

Perception of the Current Situation of Urban Solid Waste in the Municipality of Quelimane, Mozambique

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ABSTRACT

This paper analyzed the solid waste management process in the municipality of Quelimane, Mozambique. The methodology of this study is based on reviewing the scientific literature through fieldwork and observations on how urban solid waste management reaches its final destination. For that purpose, the population selected for this article was interviewed for a better perspective. As a result, it was possible to obtain answers that impacted the public management of the municipality since the level of attention to control depends on the location of the houses and also lacks a great deal of training for the workers who collect solid waste in the Quelimane region, along with awareness, environmental education programs for the population.

Keywords: Quelimane, Mozambique, sustainability, urban solid waste, waste management

ARTICLE INFO

Article history:

Received: 27 June 2022

Accepted: 20 September 2022

Published: 24 May 2023

DOI: <https://doi.org/10.47836/pjst.31.4.09>

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INTRODUCTION

The economy of Quelimane, a municipality with a population of 349.842 inhabitants, relies on commerce, the fishing industry, and the storage of agricultural products (Moçambique, 2017). The city is considered vital for the region's development, and its natural conditions favor the growth of palm trees, orange and lemon trees, and other fruit varieties (Fews Net, 2014). It also has a maritime port, and the infrastructure is

adapted for the marine sailing of large-sized ships. Figure 1 shows the map of Mozambique and the location of Quelimane.

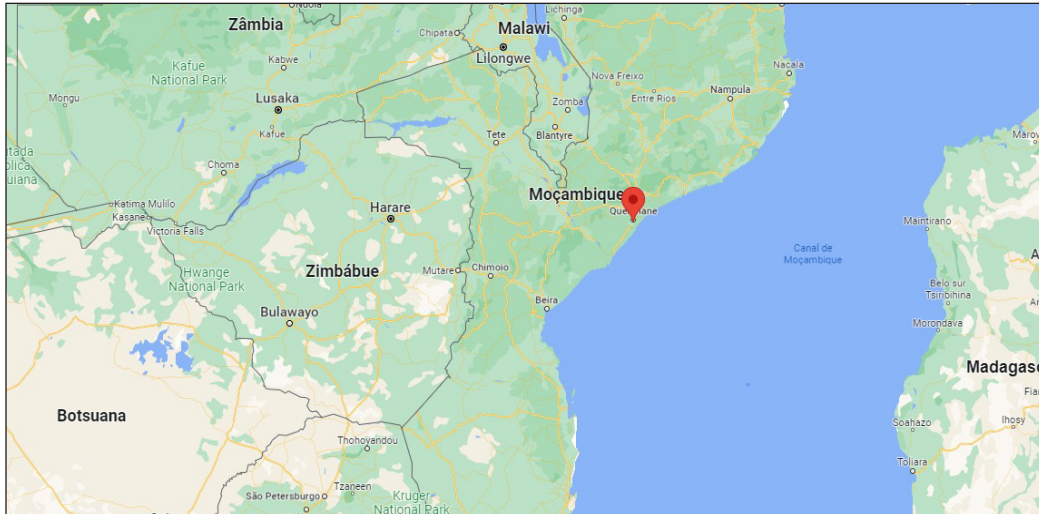


Figure 1. Map of Mozambique, Quelimane (Google Maps, 2022)

Taking as a point of reference some of the current weaknesses in the management and treatment of solid waste in the municipality of Quelimane, some alternatives are recommended to improve the collection and disposal of solid waste, as well as for the reduction of expenses related to the large labor force of the municipal public company that is responsible for providing services in Quelimane.

Firstly, the urban cleaning systems, together with the rupturing of the wastewater ducts, and storm drains, part of the essential sanitary services in Quelimane (Deutsche Welle, 2021), represent a high interest in public health and the preservation of the environment since they all guarantee a better quality of life for the people in the municipality.

