN A TYPESCRIPT OR MANUSCRIPT

Dissertation presented as part of, and in accordance with, the requirements for the Final Degree of MSc in Environmental Policy and Management at the University of Bristol, School of Geographical Sciences.

I hereby assert that I own exclusive copyright in the item named below. I give permission to the University of Bristol Library to add this item to its stock and to make it available for use and re-copying by its readers.

| | |
|---------------------------|---|
| AUTHOR | Sally Corina Fabian Llantoy |
| TITLE | Policy Analysis about the approach of the household solid waste management and handling in Metropolitan Lima - Peru |
| DATE OF SUBMISSION | 12 September 2021 |

Signed:

A handwritten signature in blue ink, appearing to read "Sally Corina Fabian Llantoy".

Full name:

Sally Corina Fabian Llantoy

Date:

12 September 2021

ACKNOWLEDGEMENTS

I would like to thank the Peruvian government for allowing me to study abroad and research environmental issues. Also, I am thankful to my supervisor Joe Williams and tutor Rachel James for their support and advice during this process. Thank you to all the specialists, who gave me valuable information in the interviews despite having a busy schedule. Finally, to my family for sending me the best vibes and supporting me every time.

ABSTRACT

In Metropolitan Lima, household solid waste represents 70%, and its mismanagement brings infectious diseases and pollution to water, air and soil. Then, assessing the current issues about management and handling focusing on the household solid waste is necessary to identify the main reasons. Therefore, it is crucial to examine the gaps between the waste policy, solid waste management and handling allowing us to recognize the critical points. This study focused on three points. One is related if the Legislative Decree N° 1278 based on the Peruvian waste policy has solved the main issues. The second is about the constraints in Metropolitan Lima. The third is to examine the compliance of the waste policy and laws. Two methods were carried out for this study. The first one was the interviews with specialists from the solid waste field in Peru for applying qualitative analysis. The second was using the official statistics to describe the current situation and provide specific points. Metropolitan Lima was chosen for generating the highest quantity of solid waste due to having the highest population density in Peru. The research findings indicate that it is vital to execute certain adjustments in the policy to conceive proper responses to the current issues. Also, it should be accompanied by effective training to the stakeholders in solid waste management and handling. Then, tracking the waste programmes according to the different situations of the municipal communities in Metropolitan Lima for giving concrete results. Moreover, strengthen monitoring and enforcement of the regulatory framework to improve the stakeholder's performance. At the same time, promote a platform to articulate the different tasks of stakeholders for supporting them, sharing the best practices enhancing the current situation and overcoming the limitations in the competencies of each stakeholder.

AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Taught Postgraduate Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, this work is my own work. Work done in collaboration with, or with the assistance of others, is indicated as such. I have identified all material in this dissertation which is not my own work through appropriate referencing and acknowledgement. Where I have quoted from the work of others, I have included the source in the references/bibliography. Any views expressed in the dissertation are those of the author.

SIGNED:



DATE: 12 September 2021

TABLE OF CONTENTS

| | |
|--|-----------|
| 1. INTRODUCTION | 9 |
| 1.1. RESEARCH QUESTIONS | 11 |
| 2. LITERATURE REVIEW..... | 11 |
| 2.1. SOLID WASTE..... | 11 |
| 2.1.1. <i>Household Solid Waste</i> | 11 |
| 2.2. WASTE POLICY | 11 |
| 2.2.1. <i>Principles</i> | 13 |
| 2.2.2. <i>Hierarchies</i> | 14 |
| 2.3. SOLID WASTE MANAGEMENT | 14 |
| 2.3.1. <i>Challenges</i> | 15 |
| 2.4. CIRCULAR ECONOMY | 16 |
| 2.4.1. <i>3'R and Composting</i> | 17 |
| 2.5. SOLID WASTE POLICY AND MANAGEMENT..... | 17 |
| 3. METHODS AND DATA | 18 |
| 3.1. POLICY ANALYSIS..... | 18 |
| 3.1.1. <i>Matrix of Approaches</i> | 18 |
| 3.2. SECONDARY ANALYSIS..... | 22 |
| 3.3. QUALITATIVE RESEARCH | 22 |
| 3.3.1. <i>Interviews</i> | 23 |
| 4. CASE STUDY..... | 23 |
| 4.1. METROPOLITAN LIMA | 24 |
| 4.2. SOLID WASTE POLICY, REGULATORY AND OPERATIONAL FRAMEWORK IN PERU..... | 26 |
| 4.2.1. <i>Solid Waste Policy in Peru</i> | 26 |
| 4.2.2. <i>Solid Waste Laws in Peru</i> | 29 |
| 4.3. SOLID WASTE MANAGEMENT AND HANDLING IN PERU..... | 30 |
| 4.3.1. <i>Processes</i> | 31 |
| 4.3.2. <i>Compliance</i> | 31 |
| 5. RESULTS | 32 |
| 5.1. INTERVIEWS | 32 |
| 5.2. SECONDARY SOURCES | 36 |
| 6. DISCUSSION..... | 41 |
| 7. POLICY RECOMMENDATIONS | 44 |
| 8. CONCLUSIONS | 45 |
| 9. FUTURE WORK | 46 |
| 10. REFERENCES CITED | 47 |
| 11. APPENDICES | 61 |
| 11.1. INTERVIEW INFORMATION..... | 61 |
| 11.2. GUIDE TO INTERVIEW QUESTIONS..... | 61 |
| 11.3. ETHICS FORM | 63 |
| 11.4. ANALYSED TRANSCRIPT | 70 |

LIST OF FIGURES

Figure 1. Matrix about the different kinds of policy analysis.

Figure 2. Map of Metropolitan Lima.

Figure 3. Peruvian Policy Hierarchy.

Figure 4. Graph of household solid waste generation.

Figure 5. Graph of household solid waste generation by municipal community.

Figure 6. Graph of Cost vs Tax Collection.

Figure 7. Graph of Valorisation.

Figure 8. Graph of Final Disposal Cost.

Figure 9. Graph of Issued Document of Solid Waste Management and Handling.

Figure 10. Graph of EDUCCA Program Implementation.

ABBREVIATIONS

| | |
|-----------------|--|
| D.L. | Legislative Decree |
| MINAM | Ministry of Environment in Peru |
| OEFA | Agency for Environmental Assessment and Enforcement |
| MUNLIMA | Council of Metropolitan Lima |
| GL | Local Government |
| GR | Regional Government |
| DIGESA | General Directorate of Environmental Health |
| MEF | Ministry of Economy and Finance |
| EDUCCA | Programme of Education, Culture and Environmental Citizenship |
| GHG | Greenhouse gases |
| LAC | Latin America and the Caribbean |
| PESEM | Multiannual Sector Strategic Plan for the Environmental Sector |
| NA | National Agreement |
| MDGs | Millennium development goals |
| SDGs | Sustainable development goals |
| R.M. | Ministerial Resolution |
| CEPLAN | National Centre for Strategic Planning |
| EC-RS | Commercial company |
| EPS-RS | Service company |
| INEI | National Institute of Statistics and Informatics |
| SINIA | National Environmental Information System |
| SIGERSOL | Information System for Solid Waste Management |

1. Introduction

Solid waste management and handling represent a massive challenge worldwide. Hence, the diversity of initiatives and approaches to tackle the topic to provide solutions to the current issues that continue year by year. This is further aggravated by the population growth (Hoorweg and Bhada-Tata, 2012). Thus, it is necessary to examine the basis of solid waste management and handling, which is the policy.

Policy is the main tool to generate principles, strategies and programmes. This is because it provides the mission and the vision of a country. Also, it is allocated in the highest position of political hierarchy for being part of the central government (Jordan and Adele, 2013). The regulatory framework is conceived from the basis of the policy and it allows to establish limitations and competencies to the stakeholders. The execution of the strategies from the policy, taking into account the regulatory framework that is part of the management, will be the handling (Cetrulo et al., 2018). Then, the policy-makers intervene in the waste policy, regulatory framework, solid waste management and handling because they elaborate these documents to generate improvements in the life quality and protecting the environment.

In the first instance, the solid waste issues in Peru were perceived as a health concern, however, the Peruvian government had to realize the depth of issues related to the political, economic, environmental and social dimensions (Monteiro, 2006). Thus, it has to take into account the environmental approach mandating the Ministry of Environment – MINAM as the organization to find solutions with stakeholders.

The way to measure the outcomes of a policy is related to three factors, which are the 'output (performance of policies), outcome (social change) and impact (environmental impact)' (Crabbé and Leroy, 2008). As an example, Metropolitan Lima displays many issues such as solid waste in the streets, critical points where the solid waste is accumulated and simply having inherently dirty streets. Likewise, the citizens that are the users have a lack of environmental awareness because they do not segregate, although that it is mandatory to do in the households based on the regulatory framework (Lopez, 2007). Then, there are some gaps between the policies and the handling because they are not working together or not under the same goal because the

policy performance does not have any social change or environmental impact until now in Metropolitan Lima.

Different researchers are focusing on specific districts of Metropolitan Lima. According to Oldenhage (2016), solid waste management and handling in San Juan de Miraflores (Lima South) have addressed different perspectives such as engineering in infrastructures, economics, political and social; however, there are no substantial improvements. The same driver states that management and handling are inefficient and continue to be a challenge in related studies (Sanchez-Muñoz, Cruz-Cerón and Maldonado-Espinel, 2019; Haro-Corales, 2017; Marticorena-Dominguez,2021). Then, the current performance generates more difficulties than solutions because the policy, regulatory framework, management and handling do not accomplish the Peruvian government goals.

This research focuses on contextualizing the current solid waste situation in Metropolitan Lima to assess if the policies as principals generate the basis for a congruent regulatory framework that allows executing efficient management and handling. Moreover, many aspects have been affected in the solid waste policy, management and handling due to the COVID-19 exposing the current issues and demonstrating the gaps between the different municipal communities in Metropolitan Lima.

The research for this project aims to examine household solid waste because it is the category that represents the highest percentage in Metropolitan Lima (MINAM,2019a). The organic fraction represents 48% of household solid waste (MINAM,2019b). There is an interesting opportunity to minimize, recycle and reuse household solid waste in Metropolitan Lima. For example, composting the organic fraction and assessing the other possibilities to minimize the generation of solid waste.

Identifying the gaps between the policies, management and handling of household solid waste in Metropolitan Lima is the main objective of this research. The limitation of the study is the validity of the policies and regulatory framework in the Peruvian waste sector. However, the study can be considered as a foregoing to generate new policies and strategies.

1.1. Research Questions

- Which aspects of the regulatory framework Legislative Decree (D.L.) 1278 have solved the main issues of household solid waste in Metropolitan Lima?
- What are the limitations of management and handling household solid waste in Metropolitan Lima?
- Have the management and handling of household solid waste complied with the regulatory framework and policies?

2. Literature Review

2.1. Solid Waste

The per-capita estimated value of solid waste is about 0.74 Kg per day worldwide (Kaza et al, 2018). Then, the value is going up every year due to the population growth. There is a significant relationship between the solid waste generation volume with the income level and the urbanization rates (Alam and Ahmade,2013). It is reflected in the big cities with having a demographic concentration and sectors with different incomes. Thus, solid waste generation will vary depending on the population and urbanization level. The main variable for the management and handling of solid waste is the density and population size because they imply high solid waste generation (Koushki et al., 2004).

2.1.1. Household Solid Waste

It is the solid waste from the households. It represents the highest percentage in the municipalities of urban areas due to the “economic growth, consumption capacity”, and population growth (Wang et al., 2018).

2.2. Waste Policy

The forecasted solid waste in 2050 is around 3,400 million tonnes (Kaza et al, 2018). Hence, it is necessary to take decisions to detain the excessive generation of solid waste through effective mechanisms adopting by the stakeholders that formulate solid waste policy. The authorities should have an integral perspective about solid waste to execute different strategies related to solid waste minimization and circular economy (Alam and Ahmade,2013).

Additionally, the key points in policy are related to the planning and the availability of datasets. They contribute to determine which aspects should control, improve or change to enhance efficiency (Perez- Lopez et al, 2016). It should include a list of actions such as the segregation of the solid waste, capacity of handling solid waste, emergency disposal places and community awareness contributing to a holistic perspective about solid waste policy, management and handling. According to Chen and Lo (2016), it contributes to developing new strategies to generate energy from solid waste through incineration or anaerobic digestion.

On the other hand, sustainability and the resilience to face climate change should be a statement in the solid waste policy, management and handling (Kaza et al, 2018) because it contributes to reducing greenhouse gases (GHG). This is illustrated by waste management has contributed to increasing methane emissions, and it has had a slow response; although to have policies and strategies focused on reducing the emissions (IPCC, 2021).

In the international approaches, there are assumed commitments (UNEP,2015):

- The Stockholm Convention in 1972 was related to environmental protection. It was the first global conference to discuss environmental topics and the prevention of pollution.
- The Hong Kong Convention in 2009 related to recycling ships, assuring the care pertinent and the minimization of health, safety and environmental risks.
- The Minamata Convention in 2003 focused on controlling mercury concentrations to protect health and the environment.
- The London Convention in 1972 took measures preventing solid waste from ending up in the sea.
- The Basile Convention in 1989 promotes the adequate handling of dangerous solid waste.
- The Rotterdam Convention in 1998 focused on the dangerous chemical solid waste and the adequate handling to avoid health and environmental risks.

The application of a national strategy has a period of 5 to 10 years to promote solutions that allow the current issues to be faced through the established objectives supporting

in legal foundation and guides to determine the measurement of the objectives. Hence, it is necessary to plan and assess continuously the policies to be effective and contribute to solid waste management and handling (Abarca Guerrero, Maas and Hogland, 2013).

2.2.1. Principles

The solid waste topic is multidimensional because it is associated with socio-economic, climatological, geographical and cultural aspects. The planning of a policy needs to gather all of these dimensions because they intervene in every decision of each stakeholder in solid waste management and handling (Taghipour et al., 2016). Therefore, there is a vast number of studies related to collection and treatment processes for improving the policy, investment and strategies to face the current issues in the urban areas (Sanjeevi and Shahabudeen ,2015).

The policies need to be aligned to the local conditions and information about solid waste for having effective management and handling. Therefore, it is essential to gather all the stakeholders to identify the specific needs and issues of solid waste field. Moreover, the information should be measured and monitored for it's efficacy (UNEP,2015).

These principles are associated with legal, economic and social instruments. As part of the legal instrument, it provides a regulatory framework that allows the operator to plan the handling and making investments in the case of the private sector. The economic aspect provides a market based on incentives and application fees to specific critical practices. The social aspect involves communication, commitment and awareness of the citizens for ensuring the proper policy understanding. Likewise, these instruments should be accompanied by the processes of coordination, implementation, monitoring, compliance and assessment for guaranteeing their effectiveness (UNEP,2015).

The policymakers should assess the variety of factors to take a final decision. The quantity, type and composition of solid waste are dynamic points that fluctuate depending on the city conditions. Therefore, it is necessary to elaborate a list of options examining the forecasted results, profits and feasibility because they are valuable to choose which policy will be applied (Huang et al.,2005).

The determining factor to renovate or adjust a policy is derived from the current context of the society. The world has experienced changes in consumption patterns and

lifestyles generating a high quantity of solid waste. Therefore, it is crucial to take actions that allow modifying consumption patterns contributing with sustainability to protect the environment and human health (Da Silva, Marques and Pavan,2019). Similarly, it is framed to the sustainable development goals being the objective 12 related to the consumption and sustainable production (United Nations, 2016) emphasizing in policies related to solid waste (Rodić and Wilson,2017) to achieve the assumed commitment to 2030 through having integral solid waste management (UNEP,2015).

2.2.2. Hierarchies

The experiences in different countries state different points such as “the polluter pays more”, the prevention, universal coverage, inclusion and recovery cost. They are approaches to elaborate different policies that will be executed through the management and handling. However, each country has particular characteristics that they need to assess in detail (Woodruff,2014). Therefore, the guidelines provide ideas to be established as starting points that policy-makers use to decide their context.

The solid waste policies have four scopes, which are international, regional, national and local. Environmental protection, transport and final disposal of dangerous solid waste are the key drivers in international scope. Having guidelines, protocols, alliances between different countries are the regional scope. The development of strategies, laws, financial support to local government is part of the local level as an approach related to the management and handling of solid waste (Powell and Chertow ,2019).

It is fundamental to establish a hierarchy to prioritize the different approaches, strategies and programmes. Therefore, the addition of sustainable development performs a crucial role to initiate a change in the solid waste conception. It is through minimization, reuse and recycling as fundamentals to prevent the generation of solid waste (Vyas,2010).

2.3. Solid Waste Management

In the beginning, the international guidelines related solid waste management and handling to human health and safety, however, it changed due to the evident environmental impacts in water, soil and air expanding the outlook (McDougall and Hruska,2000). The main challenges in developing countries are inappropriate service

coverage, inefficient operational services, limited recycling, inadequate handling of dangerous solid waste and inappropriate final disposal due to the precarious economic situation (Marshall and Farahbakhsh, 2013; Ferronato and Torretta, 2019). As a result of inefficient solid waste management, there is a list of consequences such as the proliferation of vectors, infectious agents and GHG emissions polluting the air, soil and water (Contreras, 2008).

The aspect of the partnership between the public and private sectors is vital to develop different strategies. It contributes to the improvement in management and handling. In the beginning, the management and the handling were controlled by the public sector. It brings many issues such as bureaucracy and reduction in the national budget, aggravating the difficult situation (Baud et al., 2001). Therefore, it is necessary to deploy an effective partnership between the two sectors.

2.3.1. Challenges

The scope of the national government is to develop strategies through guidelines, objectives, operational and environmental standards about solid waste management and handling, as well as, deploying guidelines for the adequate performance of the stakeholders. For instance, the private sector provides investing and technical expertise (McAllister, 2015).

The local government scope is focused on the operationalization of the management through the suitable execution of the regulatory framework, economic resources, monitoring and implementation of programs to search solutions (Margallo et al., 2019). The importance of planning in solid waste management and handling is vital to make effective the policies and laws. In addition to this, the articulation between the stakeholders is a means to achieve the set objectives (Pires, Martinho and Chang, 2010).

A master plan implementation at the local level is focused on bringing solutions and providing a service that covers the population needs because the local government works closer to the citizens. Most of the time, it depends on the attitude of the population to execute the strategies (Jones et al., 2010). Therefore, a keystone is ensuring population participation and awareness because they are the main generators of solid waste (Sáez and Urdaneta, 2014).

The synergy between the different stakeholders is vital because each of them takes the role of politician, policymaker, regulator, planner, employee, operator and financial agent. Then, the efficient performance of these stakeholders allows achieving the set objectives in the national strategies (UNEP,2015).

The critical concept is that treatment is conceived as a massive investment. However, final disposal in a landfill represents low cost and investment because the solid waste is dynamic and the strategies have to assess the critical concepts because treatment is valuable instead of disposing of everything in a landfill (Alam and Ahmade,2013). Therefore, it is necessary to invest in technology because it helps to improve efficiency of the solid waste processes (Silgado-Rodriguez,2006).

The lack of solid waste treatment and inadequate final disposal generates lixiviates which pollute the soil and water (PAHO-AIDIS-IDB¹,2010). 33% of dumpsites are not controlled and the solid waste recuperation is approximately 4% (Margallo et al., 2019).

In Latin America and the Caribbean, the continuing challenge is the budget as solid waste management only receives on average about 2 to 8% (Hoonrnweg and Giannelli, 2012). Therefore, it is reflected in the quality of service because they do not have money to pay qualified professionals. As a consequence, there are limitations in the collection coverage, final disposal in dumpsites and the lack of awareness in the population (UN-Habitat,2012; PAHO-AIDIS-IDB,2010²; Hernández-Berriel et al.,2017; Bustos-Flores, 2009). This demonstrates that the willingness of the governments is essential to increase the number of investments, initiatives and committed social awareness (Sáez and Urdaneta,2014).

2.4. Circular Economy

Solid waste should be conceived as a resource to be used in the production cycle by eliminating the idea of unprofitability in the final stage (European Commission,2018). The approach of circular economy is becoming more relevant because the principles are reuse, reduction in the final disposal and a meaningful improvement in the useful life

^{1, 2} Pan American Health Organization (PAHO), Inter-American Association of Sanitary and Environmental Engineering (AIDIS) and Inter-American Development Bank (IDB)

(Ghisellini, Cialani and Ulgiati, 2016; Ragazzi et al., 2017; Cobo, Dominguez-Ramos and Irabien, 2018). It aims to reduce costs, protect the environment and generate benefits for society (Paes et al.,2019).

2.4.1. 3'R and Composting

The percentage of organic waste in 2016 is about 52% and the recycling rate is around 4.5% in Latin America and the Caribbean (LAC) (Kaza et al, 2018). Therefore, the policy approach should be aligned to the treatment of organic solid waste, as well as emphasizing composting and recycling every solid waste that is profitable (Haas et al., 2015; Hernández-Berriel et al.,2017). As a result, the amount of solid waste that reaches final disposal will be significantly less, saving costs and contributing to the environment.

Another challenge is the informality level in recycling and collection processes. It generates disarticulation and a lack of control in solid waste management and handling because the informal recyclers do not report their activities to any public institution and do not have a proper job description generating bottlenecks (Zhu et al., 2011). Then, it is necessary to handle properly the informality to avoid the bottlenecks in solid waste management and handling.

2.5. Solid Waste Policy and Management

The economic approach has played an important role in the solid waste policy and management because it provides market structure, competencies, ownership and the incentive roles to promote efficiency and innovation (Simões and Cunha,2012). For instance, the application of “economic instruments” in the European Union such as “Pay-As-You-Throw (PAYT)” and the incentive for segregating the “organic waste” have given positive outcomes (Pires, Martinho and Chang,2011).

Many discussion points between the different studies have determined aspects connected to the regulatory incentives, governance structures, private sector participation, environmental awareness and increasing the life quality of citizens (Simões and Cunha,2012).

The sustainable approach should be included in solid waste management because it has been successful in different countries through defined objectives and correct

monitoring. For example, the city of London in Canada has integral solid waste management that accomplishes every principle. Likewise, there is effective participation between the public and private sectors (Asase et al.,2009).

The term integral solid waste management is referred to be effective, economically profitable and socially accepted (McDougall et al., 2001). Therefore, the planning process is vital to develop congruent strategies with the population needs ad priorities accompanying monitoring, continuous assessments and methods to disseminate the achievements (Asase et al.,2009).

3. Methods and Data

3.1. Policy Analysis

The policy analysis is considered as a 'political act' than a technical aspect. Therefore, it is well-known as 'Art and Craft' because the decisions do not always translate the scientific perspective (Cairney,2021). Policy analysis has two approaches, which are the 'ex-ante' and 'ex-post'. The research uses the 'ex-ante' approach because it starts with defining the problem and predicting solutions. Furthermore, the scope of the research covers problem identification, evidence demonstration, alternatives construction and policy recommendations because the other steps such as forecasting the outcomes and trade-offs are feasible by the execution of the recommendations. Therefore, the main objective of the research is to identify the gaps and propose policy recommendations.

3.1.1. Matrix of Approaches

The different policy analysis as described in Figure 1 has the same fundamentals. Therefore, the different steps of each model have been organized in the following five stages:

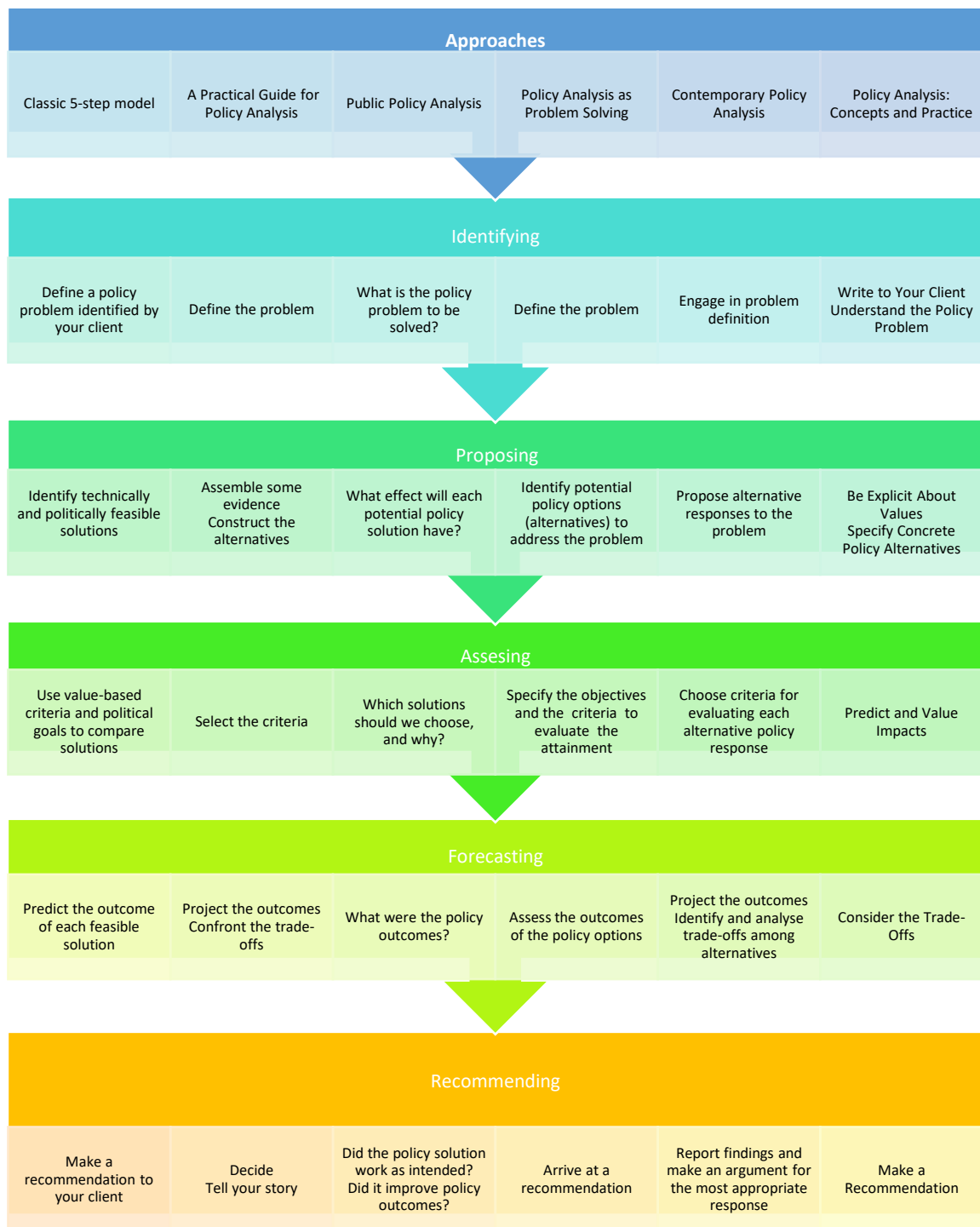


Figure 1. Matrix about the different kinds of policy analysis. They are identifying, proposing, assessing, forecasting and recommending. Illustration produced by the author, using data from Cairney and Kwiatkowski, 2018; Bardach and Patashnik, 2016; Dunn, 2017; Schwartz and Meltzer ,2019; Mintrom,2012; Weimer and Vining,2017.

1. Starting with the problem determination is vital to start the assessment.
2. Elaborating the alternatives aims to solve the situation.

3. Selecting the criteria is crucial to choose the most appropriate and feasible solution for each identified issue.
4. Forecasting outcomes is important to quantify the benefits.
5. Communicating the policy appropriately is the keystone to awareness of the population and the stakeholders.

In sum, each stage of the policy analysis has a set of guidelines ensuring an effective policy analysis (Cairney and Kwiatkowski, 2018).

This research tackles the first three steps because the other steps need the implementation of the solutions to be explained. Therefore, the policy analysis about solid waste management and handling in Metropolitan Lima has identified a list of issues.

The presence of solid waste in the different streets of Metropolitan Lima entailing a serious problem in the collection process. Many districts do not accept solid waste in containers and it generates critical points in different parts of Metropolitan Lima concentrating pollutants and infectious vectors (Lopez,2007).

The aim of the policy is the minimization through segregation. However, the population in Metropolitan Lima is not aware of it and they offer their solid waste without segregating. The supervision is poor because there are no adequate mechanisms to comply with the regulatory framework. Additionally, there are not clear competencies for each stakeholder because the government needs to make the responsibilities and sanctions more precise (Haro-Corales, 2017; Marticorena-Dominguez,2021).

According to the different policy plans, the goal was to solve all the solid waste issues by 2021 (MINAM,2011). The reality demonstrates that the problems have actually worsened. The main reason is the lack of commitment and monitoring of the stakeholders.

In the stage of assembling the evidence, this research has revealed information from official statistics and interviews. Therefore, the examination has been quantitative and qualitative to explain the current situation of Metropolitan Lima. The information related to the official statistics has checked different sources to show the gaps in the reported and the current situation. The interviewees were specialists in the solid waste

sector from different government levels. Each interview has collected their point of view about the policy, management and handling. Moreover, it has included the COVID-19 implications in Metropolitan Lima for exposing the limitations and difficulties faced by the country during the pandemic. Likewise, it has provoked structural changes in solid waste management and handling.

In the stage of building solutions, the proposal was aligned to promote effective mechanisms to articulate the competencies of each stakeholder and enhance the monitoring process because the stakeholders need to be accompanied by a third institution for obtaining tangible results. The feasibility of these solutions is high because they are linked to the mainstreaming of management tools, focus groups, platforms to share best practices, effective communication, enhancing technical capabilities and the enforcement of effective supervision. These solutions can be applied and executed continuously by the central government. They can be part of an updating process in the waste policy, management and handling.

In the stage of selecting the criteria, the scope of the different levels of government needs to be assessed for determining the solutions. Therefore, there are technical and political aspects that should be adjusted for ensuring structural changes. Such as, tracking the training with specific targets measured in different periods contributing to achieving goals permanently; create a platform under the scheme of communities for tying districts and promoting synergy, to discuss the different activities of management and handling to spread the best practices; and clarify the competencies of each stakeholder and execute the appropriate enforcement of the regulatory framework because they are the only way to generate changes in society.

In summary, the approach is normative and applicative regarding different aspects such as “feasibility, effectiveness, equity, efficiency, cost, sustainability and human flourishing” (Mintrom, 2012; Weimer and Vining, 2017). They ensure reachable solutions ensuring significant changes in the solid waste policy, management and handling in Metropolitan Lima.

The modes of governance have a set of criteria such as ‘scale, source of rules, the requirement for collective action, the status of the stakeholder, the role of the

institutions, cost and potential to steer' (Evans,2011). In the particular case of Peru, the network governance has been applied through the signed international agreements and the governing market continues being executed by the regulatory framework. Therefore, transition management and adaptive governance should be applied because these approaches contribute to the focus of solid waste in the two scopes, national and local, that are critical in the solid waste field.

The collective actions need to enhance the regulations and capacities establishing the same basis for all the communities in Metropolitan Lima. Similarly, the articulation between the stakeholders is fundamental, where the stakeholders with the private sector need to reinforce their relation for working together. Furthermore, public institutions need to make a significant change in solid waste management through effective learning. Also, the list of activities needs a budget categorized between medium to high. Therefore, Metropolitan Lima should examine in detail the tasks in management and handling emphasizing teamwork under a scheme of municipality communities.

3.2. Secondary Analysis

The secondary analysis is taking different official sources of information such as the data from the National Institute of Statistics and Informatics (INEI), the Ministry of Environment (MINAM) and Ministry of Economic and Finance (MEF) through National Environmental Information System (SINIA) and Information System for Solid Waste Management (SIGERSOL).

3.3. Qualitative Research

In research with policy implications, it is necessary to gather information from the stakeholders from the different processes of solid waste management and handling. Therefore, the study conducted nine interviews to collect different perspectives from specialists that work at the three governmental levels in Peru. The nine interviews have been 'semi-structured'. The role of the researcher was performing 'participant interviews' because there was a 'questionnaire structured' with three topics. It tackles the solid waste management and handling, waste policy focused on environmental

governance and programs, and the COVID-19 implications in solid waste (Matthews and Ross,2010; Flowerdew et al.,2005).

3.3.1. Interviews

The stages in the interviews have three periods. The first one was 'exploratory research' to identify the specialists that could give valuable information about the topic.

The second stage was inviting them to a previous meeting. The purpose was to explain the scope of the research and the main objectives. When the specialists accept to participate received, they will receive the specific details of the meeting. Before conducting the first interview, the research executed a 'pilot-testing' with two participants for ensuring that every question was clear and direct to get specific information.

The third stage was conducting the interviews. As a previous step, each interview sent me the signed consent form. Then, all the interviews have followed the 'interview guide' elaborated as a supporting document. It set up in the following three steps:

- The first step was reading the confidentiality terms of the research and stating that each interviewee will receive a code as identification to protect their privacy.
- The second was explaining the research objectives briefly.
- The third was sending the transcripts to the interviewees.

In the process of dataset analysis and evaluation, the transcripts have used 'thematic analysis' (Matthews and Ross,2010; Flowerdew et al. ,2005). It has emphasized key terms as solid waste management and handling, waste policy, policy programs, stakeholders and COVID-19. The collected information has different perspectives because the interviewees have vast experience and background in the solid waste sector. Therefore, it has allowing to gather different perspectives and having a multi-sectorial approach in the research.

4. Case Study

The solid waste policy in Peru has experienced many changes from the first management by the General Directorate of Environmental Health (DIGESA) until the current

management of the Ministry of Environment (MINAM). The scope of the study is about the current management because the waste policy has developed plans and guidelines as a reference to structure norms and regulatory framework. They have been applied in solid waste management and handling. However, the results have not been as expected. The most important point is the inclusion of concepts such as the circular economy and 3'R to minimize solid waste generation (Gomez and Flores,2014).

4.1. Metropolitan Lima

The study is analysing the city of Metropolitan Lima, the capital of Peru because it generates the highest quantity of solid waste. Furthermore, the population density is relatively high compared to other cities and it concentrates six communities that tied the different 43 districts of Metropolitan Lima (INEI, 2014). There are differences between these communities in solid waste management and handling in terms of income level and payment performance. Certain districts that are part of Lima Centre have a high-income level and it helps to provide good solid waste management and handling. However, there are other communities that have a lot of limitations due to the lack of environmental awareness in the population, low payment performance, difficult areas that complicated the collection process and they are overpopulated.

The study is focused on these communities that continue presenting difficulties in solid waste management and handling. Therefore, the research is looking for demonstrating the gaps between the solid waste policy, management and handling of those communities that are struggling with these points.

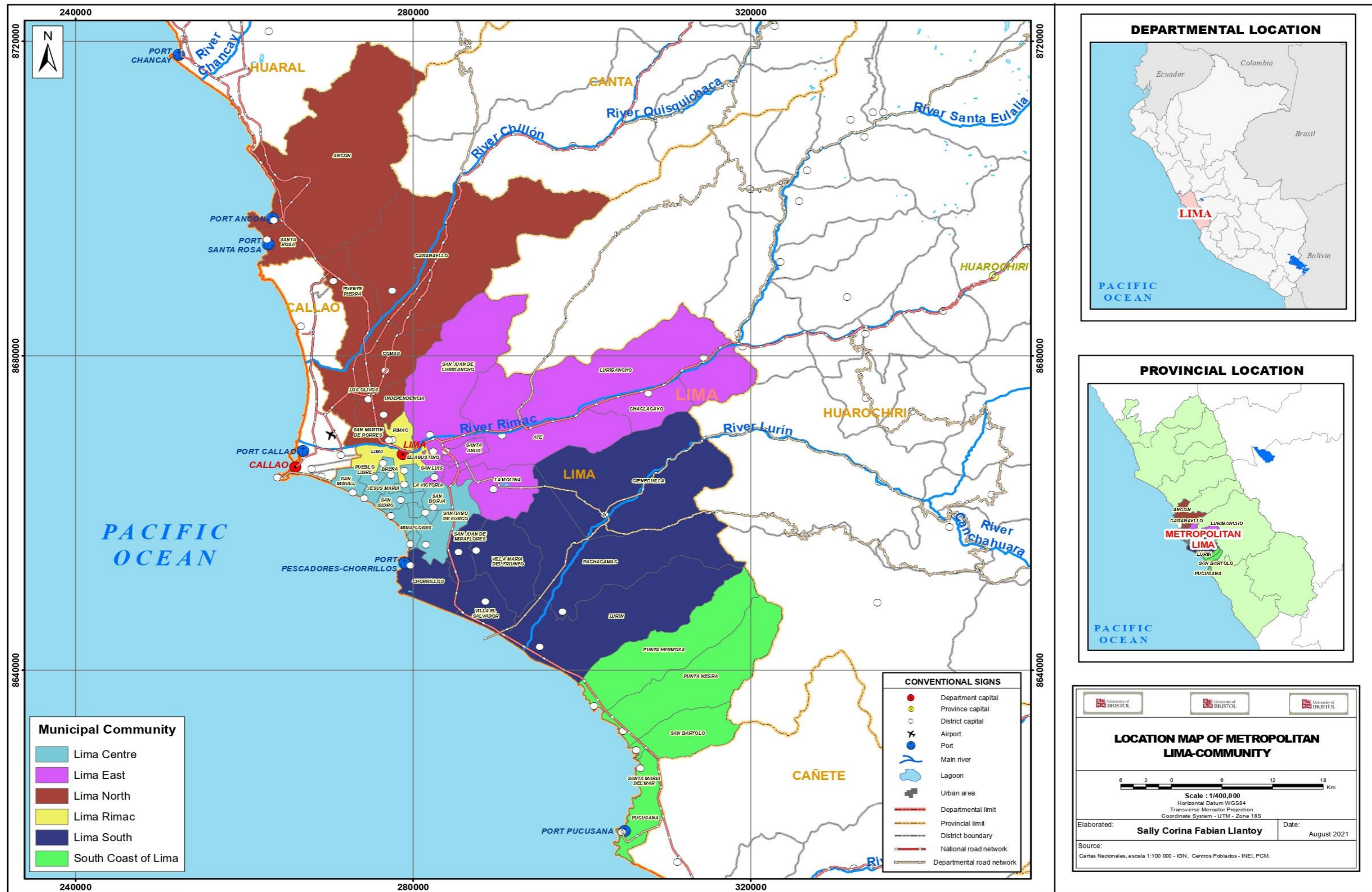


Figure 2. The larger territorial extensions are Lima North with 810 495 205.81 m²., Lima South with 757 809 641.23 m² and Lima East 589 677 092.47 m². The shorter territorial extensions are the South Coast of Lima with 342 072 772.93 m², Lima Centre with 108 245 683.27 m² and Lima-Rimac with 33 588 421.85 m². The higher population density is Lima East with 2 672 454 people, Lima North with 2 623 420 people and Lima South 1 834 232 people. The lower population density is the South Coast of Lima with 48 482 people, Lima Centre with 1 531 581 people and Lima-Rimac with 452 153 people. Map produced by author, using data from INEI (2017), PCM (2020)

4.2. Solid Waste Policy, Regulatory and Operational Framework in Peru

4.2.1. Solid Waste Policy in Peru

Waste Policy is framed in the National Agreement. It also takes into consideration international commitments such as the Millennium Development Goals and Sustainable Development Goals. These points are included in the elaboration of the National Policy of Environment. From this document, there is a variety of alternatives explained in the Multiannual Sector Strategic Plan for the Environmental Sector -PESEM. From an empirical perspective, the National Plan of Environmental Action and the National Agenda of Environmental Action mark the beginning of drivers in the waste policy. Finally, the National Plan of Solid Waste Management is the guide to execute concrete strategies.

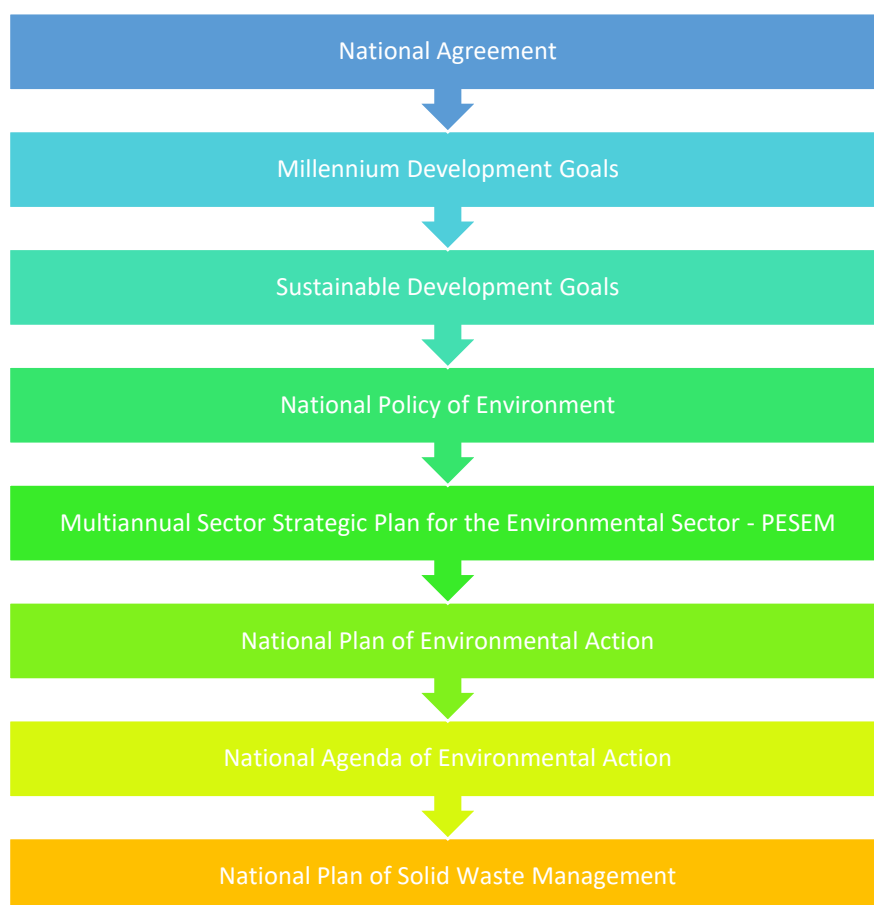


Figure 3. The Peruvian policy has a list of categories for making public policies. The Peruvian waste policy starts from the National Agreement until the National Plan of Solid Waste Management. Illustration produced by author, using data from Abugattás (2018)

The National Agreement (NA) is the core document to elaborate public policies in Peru. It was subscribed in 2002. Therefore, the solid waste topic is part of the nineteen-state policy “Sustainable development and environmental management” of the third objective in NA, which is “Promotion of the Competitiveness of the Country”. It details that “It will promote urban planning, integral management of urban and industrial solid waste stimulating the reduction, reuse and recycle” (Acuerdo Nacional,2002). Thus, the directives of the Peruvian state are aligned with the minimization approach. It should be coherent with the objectives and strategies that the country has been executing through the regulatory framework and assigned competencies to the other governmental organizations.

In 2000, Peru subscribed to accomplish the millennium development goals (MDGs). The point related to solid waste is the seventh objective framed in “guaranteeing the sustainability of the environment”. The aim was related to reducing GHG emissions to face climate change. The deadline to achieve the MDGs was 2015. (United Nations, n.d.)

In 2015, Peru subscribed to accomplish the sustainable development goals (SDGs). The eleventh, “Sustainable cities and communities”, and the thirteenth objective, “Climate Action”, are related to the solid waste policy, management and handling. Having sustainable cities is possible by the development of a circular economy and solid waste minimization. Similarly, effective solid waste management contributes to reducing the concentrations of GHG emissions facing climate change (United Nations, n.d.).

In 2009, the National Policy of Environment was approved by Supreme Decree N°012-2009-MINAM. The first pivot develops the ninth objective, “Mitigation and adaptation to climate change”. It will be achieved through efficient solid waste management and handling. Then, the second pivot is to execute integral management of environmental quality enhancing the life quality of the citizens (MINAM,2009). Therefore, there are guidelines about solid waste management taking into consideration the following aspects:

- To enhance the management by regional and local governments because they are the main stakeholders in the execution.

- To improve the tax collection measures to provide adequate solid waste management.
- To promote environmental awareness to improve solid waste management.
- To apply public and private investments to improve solid waste handling.
- To develop adequate solid waste management and handling considering the population conditions.
- To formalize the recyclers and waste pickers for solid waste handling.
- To handle the dangerous solid waste properly arranging with the sectorial authorities.
- To use adequate infrastructure, facilities and practices in the non-municipal solid waste handling.
- To promote the minimization in the solid waste generation through effective solid waste handling and the final disposal in segregating dangerous solid waste.

In 2016, Multiannual Sector Strategic Plan for the Environmental Sector (PESEM) was approved by Ministerial Resolution N°385-2016-MINAM following the guidelines of the National Centre for Strategic Planning (CEPLAN). One of the prioritized lines is efficient solid waste management and handling through solid waste processes such as generation, segregation, collection, transport, treatment and disposal of municipal and non-municipal solid waste (CEPLAN,2016).

The stakeholders have two categories, the influencer and influenced. Then, MINAM, OEFA, local government (GL), Regional government (GR), private sector and solid waste companies play the role of providing the service and they influence solid waste management and handling. Likewise, there are the citizens, who receive the service being the influenced.

In 2011, the National Plan of Environmental Action was approved by Supreme Decree N°014-2011-MINAM (MINAM,2011). Many issues were exposed to provide solutions. The following statements explain the critical points:

- Exponential growth of the population and urbanization collapsing the execution of solid waste processes.

- There is inadequate solid waste disposal and it brings as a consequence the large quantity of illegal dumpsites.
- The highest percentage of solid waste is organic around 48% and it is not well-segregated or treated.
- Water pollution due to the lixiviates from the dumpsites.
- Unsatisfied demand of collection process in urban areas around 16%.
- Large quantity of commercial company (EC-RS) than service company of solid waste (EPS-RS).

Therefore, the National Agenda of Environmental Action was proposed as a solution by promoting eco-efficiency initiatives applied to the citizens, companies and governmental institutions through different strategies. One of them is the programme “Clean Peru” (Perú Limpio), whose objectives are increasing the coverage of solid waste collection and the processes of waste handling in Peru. The term to solve these issues through strategic actions is 2021 (MINAM,2011).

In 2016, MINAM elaborated the National Plan of Integral Solid Waste Management as an instrument to articulate efforts at three governmental levels. It is aligned to reduce solid waste and control environmental and health risks through environmental education, citizen participation, minimization of the solid waste generation, increase the quality and coverage in the waste services by the selective collection and safe and environmentally final disposal of residual solid waste (MINAM,2016). The Solid Waste Management Information System (SIGERSOL) is a platform that allows tracking the filled information by local governments in Peru as well as contributing to effective supervision.

4.2.2. Solid Waste Laws in Peru

The hierarchy in the Peruvian norms has the following order: Legislative Decree (D.L.), Supreme Decree (D.S.) and Municipal Ordinance. The D.L. has the highest category supported in public policy. The D.S. helps to issue sector laws. The Municipal Ordinance is issued by the local government and is being considered as a guide.

- ❖ Legislative Decree
 - Supreme Decree

- Municipal Ordinance

The D.L. N° 1278-2016 (Ley de Gestion Integral de Residuos Sólidos,2016) is the essential norm for solid waste management and handling because it signified a change in the approach. The norm assumes the waste as a resource and the importance to value for generating benefits to the population. It has classified solid waste into two categories, which are municipal and non-municipal. In the case of municipal, there is a classification stating the household and non-household waste. The main pillars are solid waste minimization as the priority, efficiency in the material use and change in the solid waste perception.

The D.L. N° 1501-2020 (Modifica el D.L. N°1278 que aprueba la Ley de Gestion Integral de Residuos Sólidos,2020) is the updated law because the D.L. N° 1278 had to be adjusted by measures to face the COVID-19.

The D.S. N° 014-2017-MINAM (Reglamento del Decreto Legislativo N°1278,2017) establishes the technical aspects of solid waste management and handling. It is vital for auditing and supervision.

The municipal ordinance N° 1778-2016 (Gestión Metropolitana de Residuos Sólidos Municipales, 2014) is an operational guide for the local government.

4.3. Solid Waste Management and Handling in Peru

The approach of solid waste management and handling has experienced two periods. One of them was with the General Law of Environment N° 27314, where the main process was the final disposal. However, it has changed by means of D.L. N° 1278 with the incorporation of the circular economy.

MINAM and OEFA are part of the central government. The main task of MINAM is related to elaborate waste policy, support the management from a normative approach and propose sector norms. Moreover, OEFA has the main activity to supervise and auditing the compliance of the regulatory framework. The GR and GL are the operators of solid waste management and handling following the national guidelines.

- ❖ MINAM
 - OEFA

- GR
 - GL

4.3.1. Processes

The D.L. N° 1278 describes the ninth process of solid waste management and handling.

1. Maintaining the sanitary conditions of the city by sweeping and cleaning public spaces.
2. Segregating the solid waste by the generators.
3. Storing the solid waste adequately in containers.
4. Collecting the solid waste.
5. Valorising the usable solid waste.
6. Transporting the solid waste.
7. Transferring the solid waste to the treatment plant.
8. Treating the high percentage of solid waste.
9. Disposing the residual solid waste in a landfill.

4.3.2. Compliance

Solid waste management and handling are conceived from the policy. Therefore, the regulatory framework plays the role of monitoring and establish the laws. As a result of observing the current situation, the compliance of the regulatory framework hasn't been adequate, and there are many aspects to improve. The stakeholders to execute the supervision is OEFA.

4.4. Solid Waste Programs in Peru

The waste policy raises different strategies, objectives, challenges and actions. Therefore, the programmes are tools to materialize a variety of strategies.

EDUCCA is a programme promoted by MINAM. The aim is to contribute to environmental education by the awareness population.

Incentive Program or "Programa de Incentivos" is a programme promoted by MEF. It contains a set of goals that every local government should fulfil to receive an economic incentive.

5. Results

5.1. Interviews

They have addressed various topics related to the D.L. 1278, solid waste management and handling, waste policy, programmes, stakeholders and COVID-19.

Regarding the D.L.1278, some points have marked a difference. Firstly, taking the new approaches as the circular economy, solid waste minimization, segregation, treatment and valorisation as pillars to have effective solid waste management and handling. The integral approach to solid waste management and handling implies that the processes work in synergy. It should be assumed as a whole group of concrete actions.

There is a shift in the pyramid prioritizing the minimization instead of the final disposal due to climate change, GHG emissions, health, efficiency and long term. All the interviewees state that D.L. 1278 has set up interesting perspectives from a normative view; however, the empirical application hasn't been favourable because they haven't been executed totally. Therefore, there are no substantial changes in Metropolitan Lima.

The government's environmental policy sets out plans and strategies that are conceptually sound. The policy, written in 2009, aimed to achieve its goals by 2021. However, it has not been followed through and very little has improved. The interviewees agree that the government's environmental policy clearly explains the aims. Nevertheless, the monitoring of the strategic actions has been left out. Consequently, the strategies haven't been executed properly and it demonstrates that there is no synergy between the different stakeholders.

The reasons for having inefficient solid waste management and handling are political, technical, legal and economic. The political aspect is affected by local authority changes every four years through election. This means that the work that has been established over the previous four years is stopped and new changes often cause distribution to any continuity. It generates critical points and aggravating inefficient management due to the lack of provision of the waste processes. Each mayor decides to hire the close team of the electoral campaign, however, many of these team members do not have technical qualifications to perform the appropriate solid waste management and handling.

Therefore, solid waste management and handling face a complex situation for each regime change. The execution of improvement is assessed again for the new regime. Therefore, the political change generates obstacles instead of facilities to improve solid waste management.

Concerning the technical aspect, the interviewees agree that the general guidelines are well-defined. However, there are some empirical cases that nobody knows how to solve, generating difficulties in solid waste management and handling. Therefore, the update of the regulatory framework should be executed as soon as possible considering information through the examination of a case-by-case basis.

MINAM executes different training and workshops to enhance the capabilities of the professionals in the solid waste sector. However, the professionals of the local government state that they are good initiatives but do not have enough time to execute the new knowledge. Moreover, there is no tracking system to measure if the provided information is being applied in the local government. The initiatives are ineffective instruments because none of them are applied to improve solid waste management and handling.

MINAM elaborates guidelines for developing structural plans. Nevertheless, few municipalities have elaborated it, while many municipalities indicate that they do not have enough skills and tools to do so. Therefore, the planning that is a crucial step to run an efficient process is not elaborated by the local governments having as the foreseeable result more complexities instances of solutions in solid waste management and handling.

In relation to the legal aspect, the interviewees were precise that there are loopholes at the level of competencies and regulatory framework. There are different situations that the norms do not help to find a solution and they contradict other legal clauses, provoking confusion and delays in providing answers. Therefore, it is necessary to assess in detail the different clauses with the stakeholders for correcting and clarifying the responsibilities. One significant deep loophole was the responsibility of the local government or the central government for assuming the collection process of solid waste due to the COVID-19 pandemic. The situation was very complicated; however, the

pandemic context helps to pressure the governmental levels for executing quick and feasible solutions. The enforcement of the regulatory framework needs to be strengthened progressively. As an example, OEFA cannot supervise the local governments because many of them do not elaborate on the integral plan of solid waste management and handling. The responsibility becomes ineffective because they do not have any documents to audit.

When considering the economic aspect, the allocated budget and the tax collection are the key sources of revenues to execute solid waste management and handling. The annual budget should be used effectively because it represents a basis amount given by the MEF. However, the tax collection is a huge challenge because the pay-for-performance culture is very low in Metropolitan Lima.

There are not enough incomes to deploy strategies and improvements. Therefore, the costs for displaying programmes, strategies and efficient solid waste management and handling are higher being the main justification for having a current inefficiency because the local governments in Metropolitan Lima can't afford those expenses.

The compliance of the regulatory framework and policies in solid waste management and handling is poor, provoking gaps between the different districts in Metropolitan Lima. The main consequence of not having compliance is the number of dump sites that are located in different parts of Metropolitan Lima generating infectious vectors and polluting the soil, water and air.

As a mechanism to enforce the law, MEF has been executed the programme called "Programa de Incentivos" which is conceived to achieve objectives for having proper solid waste management and handling. Each year, the programme establishes objectives and the incentive is the allocation of money for the competitors that achieve all these goals. The interviewees agree that the programme has had good outcomes. However, it should be adjusted and tracked to ensure the appropriate managing of the fundings. The adjustment needs to be fair because every district in Metropolitan Lima has more difficulties than others. Therefore, it will be more effective if the proposed goals coincide with the different realities for ensuring that most of the districts can enhance their solid waste management and handling.

The programme called “EDUCCA” is an important initiative for environmental awareness through education. Many interviewees stated that it was successful in some districts, where people know how to segregate properly and composting their organic fraction. The main objective of “EDUCCA” is to reach the environmental concepts and solutions to the population by teaching and doing commitment to change the current situation.

The consequences of the COVID-19 have displayed the gaps between the policy, the management and handling. Also, it has exposed the necessity to build an interdisciplinary team of experts for gathering the main issues in the empirical side of the solid waste sector.

The team should have communication streams to disseminate the strategic actions widely. The pandemic has created many difficulties and continuous challenges. The operators of the solid waste collection process did not have safety equipment and the local governments did not have enough revenues to provide them. There was a complex situation, where the municipality did not have any income to pay to the employees.

The immediate action of the central government was transferring money to continue providing the solid waste processes. The lack of segregation of toxic waste such as the masks and other material used by a COVID-patient has delivered a higher risk of infection generating a loss of human lives. The main activity of the central government was to elaborate guidelines to treat this toxic waste, however the population in Metropolitan Lima does not know how to segregate. Informing the population about this continues to be a challenge that should be solved as early as possible.

The consensus point between the specialists is the urgency to articulate the actions and competencies of the stakeholders. It will be a platform under a scheme of municipal communities starting from a planning stage for elaborating effective plans of action. The constant monitoring of the strategic actions will ensure the improvement and accurate solutions for the solid waste issues. The best practices from certain districts of Metropolitan Lima should be replicated and executed. It will be possible through the proper dissemination. Furthermore, the importance to do research and reinforce the partnership with the private sector is vital for getting results quickly and receiving funding progressively.

5.2. Secondary sources

The solid waste generation is 1.1 Kg per capita with a total of 9 901 tonnes daily in Metropolitan Lima (MUNLIMA,2019b). The daily average amount of collected solid waste is 9 479 781 Kg in Metropolitan Lima. There are varying frequencies to waste collections within the different districts, and 10% of the population have no waste collection service at all (INEI,2018a; MINAM, 2017). To illustrate this, thirty-eight districts collecting daily, four districts collecting every second day and one district collects solid waste two days per week (INEI,2018b). The total amount collected for disposal in landfills is about 2 898 275.77 tonnes (MINAM, 2018). Of the 43 districts, 24 districts recycle their waste, 17 districts dispose in landfills, one dispose in a dumpsite, and one opts to burn it (INEI,2018c).

According to the official statistics of INEI, the generation of household solid waste has increased gradually from 2000 until 2019, Metropolitan Lima being three times higher in 2019 compared with 2000. It is important to note that the generation has not experienced any reduction during the analysis from 2016 to 2019 despite the policy strategies, programs and the regulatory framework.

In 2019, the household solid waste generation was 2 370 938.6 tonnes with 0.63 Kg per capita, while the total solid waste was 3 375 280.3. The household solid waste represents about 70% of the total solid waste (MINAM, 2019c).

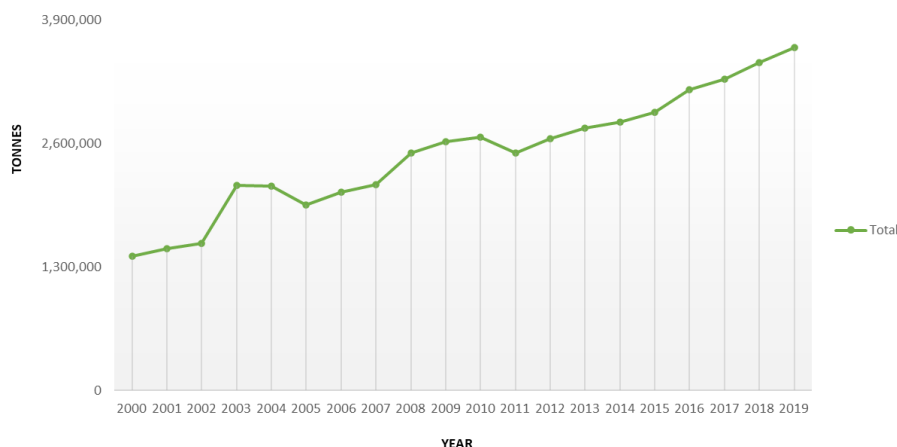


Figure 4. Household Solid Waste Generation. It has increased around 5% annually from 2000 to 2019. It was 1 411 612 tonnes in 2000. Graph produced by author, using data from MINAM (2019a)

Metropolitan Lima has six communities. They tied the 43 districts in the following order, Lima Centre (13), Lima East (8), Lima North (8), Lima South (7), Rimac- Lima (2) and South Coast of Lima (5).

The household solid waste generation by communities in Metropolitan Lima reveals that four communities generate the highest quantities. One of them is Lima Centre that ties the higher number of districts. The others are Lima East, Lima South and Lima North because these communities concentrate on the districts with the highest population density. Overall, household solid waste generation has increased in most of the communities and continue steady in two communities (Rimac- Lima and South Coast of Lima) from 2016 to 2019.

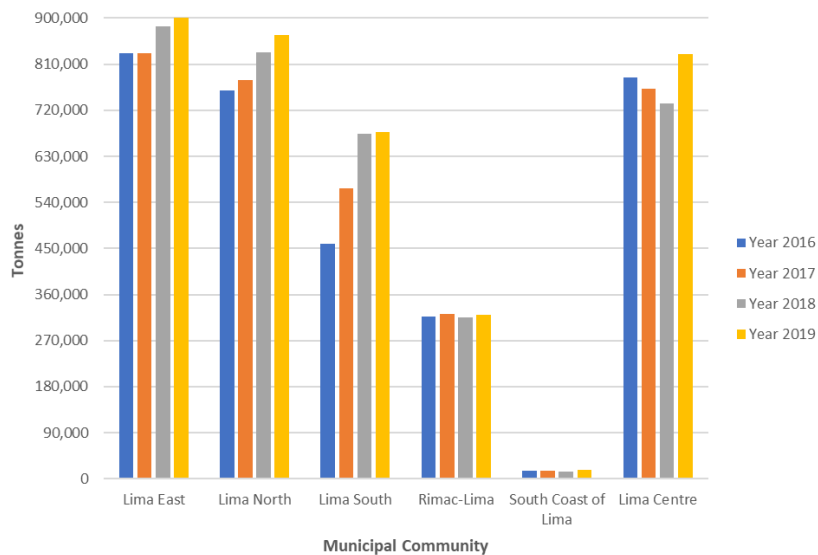


Figure 5. Household Solid Waste Generation by Municipal Community. Graph produced by author, using data from MUNLIMA (2019a)

The expense per capita of solid waste in Metropolitan Lima was 70.72 soles (~12.49 pounds) in 2019, with the annual expense in solid waste management and handling 697 920 042 soles (~123 296 383.10 pounds) in 2018, totally an annual budget of 834 560 941 soles (~147 435 722.30 pounds). The overall amount invested in solid waste projects is 19 556 172 soles (~3 454 844.58 pounds) (MEF,2019).

In addition to this, the cost of sweeping is approximately 157 million soles (~27 965 406.62 pounds) on average for the communities of Lima Centre, Lima East and Lima

North. Nevertheless, the tax collection is the income of the municipalities, however, it is very low at 58 million soles (~10 331 169.32 pounds). Therefore, it is notable to conclude that there is inefficiency in solid waste management and handling because there is not enough money to appropriately fund this. Furthermore, a constant issue in the examination of the data is that many districts have not reported their expenses, creating a limitation of data (MINAM,2019d).

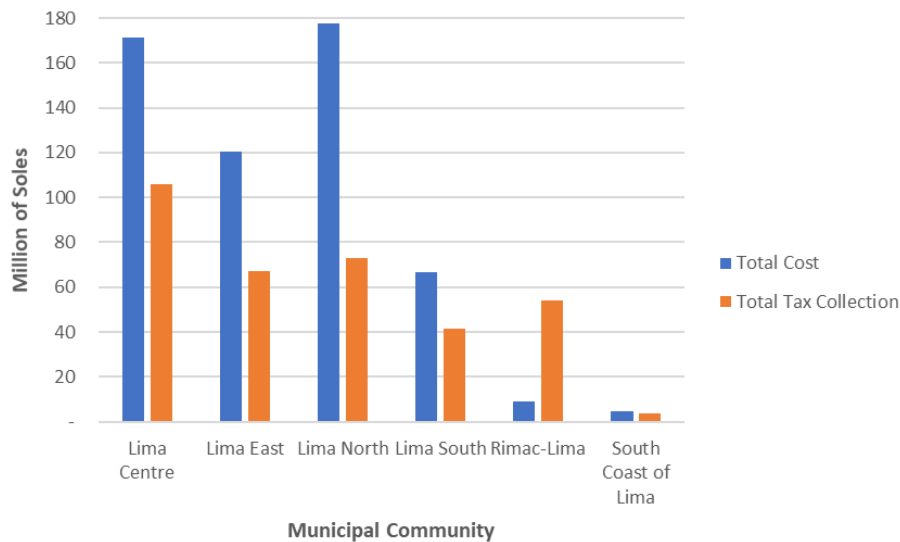


Figure 6. Cost vs Tax Collection. Graph produced by author, using data from MINAM (2019d)

The communities in Metropolitan Lima show different performances within their individual processes for solid waste management and handling. For instance, the solid waste volume from the sweeping and cleaning of public spaces process is highest in Lima Centre whereas the communities with a higher population density, such as Lima East and Lima North have fallen behind. This makes the gaps in data reports from some districts in Lima South clearer to detect. Therefore, it is logic to say that there are gaps in the processes between the districts of the different communities (MINAM,2019d).

The different communities have valorised around 1.3% of the total household solid waste being Lima Centre with the higher value. Then, Lima North and Lima East focusing more on inorganic solid waste; however, the aim to valorise is to work with organic and inorganic fraction in the same way (MINAM,2019e).

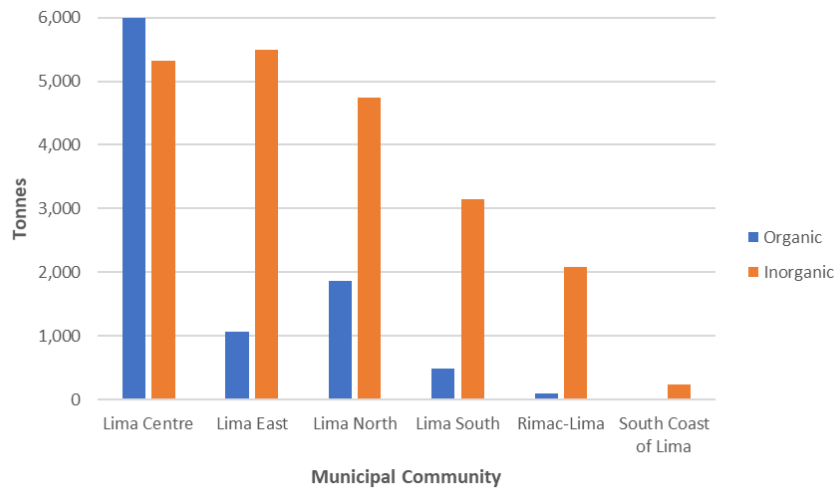


Figure 7. Valorisation. Graph produced by author, using data from MINAM (2019e)

According to the final disposal, the communities of Metropolitan Lima display different costs being Lima Centre that expenses about 96 million of soles (~17 099 866.47 pounds) in comparison to other communities that less than half. Therefore, it is foreseeable that most of the districts of Lima Centre have better solid waste management and handling than the others such as Lima East, Lima North, Lima South, Rimac-Lima and South Coast Lima (MINAM,2019f).

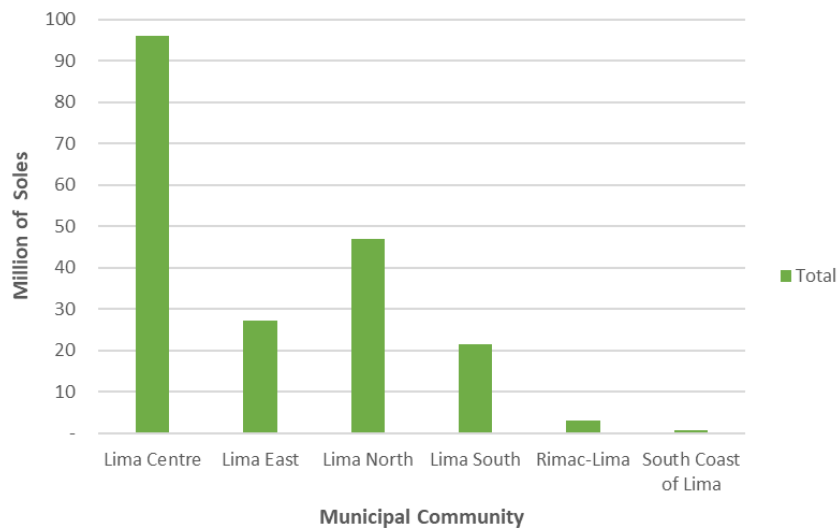


Figure 8. Final Disposal Cost. Graph produced by author, using data from MINAM (2019f)

One of the critical points in solid waste management and handling is the planning stage. As Figure 9 illustrated, the district and provincial plans are low in the different communities in Metropolitan Lima. The best cases are Lima Centre and Lima East for

having between eleven to sixteen plans, and the same amount should be in the other communities; however, the ordinance quantity is between twenty to twenty-five in handling and taxes. It implies that the aim of planning is leaving behind for focusing on dictating laws through ordinances (MINAM,2019g).

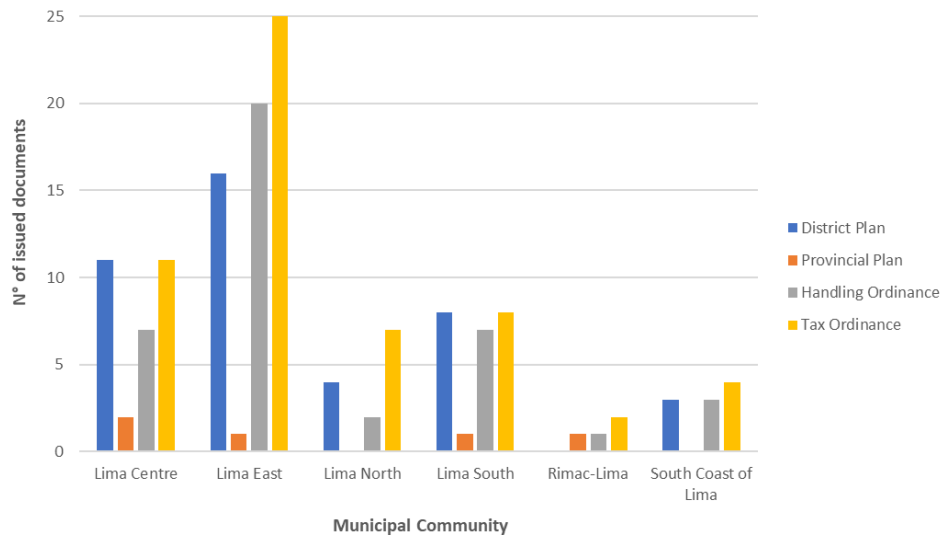


Figure 9. Issued documents of Solid Waste Management and Handling. Graph produced by author, using data from MINAM (2019g)

In the case of EDUCCA program, the community of Lima Centre has implemented it in a 77% and Lima North around 75%; however, the cases such as Lima East, Lima South and Rimac-Lima have implemented on average 52%, and South Coast of Lima with 20%. Therefore, it is consistent to say that there are gaps in the EDUCCA program implementation between the communities and it demonstrates the reason for Lima Centre has better solid waste management and handling than others (MINAM,2019h).

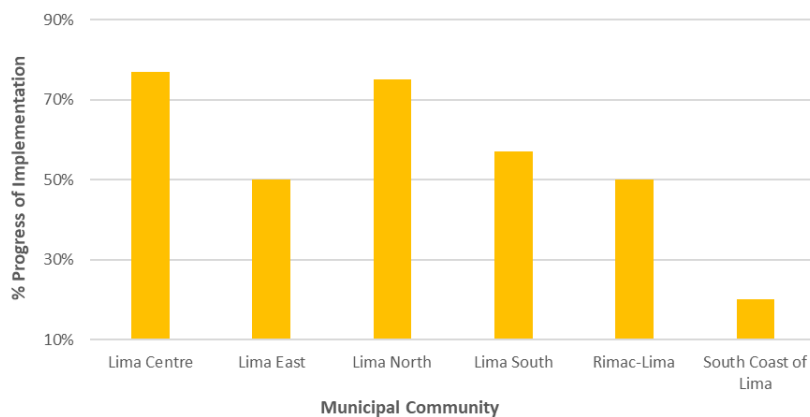


Figure 10. EDUCCA Program Implementation. Graph produced by author, using data from MINAM (2019h)

6. Discussion

Currently, the measurement of the strategic goals in Metropolitan Lima is a list of shallow details that is not adjusted to the main issues of the different districts in Metropolitan Lima. The majority of the districts do not achieve any potential goal being the supervision, a mere formality sent to the central government. The shift should be structural because many strategies are not adjusted to the current issues in solid waste management. Thus, the examination should be deeper to identify the gaps and run proposals to solve them. Then, the monitoring and measuring of the strategic actions and goals are fundamental to effectuate the policy strategies correctly. The assessment should be adjusted specifically to solve the issues of each municipality because it helps to raise immediate solutions (Staristona et al.,2018).

The central government of Peru needs to make commitments with the different regimes in Metropolitan Lima stating that every improvement should continue despite the fact of change the regime. Each stakeholder in the solid waste sector should follow the guidelines to ensure the full implementation of the strategic activities. Thus, the planning stage in each district of Metropolitan Lima is the basis to generate concrete actions. Similarly, the pay-for-performance culture needs to be solved as soon as possible because it is one of the biggest problems in Metropolitan Lima, and it means a barrier for deploying initiatives. Therefore, the key to achieving concrete goals is associated with the willingness of the politicians, policy-makers and the stakeholders to generate transcendental changes in solid waste management and handling. Each stakeholder should be aware of the competencies and the roles assigned in the sector and it should be joined by a favourable economy that allows deploying strategies and programmes properly (De Jaeger et al., 2011).

The main barriers to executing solid waste management and handling are related to the political issues in Metropolitan Lima. Then, a set of drivers should be deployed in the bureaucratic and political aspects to ensure the proper implementation of the national policies because these aspects can impede the correct execution (Cornea, Veron, and Zimmer,2017). It should be accompanied by monitoring and planning because they identify quickly for enhancing the stakeholder's activities in solid waste management and handling.

The approach of minimization is the essential solution to have better solid waste management and handling. However, it needs to be developed as the recycling process to be effective. It is well-known that the recycling process took time to be understood and shared in the population. Thus, minimization is the only way to reduce substantially the solid waste contributing to the low final disposal (Masullo, 2017).

The vital stakeholder in solid waste management and handling is the population because they are the main generators and their actions are decisive to improve and deteriorate the current situation (McAllister,2015; Lopez,2007). The Peruvian waste policy tackles minimization as a pillar, yet it has not been applied properly. The programme “EDUCCA” aims to teach the population how to segregate and compost their solid waste with a minimization approach.

The clear strategy for having success in policy is joining the social component as the basis because all the actions related to solid waste management and handling are looking for protecting the environment and the health of the population (Pires, Martinho and Chang,2011). It has been implemented in some districts in Metropolitan Lima such as the Municipality of Comas.

The programme “EDUCCA” has been very successful due to the collective of professionals providing expertise through the virtual workshop, composting campaigns, reusing the plastic to produce bags and oil to produce soaps with a committed group of the population. Thus, the approach of minimization can be achieved as long as the local government should be committed to deploy effective measures and continue tracking the activities to improve them.

The circular economy perspective is crucial to insert profitable solid waste into the production system and minimize the residual waste. Therefore, the 3’Rs approach is important because reducing the amount of solid waste is a minimization, reusing extends the shelf-life of the products, and recycling allows to include in different productive processes (Conke, 2018).

There are some issues related to the informal and formal sectors that face market pressure with the lack of infrastructure in economies such as LAC (Hoornweg and

Giannelli, 2007). The solid waste policy in Peru has the circular economy as a fundament included in the regulatory framework, however it is not applied in the reality.

The main challenge is to build a set of coordinated actions related to the policy, management, handling, technology, research and behavioural themes for running strategic actions based on the circular economy (Vergara and Tchobanoglous, 2012). It allows deploying a set of actions that will improve the current solid waste management and handling in Metropolitan Lima because any district of Metropolitan Lima has implemented the integral approach of the circular economy.

The economic component is vital in solid waste management and handling because the processes are a set of services attending to the demand of the population and the provider is the local government (De Jaeger et al., 2011). Therefore, it is necessary to assess solid waste management and handling from an economic perspective because it will provide market conditions to be more attractive to the solid waste sector.

The number of investments related to enhancing the solid waste infrastructure has increased year by year because they are megaprojects, whose benefits contribute to society and the country if they are executed (Ziegler-Rodríguez et al., 2019). Thus, the current solid waste management and handling need to include an economic perspective to improve the payment-for-performance culture in Metropolitan Lima because it is critical and the main reason for not having funds to do any activity.

The strategy will be providing a good service, and the population need to be aware of it paying their taxes on time. The investment received from international cooperation in Metropolitan Lima is usual, however there is no infrastructure or outcomes from these megaprojects. Therefore, it is necessary to monitor the funds and the results.

The final disposal in landfills has represented a constant challenge to many countries because landfills have a period of shelf life and they pollute the soil. There are new technologies such as the composting of organic waste, incineration and anaerobic digestion as alternatives to avoid polluting the environment and being more efficient in the final disposal (Sinha et al., 2011). Moreover, these alternatives such as incineration or anaerobic digestion take advantage of solid waste to produce energy (Al-Salem, Evangelisti and Lettieri, 2014) reinforcing the circular economy approach.

The critical issues in Metropolitan Lima are the number of dumpsites and the status of landfills because placing the solid waste in a dumpsite is illegal, but they are still increasing. In the case of the status of the landfills, they are ancient and there are initiatives to close them for building new ones but there are no funds to do it.

The previous waste policy was focused on generating more landfills as a solution, but the current policy and regulatory framework are looking to minimize saving costs in final disposal by applying a circular economy. The specialists affirm that landfills are lower than incineration and anaerobic digestion because these alternatives are more expensive. On the other hand, the highest percentage of solid waste is organic and it is the opportunity to emphasize composting.

The partnership between the public and private sectors is an important mechanism to facilitate different activities. For instance, reducing bureaucratic procedures, reinforcing the solid waste market and services, making alliances to accomplish particular goals and generating fundings to improve solid waste management and handling (Hettiarachchi, Ryu, Caucci, and Silva, 2018; Dorvil, 2008). Therefore, the policy-makers in Peru needs to reinforce the partnership with the private sector because the relation is not consistent.

The first step will be promoting that solid waste processes should be improved and more efficient to avoid the critical points of solid waste accumulation. The second step will be supporting the recycling alliances to reuse the profitable solid waste. The third step is contributing to implementing technologies in the solid waste processes to improve efficiency.

Currently, the relation between the private sector and the local government in Peru is not productive. As a result of that, different companies offer poor services and the local municipalities accept due to the lack of budget. Therefore, it is necessary to rebuild the partnership to ensure better alliances.

7. Policy Recommendations

It is advisable to create a group of specialists from the different government levels who update and collect the most important information on issues. It will be an important input to change the current policy and regulatory framework. This group should gather

the main obstacles that stakeholders are facing to propose solutions. The group should consist of multidisciplinary specialists to tackle the politics, economics, legal and social aspects.

The management tools such as SINIA and SIGERSOL should be improved because the information is the key to make decisions. Therefore, the data should be validated and presented accurately because it is fundamental for elaborating strategies and plans of action.

The programme as EDUCCA needs to be expanded because environmental awareness is fundamental to make changes in the population and the segregation should be generalized in Metropolitan Lima, as a law, to face properly the COVID-19 context.

8. Conclusions

The main gaps in solid waste management and handling are the partial planning, the limitation of the technical capabilities and lack of monitoring to execute the waste policy effectively in Metropolitan Lima. The waste policy in Peru gathers vital points, nonetheless, the strategies need to be adjusted and updated with current situations. Therefore, it is crucial to reinforce the planning in the first stage because the municipal communities in Metropolitan do not have an adequate district or provincial plan. It constantly happens due to the limitation of technical capabilities in professional teamwork. Then, it is necessary to detect the specific issues by monitoring for bringing support and solutions. Consequently, the policy needs to be appraised in different periods for ensuring effectiveness. At the same time, it needs to gather the technical knowledge well-defined to be communicated to the stakeholders properly.

The articulation between the stakeholders is the essential finding of this research due to the lack of synergy between them has provoked inefficiency in solid waste management and handling. The approach of working as a community could be an important step to generate concrete changes in Metropolitan Lima. Thereupon, Metropolitan Lima should strengthen the municipal community building a platform to unify efforts because each municipal community has different districts that some of them have a good management and handling and others, not. Thence, it is necessary to align all the districts to a same basis for each municipal community. Subsequently,

elaborating a plan as community will be valuable to determine the same goals allowing to overcome the current challenges.

This research has explained and proved that solid waste management and handling need immediate solutions because the exponential population growth is increasing, and the government does not have the infrastructure to deal with the situation. Therefore, improving solid waste management and handling is a continuous process that needs to be tracked constantly for ensuring effectiveness accompanied by the commitment of the stakeholders. Likewise, environmental awareness plays an important role to execute the strategies properly. Indeed, reinforcing educational programs such as 'EDUCCA' focused on minimization will help to improve solid waste management and handling in Metropolitan Lima. Finally, researching waste policy allows to identify the bottlenecks and it should be replicated for the whole country with the purpose to develop an effective policy applicable in every city of Peru.

9. Future Work

The monitoring should make a cost-benefit analysis as a measurement tool after implementing the new policies, strategies and plans of action because it allows assessing the efficiency. It should be executed periodically and adjusted to the demands of the stakeholders (De Jaeger et al., 2011) whilst provide waste relief strategies to support the solid waste management processes. It will contribute to generating efficiency schemes about the achieved and the target promoting continuous improvement (Nogueira and Jorge, 2016).

Environmental awareness and education have an extensive path. It is necessary to state that people realize the value and the use of something through a practical immersion in it (Requena Sánchez, Carbonel Ramos and Vallester, 2021). Therefore, workshops about environmental education provide knowledge to the population. These workshops tackle topics such as segregation, minimization, treatment and valorisation in solid waste. The main outcome is to demonstrate that people can get profits if they execute them properly.

10. References cited

Abarca Guerrero, L., Maas, G. J. and Hogland, W. (2013) "Solid Waste Management Challenges for Cities in Developing Countries," *Waste Management*, 33(1), pp. 220–232. doi: 10.1016/J.WASMAN.2012.09.008.

Abugattás, J. (2018) "Mejora inmediata con perspectiva de largo plazo, la Agenda al 2030 y más" [PowerPoint presentation]. Presidencia del Consejo Directivo (PCD): Centro Nacional de Planeamiento Estratégico (CEPLAN). Available at: <https://www.cepal.org/sites/default/files/events/files/abugattas.pdf> (Accessed: June 6, 2021)

Acuerdo Nacional. (2002) "19. Desarrollo sostenible y gestión ambiental". Available at: <https://www.acuerdonacional.pe/politicas-de-estado-del-acuerdo-nacional/politicas-de-estado%e2%80%8b/politicas-de-estado-castellano/iii-competitividad-del-pais/19-desarrollo-sostenible-y-gestion-ambiental/> (Accessed: June 7, 2021)

Alam, P., & Ahmade, K. (2013). Impact of solid waste on health and the environment. *International Journal of Sustainable Development and Green Economics (IJS DGE)*, 2(1), 165-168. Available at: https://www.researchgate.net/publication/306150450_Impact_of_Solid_Waste_on_Health_and_The_Environment (Accessed: July 31, 2021).

Al-Salem, S. M., Evangelisti, S. and Lettieri, P. (2014) "Life Cycle Assessment of Alternative Technologies for Municipal Solid Waste and Plastic Solid Waste Management in the Greater London Area," *Chemical Engineering Journal*, 244, pp. 391–402. doi: 10.1016/j.cej.2014.01.066.

Asase, M., Yanful, E., Mensah, M., Standford, J. and Amponsah, S. (2009) "Comparison of Municipal Solid Waste Management Systems in Canada and Ghana: A Case Study of the Cities of London, Ontario, and Kumasi, Ghana," *Waste Management*, 29(10). doi: 10.1016/j.wasman.2009.06.019.

Baud, I., Grafakos, S., Hordijk, M. and Post, J. (2001) "Quality of Life and Alliances in Solid Waste Management," *Cities*, 18(1), pp. 3–12. doi: 10.1016/S0264-2751(00)00049-4.

Bardach, E., Patashnik, E. M. and Patashnik, E. M. (2016) A practical guide for policy analysis : the eightfold path to more effective problem solving. Fifth edn. Thousand Oaks, California: CQ Press.

Bustos Flores, C. (2009) "La Problemática De Los Desechos Sólidos," *Economía*. Available at:

https://www.researchgate.net/publication/237028827_La_problematika_de_los_desechos_solidos (Accessed: July 27, 2021).

Cairney, P. and Kwiatkowski, R. (2017) "How to Communicate Effectively with Policymakers: Combine Insights from Psychology and Policy Studies," *Palgrave Communications*, 3(1). doi: 10.1057/s41599-017-0046-8.

Cairney, P. (2021) *The politics of policy analysis*. Cham: Palgrave Macmillan (Palgrave pivot). doi: 10.1007/978-3-030-66122-9.

Cetrulo, T. B., Molina Cetrulo, N., Cunha Marques, R. and Silva Pinto, F. (2018) "Effectiveness of Solid Waste Policies in Developing Countries: A Case Study in Brazil," *Journal of Cleaner Production*, 205, pp. 179–187. doi: 10.1016/j.jclepro.2018.09.094.

Centro Nacional de Planeamiento Estratégico, CEPLAN. (2016) "Plan Estratégico Sectorial Multianual del Sector Ambiental (2017-2021)". Available at: https://www.ceplan.gob.pe/documentos_/plan-estrategico-sectorial-multianual-pesem-ambiente-2017-2021/ (Accessed: June 8,2021)

Chen, Y.-C. and Lo, S.-L. (2016) "Evaluation of Greenhouse Gas Emissions for Several Municipal Solid Waste Management Strategies," *Journal of Cleaner Production*, 113, pp. 606–612. doi: 10.1016/j.jclepro.2015.11.058.

Cobo, S., Dominguez-Ramos, A. and Irabien, A. (2018) "From Linear to Circular Integrated Waste Management Systems: A Review of Methodological Approaches," *Resources, Conservation & Recycling*, 135, pp. 279–295. doi: 10.1016/j.resconrec.2017.08.003.

Conke, L. S. (2018) "Barriers to Waste Recycling Development: Evidence from Brazil," *Resources, Conservation & Recycling*, 134, pp. 129–135. doi: 10.1016/j.resconrec.2018.03.007.

Contreras S, Maira J (2008). Evaluación de experiencias locales urbanas desde el concepto de sostenibilidad: el caso de los desechos sólidos del municipio de Los Patios (Norte de Santander, Colombia). *Trabajo Social* (10), 109-134. Available at: <https://revistas.unal.edu.co/index.php/tsocial/article/view/14084> (Accessed: July 26, 2021)

Cornea N, Veron R and Zimmer A (2017) "Clean City Politics: An Urban Political Ecology of Solid Waste in West Bengal, India," *Environment and Planning A*, 49(4), pp. 728–744. doi: 10.1177/0308518X16682028.

Da Silva, L., Marques Prietto, P. D. and Pavan Korf, E. (2019) "Sustainability Indicators for Urban Solid Waste Management in Large and Medium-Sized Worldwide Cities," *Journal of Cleaner Production*, 237. doi: 10.1016/j.jclepro.2019.117802.

De Jaeger, S., Eyckmans, J., Rogge, N. and Van Puyenbroeck, T. (2011) "Wasteful Waste-Reducing Policies? The Impact of Waste Reduction Policy Instruments on Collection and Processing Costs of Municipal Solid Waste," *Waste management (New York, N.Y.)*, 31(7), pp. 1429–40. doi: 10.1016/j.wasman.2011.02.021.

Dorvil, L. (2008) Private sector participation in integrated sustainable solid waste management in low-and middle income countries. Dissertation. Available: <https://www.e-helvetica.nb.admin.ch/search?q=bel-129671> (Accessed: July 25, 2021).

Dunn, W. N. (2017) *Public policy analysis : an integrated approach*. New edition 6 edn. London: Taylor and Francis. Available at: https://books.google.co.uk/books?id=mqAvDwAAQBAJ&printsec=frontcover&source=gbs_ViewAPI&redir_esc=y#v=onepage&q&f=false (Accessed: August 21, 2021).

European Commission. (2018). Directive 2008/98/EC on Waste (Waste Framework Directive). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705> (Accessed: July 15, 2021).

Evans, J. P. (2011) *Environmental governance*. Hoboken: Taylor & Francis (Routledge Introductions to Environment: Environment and Society Texts). Available at: <https://public.ebookcentral.proquest.com/choice/publicfullrecord.aspx?p=958051> (Accessed: August 12, 2021).

Ferronato N and Torretta V (2019) "Waste Mismanagement in Developing Countries: A Review of Global Issues," *International journal of environmental research and public health*, 16(6). doi: 10.3390/ijerph16061060.

Flowerdew, R. and Martin, D. (2005) *Methods in human geography : a guide for students doing a research project*. 2nd edn. Harlow, England: Prentice Hall. Available at: <https://ebookcentral.proquest.com/lib/bristol/detail.action?docID=1461044> (Accessed: August 14, 2021).

Gestión Metropolitana de Residuos Sólidos Municipales (2014) *El Peruano* pp.518557-518566. Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/normas/gestion-metropolitana-residuos-solidos-municipales> (Accessed: August 19, 2021)

Ghisellini, P., Cialani, C. and Ulgiati, S. (2016) "A Review on Circular Economy: The Expected Transition to a Balanced Interplay of Environmental and Economic Systems," *Journal of Cleaner Production*, 114, pp. 11–32. doi: 10.1016/j.jclepro.2015.09.007.

Gómez de Zea, R., & Flores, F. (2014). *Ciudades sostenibles y gestión de residuos sólidos*. Lima: Universidad del Pacífico, Centro de Investigación. Available at: <http://hdl.handle.net/11354/2301> (Accessed: August 17, 2021).

Haas, W., Krausmann, F., Wiedenhofer, D. and Heinz, M. (2015) "How Circular Is the Global Economy?: An Assessment of Material Flows, Waste Production, and Recycling in the European Union and the World in 2005," *Journal of Industrial Ecology*, 19(5), pp. 765–777. doi: 10.1111/jiec.12244.

Haro Corales, V. O. (2017). *Diseño de estrategias que contribuyan a reducir la contaminación ambiental generada por los residuos sólidos en la ciudad de Lima al año 2021*. Universidad Nacional de Ingeniería. Available at: <http://cybertesis.uni.edu.pe/handle/uni/6157> (Accessed: August 1, 2021).

Hernández-Berriel, M., Aguilar-Virgen, Q., Taboada-Gonzales, P., Lima-Morra, R., Eljaiek-Urzola, M., Marquez-Benavides, L. y Buenrostro-Delgado, O. (2017). "GENERACIÓN Y COMPOSICIÓN DE LOS RESIDUOS SÓLIDOS URBANOS EN AMÉRICA LATINA Y EL CARIBE,"

Revista Internacional de Contaminación Ambiental. doi:
<http://dx.doi.org/10.20937/RICA.2016.32.05.02>

Hettiarachchi, H., Ryu, S., Caucci, S., Silva, R., 2018. « Municipal solid waste in Latin America and the Caribbean: issues and potential solutions from the governance perspectives”. *Recycl.* 3, 19. <https://doi.org/10.3390/recycling3020019>

Hoornweg, D. and Bhada-Tata, P. (2012). *What a Waste : A Global Review of Solid Waste Management*. Urban development series; knowledge papers no. 15. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/17388> License: CC BY 3.0 IGO.

Hoornweg, D. and Giannelli, N. (2012) *Managing municipal solid waste in Latin America and the Caribbean: integrating the private sector, harnessing incentives*. Washington, DC: World Bank (Gridlines, 28). Available at: <http://hdl.handle.net/10986/10639> (Accessed: July 10, 2021).

Huang, G. H., Linton, J., Scott Yeomans, J. and Yoogalingam, R. (2005) “Policy Planning Under Uncertainty: Efficient Starting Populations for Simulation-Optimization Methods Applied to Municipal Solid Waste Management,” *Journal of Environmental Management*, 77(1), pp. 22–34. doi: 10.1016/j.jenvman.2005.02.008.

Instituto Nacional de Estadística e Informática, INEI (2014).” *Una Mirada a Lima Metropolitana*”. Available at: http://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitaless/Est/Lib1168/libro.pdf (Accessed: July 5, 2021).

Instituto Nacional de Estadística e Informática, INEI (2017).” *Censos Nacionales 2017: XII de Población, VII de Vivienda y III de Comunidades Indígenas*”. Available at: <http://censos2017.inei.gob.pe/redatam/> (Accessed: July 28, 2021).

Instituto Nacional de Estadística e Informática, INEI (2018a).” *65. Cantidad promedio diaria de residuos sólidos recolectada, según departamento, 2018*”. *Registro Nacional de Municipalidades*. Available at: <https://www.inei.gob.pe/buscador/?tbusqueda=residuos+solidos> (Accessed: July 29, 2021).

Instituto Nacional de Estadística e Informática, INEI (2018b).” 66. Frecuencia de recojo de residuos sólidos, según departamento, 2018”. Registro Nacional de Municipalidades. Available at: <https://www.inei.gob.pe/buscador/?tbusqueda=residuos+solidos> (Accessed: July 30, 2021).

Instituto Nacional de Estadística e Informática, INEI (2018c).” 67. Destino final de los residuos sólidos recolectados por las municipalidades, según departamento, 2018”. Registro Nacional de Municipalidades. Available at: <https://www.inei.gob.pe/buscador/?tbusqueda=residuos+solidos> (Accessed: July 31, 2021).

IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. Available at: <https://www.ipcc.ch/report/ar6/wg1/>(Accessed: July 26, 2021).

Jones, N., Evangelinos, K., Prokopiou Halvadakis, C. and Iosifides, T. (2010) “Social Factors Influencing Perceptions and Willingness to Pay for a Market-Based Policy Aiming on Solid Waste Management,” *Resources, Conservation & Recycling*, 54(9), pp. 533–540. doi: 10.1016/j.resconrec.2009.10.010.

Jordan, A. and Adelle, C. (2013) *Environmental policy in the EU: actors, institutions and processes*. 3rd edn. Edited by C. Adelle and A. Jordan. London: Routledge. Available from: <https://ebookcentral.proquest.com/lib/bristol/reader.action?docID=1075395&ppg=7> (Accessed: July 18, 2021).

Kaza, S., Yao, L., Bhada-Tata, P. and Van Woerden, F. (2018). *What a Waste 2.0. A Global Snapshot of Solid Waste Management to 2050*. International Bank for Reconstruction and Development, The World Bank, Washington, USA. Available at: <http://hdl.handle.net/10986/30317> (Accessed: July 9, 2021).

Koushki PA, Al-Duaij U and Al-Ghimlas W (2004) "Collection and Transportation Cost of Household Solid Waste in Kuwait," *Waste management (New York, N.Y.)*, 24(9), pp. 957–64. <https://doi.org/10.1016/j.wasman.2004.03.013>

Ley de Gestión Integral de Residuos Sólidos (2016) *El Peruano* pp.607472-607488. Sistema Nacional de Información Ambiental. Available at: <https://sinia.minam.gob.pe/normas/ley-gestion-integral-residuos-solidos> (Accessed: August 23, 2021).

Lopez, A (2007). Solid waste management and development: a case study in Lima, Peru. Available at: <http://urn.fi/URN:NBN:fi:amk-201003063224> (Accessed: August 1, 2021).

Margallo, M., Ziegler-Rodriguez, K., Vásquez-Rowe, I., Aldaco, R., Irabien, A. and Kahhat, R. (2019) "Enhancing Waste Management Strategies in Latin America Under a Holistic Environmental Assessment Perspective: A Review for Policy Support," *Science of the Total Environment*, 689, pp. 1255–1275. doi: 10.1016/j.scitotenv.2019.06.393.

Marticorena- Dominguez, M. (2021) Factores clave para transitar hacia una gestión integral de los residuos sólidos: análisis de la gestión de residuos en la Provincia de Lima (Perú), en la región Flandes (Bélgica) y en los casos locales de éxito de Miraflores y Amberes. Pontificia Universidad Nacional Católica. Available at: <http://hdl.handle.net/20.500.12404/18657> (Accessed: August 17, 2021).

Marshall, R. E. and Farahbakhsh, K. (2013) "Systems Approaches to Integrated Solid Waste Management in Developing Countries," *Waste Management*, 33(4), pp. 988–1003. doi: 10.1016/j.wasman.2012.12.023.

Masullo, A. (2017) "Organic Wastes Management in a Circular Economy Approach: Rebuilding the Link between Urban and Rural Areas," *Ecological Engineering*, 101, pp. 84–90. doi: 10.1016/j.ecoleng.2017.01.005.

Matthews, B. and Ross, L. (2010) *Research methods : a practical guide for the social sciences*. 1st edn. New York, NY: Pearson Longman. Available at: <https://ebookcentral.proquest.com/lib/bristol/detail.action?docID=5186165> (Accessed: August 5, 2021).

McAllister J (2015). "Factors Influencing Solid-Waste Management in the Developing World". All Graduate Plan B and other Reports. 528. <https://digitalcommons.usu.edu/gradreports/528> (Accessed: July 30, 2021).

McDougall, F. R. and Hruska, J. P. (2000) "Report: The Use of Life Cycle Inventory Tools to Support an Integrated Approach to Solid Waste Management," Waste Management and Research, 18(6), pp. 590–594. doi: 10.1034/j.1399-3070.2000.00159.x.

McDougall, F. R., White, P., Franke, M. and Hindle, P. (2001) "Integrated Solid Waste Management: A Life Cycle Inventory : Second Edition," The International Journal of Life Cycle Assessment, 6(5), pp. 320–320. doi: 10.1007/BF02978794.

Ministerio del Ambiente, MINAM. (2009) "Política Nacional del Ambiente". Available at: <https://www.minam.gob.pe/wp-content/uploads/2013/08/Pol%C3%ADtica-Nacional-del-Ambiente.pdf> (Accessed: June 9,2021)

Ministerio del Ambiente, MINAM. (2011) "Plan Nacional de Acción Ambiental". Repositorio Digital del Ministerio del Ambiente (REDIAM). Available at: <https://repositoriodigital.minam.gob.pe/handle/123456789/238> (Accessed: June 10,2021)

Ministerio del Ambiente, MINAM. (2016) "Plan Nacional de Gestión Integral de Residuos Sólidos". Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/documentos/plan-nacional-gestion-integral-residuos-solidos-2016-2024> (Accessed: June 11,2021)

Ministerio del Ambiente, MINAM. (2017) "Proporción de la población con acceso a recolección de residuos sólidos". Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/informacion/estadisticas> (Accessed: June 12,2021)

Ministerio del Ambiente, MINAM. (2018) "Residuos sólidos municipales dispuestos en rellenos sanitarios". Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/informacion/estadisticas> (Accessed: June 14,2021)

Ministerio del Ambiente, MINAM. (2019a) “Generación total de residuos sólidos domiciliarios urbanos”. Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/informacion/estadisticas> (Accessed: June 15,2021)

Ministerio del Ambiente, MINAM. (2019b) “Residuos recolectados para valorización (t/año)”. Sistema de Información para la Gestión de Residuos Sólidos (SIGERSOL). Available at:<https://sistemas.minam.gob.pe/SigersolMunicipal/#/accesoLibre/recoleccion> (Accessed: June 16,2021)

Ministerio del Ambiente, MINAM. (2019c) “Generación per cápita de residuos sólidos domiciliarios urbanos”. Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/informacion/estadisticas> (Accessed: June 17,2021)

Ministerio del Ambiente, MINAM. (2019d) “Costos de limpieza pública”. Sistema de Información para la Gestión de Residuos Sólidos (SIGERSOL). Available at: <https://sistemas.minam.gob.pe/SigersolMunicipal/#/accesoLibre/admFinanza> (Accessed: June 18,2021)

Ministerio del Ambiente, MINAM. (2019e) “Rs. Orgánicos en Planta de Valorización”. Sistema de Información para la Gestión de Residuos Sólidos (SIGERSOL). Available at: <https://sistemas.minam.gob.pe/SigersolMunicipal/#/accesoLibre/valorizacion> (Accessed: June 19,2021)

Ministerio del Ambiente, MINAM. (2019f) “Costo de Disposición Final”. Sistema de Información para la Gestión de Residuos Sólidos (SIGERSOL). Available at: <https://sistemas.minam.gob.pe/SigersolMunicipal/#/accesoLibre/disposicion> (Accessed: June 20,2021)

Ministerio del Ambiente, MINAM. (2019g) “Gestión RsSs”. Sistema de Información para la Gestión de Residuos Sólidos (SIGERSOL). Available at: <https://sistemas.minam.gob.pe/SigersolMunicipal/#/accesoLibre/admFinanza> (Accessed: June 21,2021)

Ministerio del Ambiente, MINAM. (2019h) “Programa municipal EDUCCA”. Sistema de Información para la Gestión de Residuos Sólidos (SIGERSOL). Available at:

<https://sistemas.minam.gob.pe/SigersolMunicipal/#/accesoLibre/admFinanza>

(Accessed: June 23,2021)

Ministerio de Economía y Finanzas (2019) "Gasto para manejo de residuos sólidos municipales". Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/informacion/estadisticas> (Accessed: June 24,2021)

Mintrom, M. (2012) Contemporary policy analysis. New York: Oxford University Press.

Monteiro, J. H. P. (2006). "Manual de gestión integrada de residuos sólidos municipales en ciudades de América Latina y el Caribe". Instituto Brasileiro de Administracao Municipal -IBAM .Rio de Janeiro. Available at: <http://hdl.handle.net/10625/27856> (Accessed: August 17, 2021).

Modifica el Decreto Legislativo N° 1278, que aprueba la Ley de Gestión Integral de Residuos Sólidos (2020) El Peruano pp.5-10. Sistema Nacional de Información Ambiental (SINIA). Available at: <https://sinia.minam.gob.pe/normas/decreto-legislativo-que-modifica-decreto-legislativo-no-1278-que-aprueba> (Accessed: June 27,2021)

Municipalidad Metropolitana de Lima (MUNLIMA) - Gerencia de Servicios a la Ciudad y Gestión Ambiental - Sub-Gerencia de Gestión Ambiental - División de Gestión de Residuos Sólidos. (2019a). "62. Residuos sólidos domiciliarios generados en la provincia de Lima, según distrito, 2010-2019". Instituto Nacional de Estadística e Informática (INEI). Available at: <https://www.inei.gob.pe/buscador/?tbusqueda=residuos+solidos> (Accessed: June 22, 2021).

Municipalidad Metropolitana de Lima (MUNLIMA) - Gerencia de Servicios a la Ciudad y Gestión Ambiental - Sub-Gerencia de Gestión Ambiental - División de Gestión de Residuos Sólidos. (2019b). "63. Residuos sólidos per cápita en la provincia de Lima, según distrito, 2018-2019". Instituto Nacional de Estadística e Informática (INEI). Available at: <https://www.inei.gob.pe/buscador/?tbusqueda=residuos+solidos> (Accessed: June 23, 2021).

Nogueira, S. P. S. and Jorge, S. M. F. (2016) "Explanatory Factors for the Use of the Financial Report in Decision-Making: Evidence from Local Government in Portugal," Revista de Contabilidad, 19(2), pp. 216–226. doi: 10.1016/j.rcsar.2015.09.002.

Oldenhage, F., (2016) "Propuesta De Un Programa De Gestión Para Mejorar El Manejo De Los Residuos Sólidos En El Distrito De San Juan De Miraflores," 19(2), pp. 07–12. doi: 10.15381/jidata.v19i2.12810.

Paes, L. A. B., Stolte Bezerra, B. and Matto Deus, R. (2019) "Organic Solid Waste Management in a Circular Economy Perspective - a Systematic Review and Swot Analysis," *Journal of Cleaner Production*, 239. doi: 10.1016/j.jclepro.2019.118086.

Pan American Health Organization, Inter-American Association of Sanitary and Environmental Engineering and Inter-American Development Bank (2010). "Regional Evaluation on Urban Solid Waste Management in Latin America and the Caribbean,". Publications IDB. Available at: <https://publications.iadb.org/publications/english/document/Regional-Evaluation-on-Urban-Solid-Waste-Management-in-Latin-America-and-the-Caribbean-2010.Report.pdf> (Accessed: July 26, 2021).

Pérez-López, G., Prior, D. Zafra-Gomez, J. and Plata-Diaz, A. (2016) "Cost Efficiency in Municipal Solid Waste Service Delivery. Alternative Management Forms in Relation to Local Population Size," *European Journal of Operational Research*, 255(2), pp. 583–592. doi: 10.1016/j.ejor.2016.05.034.

Pires, A., Martinho Graça and Chang, N.-B. (2011) "Solid Waste Management in European Countries: A Review of Systems Analysis Techniques," *Journal of Environmental Management*, 92(4), pp. 1033–1050. doi: 10.1016/j.jenvman.2010.11.024.

Powell, J. T. and Chertow, M. R. (2019) "Quantity, Components, and Value of Waste Materials Landfilled in the United States," *Journal of Industrial Ecology*, 23(2), pp. 466–479. doi: 10.1111/jiec.12752.

Presidencia del Consejo de Ministros, PCM (2020) "Mancomunidades Regionales y Municipales". Secretaría de Descentralización. Available at: <http://www.descentralizacion.gob.pe/index.php/2018/01/05/mancomunidades-regionales-y-municipales/> (Accessed: July 19, 2021).

Ragazzi, M., Fedrizzi, S., Rada, E., Ionescu, G., Cuidin, R. and Cioca, L. (2017) "Experiencing Urban Mining in an Italian Municipality Towards a Circular Economy Vision," *Energy Procedia*, 119, pp. 192–200. doi: 10.1016/j.egypro.2017.07.068.

Requena Sánchez, N., Carbonel Ramos, D. y Vallester, E. (2021) «Generación y segregación de residuos sólidos domiciliarios durante la cuarentena por Covid-19 en Panamá, estudio de caso», *Investigación y Pensamiento Crítico*, 9(2), pp. 16-24. doi: 10.37387/ipc.v9i2.232.

Reglamento del Decreto Legislativo N°1278 (2017) *El Peruano* pp.18-48. Ministerio del Ambiente (MINAM). Available at: <https://www.minam.gob.pe/disposiciones/decreto-supremo-n-014-2017-minam/> (Accessed: June 27, 2021)

Rodić Ljiljana and Wilson, D. (2017) "Resolving Governance Issues to Achieve Priority Sustainable Development Goals Related to Solid Waste Management in Developing Countries," *Sustainability*, 9(3), pp. 404–404. doi: 10.3390/su9030404.

Sáez, Alejandrina and Urdaneta G., Joheni A. (2014), "Manejo de residuos sólidos en América Latina y el Caribe." *Omnia*, Vol. 20, núm.3, pp.121-135. ISSN: 1315-8856. Available at: <https://www.redalyc.org/articulo.oa?id=73737091009> (Accessed: July 3, 2021)

Sánchez-Muñoz, M., Cruz-Cerón, J. and Maldonado-Espinel, P. (2019) "Gestión De Residuos Sólidos Urbanos En América Latina: Un Análisis Desde La Perspectiva De La Generación," *Revista Finanzas y Política Económica*, 11(2), pp. 321–336. doi: 10.14718/revfinanzpolitecon.2019.11.2.6.

Sanjeevi V and Shahabudeen P (2015) "Development of Performance Indicators for Municipal Solid Waste Management (pims): A Review," *Waste management & research : the journal of the International Solid Wastes and Public Cleansing Association, ISWA*, 33(12), pp. 1052–65. doi: 10.1177/0734242X15607428.

Starostina V., Damgaard, A., Eriksen, M. and Christensen, T. (2018) "Waste Management in the Irkutsk Region, Siberia, Russia: An Environmental Assessment of Alternative Development Scenarios," *Waste management & research : the journal of the*

International Solid Wastes and Public Cleansing Association, ISWA, 36(4), pp. 373–385.
doi: 10.1177/0734242X18757627.

Schwartz, A. F. and Meltzer, R. (2019) Policy analysis as problem solving : a flexible and evidence-based framework. New York: Routledge.

Silgado Rodríguez, Javier (2006) “La Gestión De Residuos Sólidos Urbanos En La Ciudad Histórica Y Sostenible: El Ejemplo De Andalucía,” 84-690-0834-X. Available at: <http://hdl.handle.net/2099/2234> (Accessed: July 7, 2021).

Simões, P. and Marques, R. C. (2012) “On the Economic Performance of the Waste Sector. a Literature Review,” *Journal of Environmental Management*, 106, pp. 40–47.
doi: 10.1016/j.jenvman.2012.04.005.

Sinha N.K, Kumar Choudhary, B. and Shree, S. (2011) “Solid Waste Management with Emphasis on Environmental Aspect,” *AIP Conference Proceedings*, 1414, pp. 123–127.
doi: 10.1063/1.3669942.

Taghipour, H., Amjad,Z., Aslani, H., Armanfar, F. and Dehghanzadeh,R. (2016) “Characterizing and Quantifying Solid Waste of Rural Communities,” *Journal of Material Cycles and Waste Management : Official Journal of the Japan Society of Material Cycles and Waste Management (JSMCWM) and the Korea Society of Waste Management (KSWM)*, 18(4), pp. 790–797. doi: 10.1007/s10163-015-0365-z.

United Nations Environment Programme (2015). *Global Waste Management Outlook*. Available at: <https://www.unep.org/resources/report/global-waste-management-outlook> (Accessed 8 July 2021).

United Nations (2016). *Responsible Consumption & Production: Why Matters*. Available at: https://www.un.org/sustainabledevelopment/wp-content/uploads/2019/07/12_Why-It-Matters-2020.pdf (Accessed 26 July 2021).

United Nations (no date) *Millennium Development Goals*. Available at: <https://www.un.org/millenniumgoals/> (Accessed 25 July 2021).

United Nations (no date) *Sustainable Development Goals*. Available at: <https://sdgs.un.org/goals> (Accessed 27 July 2021).

United Nations Human Settlements Programme (2012) *The state of Latin American and Caribbean cities 2012: towards a new urban transition*. Nairobi, Kenya: UN Habitat. Available at: <https://unhabitat.org/state-of-latin-american-and-caribbean-cities-2> (Accessed: July 2, 2021).

Weimer, D. L. and Vining, A. R. (2017) *Policy analysis : concepts and practice*. Sixth edn. New York: Routledge, Taylor & Francis Group.

Vergara S.E and Tchobanoglous G (2012) "Municipal Solid Waste and the Environment: A Global Perspective," *Annual Review of Environment and Resources*, 37, pp. 277–309. doi: 10.1146/annurev-environ-050511-122532.

Vyas, S. (2010) 'Solid Waste Management – A Step towards Sustainable Development', *Asia Pacific Business Review*, 6(1), pp. 122–127. doi: 10.1177/097324701000600111.

Wang, F., Cheng, Z., Reisner, A. and Liu, Y. (2018) "Compliance with Household Solid Waste Management in Rural Villages in Developing Countries," *Journal of Cleaner Production*, 202, pp. 293–298. doi: 10.1016/j.jclepro.2018.08.135.

Woodruff, A. (2014). "Solid Waste Management in the Pacific: Financial Arrangements. © Asian Development Bank". License: CC BY 3.0 IGO. Available at: <http://hdl.handle.net/11540/412>. (Accessed: July 18, 2021).

Zhu, Q., Geng, Y. and Lai, K.-hung (2011) "Environmental Supply Chain Cooperation and Its Effect on the Circular Economy Practice-Performance Relationship among Chinese Manufacturers," *Journal of Industrial Ecology*, 15(3), pp. 405–419. doi: 10.1111/j.1530-9290.2011.00329.x.

Ziegler-Rodriguez, K., Margallo, M., Aldaco, R., Vasquez- Rowe, I. and Kahhat, R. (2019) "Transitioning from Open Dumpsters to Landfilling in Peru: Environmental Benefits and Challenges from a Life-Cycle Perspective," *Journal of Cleaner Production*, 229, pp. 989–1003. doi: 10.1016/j.jclepro.2019.05.015.

11. Appendices

11.1. Interview Information

| Code | Solid Waste Field | Date & Time Interviewed |
|-------------|--------------------------|------------------------------------|
| S001 | Local government | Tuesday 22th June 2021, 2:30 pm |
| S002 | Private | Saturday 26th June 2021, 4:00 pm |
| S003 | Private | Wednesday 30th June 2021, 11:00 pm |
| S004 | Central government | Thursday 1th July 2021, 2:00 pm |
| S005 | Central government | Saturday 3th July 2021, 2:30 pm |
| S006 | Regional government | Thursday 8th July 2021, 00:30 am |
| S007 | Academic | Tuesday 13th July 2021, 06:00 pm |
| S008 | Local government | Saturday 17th July 2021, 4:00 pm |
| S009 | Central government | Sunday 18th July 2021, 4:00 pm |

11.2. Guide to interview Questions

Priorities in the household solid waste management and handling in Metropolitan Lima

- What is your opinion on how the management and handling of household solid waste have been developed in Metropolitan Lima?
- According to your experience and/or knowledge: What are the biggest obstacles to compliance with the management and handling of household solid waste in Metropolitan Lima?
- Do you believe that the stakeholders in the management and handling of household solid waste in Metropolitan Lima are playing their role effectively?
- How has Legislative Decree No. 1278 made it possible to develop improvements in the management and handling of household solid waste in Metropolitan Lima?

- Do you consider that there are critical aspects in the household solid waste management and handling in Metropolitan Lima due to the limitations of Legislative Decree No. 1278? Briefly explain
- How can the articulation of the stakeholders be promoted to improve the processes of solid waste management and handling at the level of Metropolitan Lima?
- Do you consider that the economic rates contribute to the fulfilment of the management and handling of household solid waste in Metropolitan Lima? Why?

National Policy of the Environment related to the solid waste

- Do you consider that the National Environmental Policy is focused on improving the current situation of solid waste in Peru? Explain why and how.
- What strategies are being applied to comply with the National Environmental Policy related to solid waste in Peru? And could you explain what the achievements have been? Do you consider that the intervention has been effective?
- Do you know the "EDUCCA" or "Programa de Incentivos"?
- How is it currently being applied? What strategies has the "EDUCAA" or "Programa de Incentivos" implemented for the management and handling of solid waste? Is the "EDUCCA" or "Programa de Incentivos" being implemented in Metropolitan Lima?

Covid-19

- What changes are being applied in the management and handling of household solid waste in Metropolitan Lima as a result of COVID - 19?
- Are there regulations for the management and handling of household waste from COVID - 19?

- What are the implications at the budget level to respond to the management and handling of solid waste during the pandemic?

The objective of my work is to identify the gaps between the regulations and the management and handling of household solid waste in Metropolitan Lima. Is there any other information that you consider relevant to my study?

11.3. Ethics Form



PGT: Research Ethics Monitoring Form 2020-2021

Research by all academic and related Staff and Students in the School of Geographical Sciences is subject to the standards set out in the Code of Practice on Research Ethics.

It is a requirement that prior to the commencement of all funded and non-funded research that this form be completed and submitted to your dissertation supervisor and the School's Research Ethics Committee (REC) (see Ethics Flow Chart). The Supervisor and REC will be responsible for issuing certification that the research meets acceptable ethical standards and will, if necessary, require changes to the research methodology or reporting strategy.

A copy of the research proposal which details methods and reporting strategies must be submitted together with this form. Submissions without a copy of the research proposal will not be considered.

The Ethics process seeks to establish from the form that researchers have (i) thought purposefully about potential ethical issues raised by their proposed research; and (ii) identified appropriate responses to those issues.

Boxes do expand, please type, and remember to save regularly.

Name: Email address:

Title of research project:

Source of funding if any?

Have you read all the ethics information on BlackBoard?

1. Does your research involve human participants under the age of 18?

No

Please provide further details

The research will involve two datasets. The first one is a secondary analysis related to the official statistics of household solid waste from the Peruvian government. The second dataset will be the outcomes of the interviews with professionals from the solid waste field in Peru. Therefore, the human participants will be people over 18.

2. Does your research involve human participants in vulnerable circumstances?

No

Please provide further details

The secondary analysis shows quantities related to household solid waste. Then, the interviewees are professional from the solid waste field in Peru, and they perform their activities in governmental or academic institutions in Peru. Therefore, the human participants will be interviewed considering their current work position.

3. Do others hold copyright or other rights over the information you will use, or will they do so over information you collect?

Yes

If relevant, please provide further details of copyright etc. information

The datasets are part from the Peruvian Official National Statistics, Ministry of Economics and Finances and Ministry of Environment. I am attaching the links of each of them:

- *INEI – Instituto Nacional de Estadística e Información – National Institute of Statistics and Information*
- *Brief Description: “Produce and disseminate official statistical information that the country needs with the required quality, opportunity and coverage, in order to contribute to the design, monitoring and evaluation of public policies and to the decision-making process of socioeconomic agents, the public sector and the community in general”. (<https://www.gob.pe/inei>)*
- *The following link (<https://www.inei.gob.pe/estadisticas/indice-tematico/medio-ambiente/>) provides data about household solid waste in the section of Solid Waste.*
- *The tables that will be used in the research are:*
- *62. Solid household waste generated in the province of Lima, by district, 2010-2019*
- *63. Solid waste per capita in the province of Lima, by district, 2018-2019*
- *64. Controlled solid waste in the sanitary landfills of the province of Lima, by district, 2010-2019*

- 65. Average daily amount of solid waste collected, by department, 2018
- 66. Frequency of solid waste collection, according to department, 2018
- 67. Final destination of solid waste collected by municipalities, by department, 2018
- The following link (<https://www.inei.gob.pe/biblioteca-virtual/publicaciones-digitales/>) provides data about household solid waste in the section of Environment
- Peru: Yearbook of Environmental Statistics 2020
- Peru: Yearbook of Environmental Statistics 2019
- Peru: Yearbook of Environmental Statistics 2018
- Peru: Yearbook of Environmental Statistics 2017
- The following link (<https://www.inei.gob.pe/biblioteca-virtual/boletines/registro-nacional-de-municipalidades-8990/1/>) provides information about solid waste
- Technical Report N ° 2 - National Registry of Municipalities 2016
- Technical Report N ° 1 - National Registry of Municipalities 2015
- The datasets are under the rights of the INEI regulated with the Law of Transparency and Access to Public Information. (http://www.transparencia.gob.pe/enlaces/pte_transparencia_enlaces.aspx?id_entidad=4&id_tema=1&ver=D#.YLJ1-PIKJIU)
- *SINIA – Sistema Nacional de Información Ambiental – National System of Environmental Information*
- Brief Description: The National System of Environmental Information (SINIA), constitutes a network of technological, institutional and human integration that facilitates the systematization, access and distribution of environmental information, as well as the use and exchange of this being support of the decision-making processes and environmental management.
- SINIA is developed with the purpose of serving as a support tool for the implementation of the National Environmental Management System. It is an instrument of Environmental Management indicated in Law No. 28611 (General Environmental Law) that promotes the consolidation of environmental information from different public and private organizations.
- The Ministry of the Environment (MINAM) is the national environmental authority in charge of the administration of SINIA. (<https://sinia.minam.gob.pe/acercade/que-es-sinia>)
- The following link (<https://sinia.minam.gob.pe/informacion/estadisticas>) provides these indicators
 - Total municipal solid waste generation
 - Per capita generation of urban household solid waste
 - Areas degraded by municipal solid waste for recovery
 - Area degraded by municipal solid waste
 - Municipal solid waste disposed of in landfills
 - Total generation of solid urban household waste
 - Per capita municipal spending on solid waste management
 - Areas degraded by municipal solid waste for reconversion

- Expenditure for municipal solid waste management
- Investment amount of investment projects in solid waste
- Budget for municipal solid waste management
- Population with access to solid waste collection
- Proportion of urban solid waste collected periodically and with an adequate final discharge in relation to the total urban solid waste generated, broken down by city
- National recycling rate
- Per capita generation of municipal solid waste
- Proportion of the population with access to solid waste collection
- The following link (<https://sinia.minam.gob.pe/informacion/publicaciones>) provides a report related to Lima
- Lima: environmental statistics, December 2019
- “Through SINIA, free access to environmental information generated by public and private entities is facilitated” (<https://sinia.minam.gob.pe/acercade/que-es-sinia>)
- MEF- Ministerio de Economía y Finanzas – Ministry of Economics and Finance
- MEF has an applicative, whose name is “Friendly Consultation” (Consulta Amigable). It shows information since 1999. Since then, changes and additions have been made to the information presented.
- The following link (<https://apps5.mineco.gob.pe/transparencia/mensual/>) provides information about the Lima budget and expenditure
- “Free access information platform that allows any user to have, in real time, the most complete economic information” (https://www.mef.gob.pe/es/?option=com_content&language=es-ES&Itemid=100931&lang=es-ES&view=article&id=424)
- The datasets will be input to elaborate tables, graphics, charts and projections by excel,
- The outcomes of the interviews will be worked out by Word.
- The softwares, which are Excel and Word, have the license of usage.

4. Does your research involve ONLY the analysis of large, secondary and anonymised datasets?

No

5. If asked, will you give your informants a

a. written summary of your research aims and its uses?

Yes

b. verbal summary of your research aims and its uses?

Yes

Please provide further details

I will send an information sheet to the interviewees about the key objectives of the research. It has the purpose to explain the aims and contributions of the research. The interviewees will be professionals related to the solid waste field from the different Peruvian government levels. I will be in touch with some existing professional contacts to access potential participants by sending a request for information about solid waste to their institutional email. Then, I will wait for their responses for asking about the possibility to have an interview with them.

The first objective of the research is to determine the aspects of the current solid waste policy and management. The second objective is to examine the different processes of solid waste management to detect the most critical points. The third objective is to assess the fulfilment of the solid waste policy into solid waste management. Indeed, the importance to conduct interviews with professional in the field allows identifying and assessing the main issues related to the solid waste policy and management. Therefore, the research contributes to identifying the gaps between the policy and management of solid waste using the results of the interviews and national statistics.

I should specify that all the interviewees will be native speakers of Spanish. I will translate the transcripts because I am a native speaker of Spanish.

6. Does your research involve covert surveillance (for example, participant observation)?

No

Please provide further details

The first stage is contacting the potential interviewees by introducing myself and a brief presentation of the research. When the potential interviewee decides to participate, I will send the participant information sheet asking the date availability for the interview. After the reply, the interviewees will receive the consent form one week before the interview. It ensures the privacy conditions of the research. During this time, I will answer any queries or doubts about it from the interviewees. After receiving the signed consent form, I will send a reminder for the interview. It will be carried out by Microsoft Teams. Moreover, I will read again the privacy conditions of the research before starting to record the interview.

7. Does your research involve analysis of social media posts or images?

No

Please provide further details

-

8. Anonymising informants:

- a. Will your informants automatically be anonymised in your research?

Yes

Please provide further details

The participants in the interviews will be anonymised in my research. It is guaranteed in the consent form because they will state that their details will be anonymised. Also, the information provided by each professional will depend on their functions in each governmental institution. All participants will be automatically anonymised in the output(s) from this research. Participants will only be identified by sector (e.g., local government, civil society organisation, etc.), so there is no chance they could be identified because of their position or organisation/department.

- b. Will you explicitly give all your informants the right to remain anonymous?

Yes

Please provide further details

The participants in the interviews will be informed that they will be anonymised in my research.

- c. Will data/information be encrypted/secured, and stored separately from identification material to maintain confidentiality?

Yes

Please provide further details

All information about participants will be stored securely on a password-protected device. Also, I will store the anonymised data on a separate machine from the code to the anonymity for enhanced security.

9. Will monitoring devices be used openly and only with the permission of informants?

Yes

Please provide further details

I will send the participant information sheet and consent form one week in advance to all the participants. It ensures the fulfilment of the privacy conditions and the confidentiality of the information. During the week, I will be available to answer any query or doubt about the research. Then, I will send a reminder for the interview. Before starting, I will read the terms of the consent form. Each interview will take between 30 to 45 mins. It will be recorded. The transcript will be translated because the interviewees are native speakers of Spanish. Then, the original and the translated transcript will be sent to the

interviewees after one to two days. Then, I will wait for the approval of the transcript by the interviewee. After that, I will delete the recording.

10. Will your informants be provided with a summary of your research findings?

Yes

Please provide further details

I will send a summary of the key findings to tell the importance of their participation. Also, I will send my dissertation if they want it for professional and academic purposes.

11. Will your research be available to informants and the general public without restrictions placed by sponsoring authorities?

No

Please provide further details

-

12. Have you considered the implications of your research intervention on informants?

Yes

Please provide full details

All the professionals are from the solid waste field. The questions will be related to their professional capacity.

13. Are there any other ethical issues arising from this research?

No

Please explain and include how they will be taken into consideration

No potential conflicts of interest have been identified. However, I will immediately declare any conflicts of interest of other ethical issues should they arise during the research process.

Declaration

I have read the School's Code of Practice on Research Ethics and believe that my research complies fully with its precepts.

I will not deviate from the methodology or reporting strategy without further permission from my supervisor and/or the School's Research Ethics Committee.

Student

Name

Signed

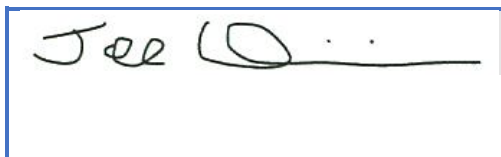


Date
(please
alter as
form
updated)

Supervisor

Name

Signed



Date
(please
alter as
form
updated)

Progress tracker: (dates to be completed by the ethics committee)

| | | | | | | |
|---|-------------------------|-----------|-------------|----------|------------|--|
| A | Clarification requested | 24/5/2021 | 2 June 2021 | 7/6/2021 | | |
| B | Approval granted | | | | 08/06/2021 | |

11.4. Analysed Transcript

Codes

- Law N° 1278
- Circular Economy
- 3'Rs and composting
- Minimization
- Incentive plan
- Incentive program
- Segregation
- Environmental awareness
- Municipal community
- Technical capabilities
- Articulation
- Political regime
- Taxes
- Pay-for-performance

- Monitoring
- National budget
- Safety measures
- Sanitary landfills
- Final Disposal
- institutional operational plans

Themes

{Waste policy}

This Policy has an **incentive plan**. This implies having a **segregation** program and promote **environmental awareness** to the population. Also, promoting the **3'Rs and composting**. The Ministry of Environment will continue promoting **sanitary landfills**, we know that a **sanitary landfill** is to transfer an impact from one place to another; that is not the right thing to do, therefore, we make efforts so that this waste does not go to **final disposal**. That is to say the **minimization** of solid waste.

{Solid Waste Management}

The new **Law No. 1278**, on solid waste management, is being applied; this rule that within its principles has included the **circular economy** as a strategy; This implies extending the useful life of the materials we are using. The Government has implemented an **incentive plan** for the municipalities so that they can meet their **segregation** and solid waste collection goals.

The biggest problem for environmental management are resources; These are linked to the aspect of the contribution of the neighbours, which is almost voluntary; that is, if you want to pay, you pay; if you don't want to pay, you don't pay; As a result nothing happens and that is why we say that it is practically a voluntary contribution because there is a lack of **pay-for-performance**; For example, the solid waste collection service has its cost: it costs to pay for fuel, to hire the vehicles, to dispose because you have to pay for final disposal; However, it does not pay, but I have to continue collecting its waste; the municipality has to plan the **pay-for-performance** and for that, generate strategies. Here you have to have management capacity, leadership and above all knowledge, you cannot exercise a function done right, you're finally going to have problems and you just won't move on.

{Solid Waste Handling}

Lima has communities, for example, a community is Lima North, Lima South, Lima East, Lima Centre and Lima West, with a total of six communities; unfortunately, the **municipal community** scheme has not succeeded in engaging the issue of solid waste. Although they have been trained and promote **environmental awareness** in different districts such as Comas, Los Olivos and San Martín de Porres, I can conclude that it is necessary to work with waste in a practical way because if we stay in theory, we do nothing.

There is a bias in both the Ministry and the OEFA. I wonder, why have we studied environmental engineering? If those functions that correspond to us are being occupied by other professionals who have nothing to do with the career, that is, sometimes we find lawyers; That is to say, if you are a textile worker, you know how to make clothes and how am I going to send you to make bread, daughter; that doesn't make sense, that's part of the problem, obviously, that happens at the macro level; At least we must have a person who is going to legislate for the entire nation, then it has to be someone who understands, who knows our reality and also knows the situation of the sector. That is to say the lack and limitation of **technical capabilities**. There is no **articulation** between the national government with the regional government and the government. local. There is also no **articulation** between local governments, which would be good, for example, the **municipal community**, we should all be working on projects to see what you are doing, can you share with me, how can we learn together, all of this does not currently exist; So at least we would talk by sector, for example, Lima North is painted green, perhaps part of your studies has to do with waste in general, effluents are also liquid waste; There is no

treatment policy here, so no one is thinking about treating the wastewater we generate, not the industry, not the homes.

The Ministry of Economy and Finance: first, the municipalities receive a contribution from the MEF called the Municipal Cooperation Fund; It is a resource that is given to all municipalities, it must be understood that not all municipalities receive the same; It is the most important resource here, it is used basically to cover the payments in projects, some of the administrative part and that's it, but there are other income like the other canons, which are the mining canon, the canon of shows, sports, etc. that it also serves the municipality; but the bulk is your own resources. The payment of the self-assessment, the light, the **taxes**, now serenazgo is also charged, parks and gardens; So that is the bulk, but that is linked to this issue of bad debts that people do not pay. So, that is one way of relating to the MEF, but we have the other that I had begun to tell you about; We are talking about **incentive program**, all incentive programs what they do to you is like giving you certain tasks; the municipality is going to fulfill this work and in return I am going to reward you; then they give you goals, for example, for this year there are actually 5 or 6 goals; One of the goals is how to improve your collection, how you simplify your attention to the public, in terms of licenses and how you do social inclusion; regarding the issue of construction and how you can fight hunger and especially in what is malnutrition. Goal 3, which is comprehensive solid waste management, the MEF, also helps municipalities to generate their **institutional operational plans**. A first part is to generate **environmental awareness** to reach the goal with the incentives it receives from the MEF. Second, force the administration to at least implement the fulfillment of the goals with the incentives. Third training of young people as environmental promoters; who will educate the population about the policy and management of household solid waste.

{Compliance}

The municipalities carry out environmental management; In this case, Metropolitan Lima, which has a very special characteristic of legislation, has a regional governor who is also mayor, who governs the 43 districts. We have the creation of the Ministry of the Environment with its obligations and objectives; So, if I have that structure, MINAM has already issued the national environmental policy as the national environmental management plan; then, the second to implement would have to be the province through its environmental management plan, in our case, it is the opposite; they do not have anything; however, they require you to present. Then, there is lack of **monitoring** of the activities that each stakeholder performs in the solid waste management and handling.

On the other hand, we must understand that every 4 years we have changes of Government as part of **political regime**.

{COVID-19}

Within the aspect of municipal management, we had problems because we did not have a planned budget to face the pandemic. Moreover, the **national budget** is very limited; Well, we had to implement personal protective equipment that we had to use on a mandatory basis, implementation of modules for disinfection for staff, buy machines to be able to disinfect public roads; see how to move our staff, because our staff moved in a car and social distancing was generated; The activities could not be paralyzed because it is considered as a front-line activity, training the personnel to take special care whenever possible, there were difficulties with personnel payments, with the support of MINAM, the implementation of equipment was partially solved. personal protection.

The lessons that COVID-19 has given us are many people learned at least to have their personal hygiene permanently, wash their hands, protect themselves, manage their waste because the issue of waste was an issue that was not handled. Then, it has promoted the execution of **safety measures**.

'Full interview transcripts available on request'