Municipal authorities are responsible for urban waste management. Therefore, even though the rules have the legal scope of guaranteeing urban sanitary services based on the legal budget, there is a need to verify if the resources can deal with the burden of fulfilling the need to provide these essential services to the people and for health promotion purposes, for the local development, and a healthy town (Moçambique, 2008).

Many countries are facing managing urban solid waste problems. Africa is a continent where the challenges associated with waste management are high, and it is expected to worsen due to its high demographic growth (Kanhai et al., 2021). Mozambique is not an exception, as this problem arises in Quelimane. It is in addition to the risk of an inadequate capacity to collect and treat waste, which increases daily (Ayeleru et al., 2020). As a result, countries worldwide are striving to improve their solid domestic waste management practices since there will be an increase in the percentage of residues (Azevedo et al., 2021).

It is expected that, in the following 30 years, due to population growth, rapid urbanization, and economic growth, there will be a 70% increase in global waste, which means that 3.4 tons of residues will be generated per year (World Bank, 2022).

The unplanned growth of many cities caused by rapid urbanization has led to infrastructure challenges that exceeded the capacities of national and municipal governments to increase the levels of service in managing waste to keep up with the demand (Guerrero et al., 2013).

The people of Quelimane generate solid waste in homes, commerce, and industries and send it to the SWM plants (Villa et al., 2022). Based on the types of products they purchase, they conditioned the trash that must be presented at the voluntary delivery posts to be collected by the trucks and tractors intended solely for that purpose.

According to the UN report on Urban Solid Waste, around 99% of the goods purchased originally to be used by consumers will become waste after the first six months. It has been one of the main factors that have led to the increase in solid waste generated worldwide every year (IISD, 2018).

As a result, the urban cleaning systems to be implemented, operated, and maintained within the patterns require financial resources and community involvement.

The deposit of urban domestic and industrial solid waste in Quelimane is made outdoors due to a lack of a container. This problem began to reach extreme and alarming levels when the waste dumpsite was closed along the Quelimane Madal road in early 1997 (Moçambique, 2016). Due to the rural exodus, the population began to get closer to the cities to find better ways of life. In the last decades, due to rapid urban growth, the increase in the population (Das et al., 2019; Dos Muchangos et al., 2015) and its transformation, there was a spike in the generation of urban solid waste (Tan et al., 2014).

Therefore, the areas reserved to deposit solid waste, even though they did not have the conditions to manage it adequately, were occupied, thus generating new problems. The homes were close to the waste dumping sites, causing uncomfortable situations for those people. In addition to polluting the surrounding saltworks and mangroves, the proliferation of flies, mosquitoes, and disgusting odors, began to pose a risk to public health, especially in the area where the waste was deposited. These generated endemic diseases such as malaria, diarrhea, and cholera. Bad waste management leads to public health risks, environmental problems, and reduced quality of life, particularly among those most vulnerable (Kazuva & Zhang, 2019; Ziraba et al., 2016).

Currently, urban solid waste removal in Quelimane is deficient, and its management is differentiated. In paved neighborhoods and the central part of the city, trash is collected daily from the containers in the defined spots. In markets, garbage is collected three times a week, such as in the case of Brandão, Central, and Aeroporto markets. Smaller markets get their trash collected twice a week. Efficient urban solid waste management is an essential

issue in cities worldwide. However, this is particularly worse in developing countries due to rapid urbanization (Perteghella et al., 2020).

Depending on availability and mechanical conditions, waste transportation is done through trucks and tractors. The area chosen as a waste deposit in Quelimane is 5km away despite the precarious conditions (Moçambique, 2016). However, it is essential to mention that urban solid waste is dumped without any prior treatment, thus polluting the underground water sources in the area.

Due to the lack of space and the existing ideological and political conflict in Quelimane, opening a sanitary landfill is far from solving this problem.

The efficiency of solid waste management relies on how it is posed in the environmental, social, economic, and political spaces. Therefore, it requires establishing an efficiency guarantee in waste collection, treatment, and disposal (Fratta et al., 2019).

Abandoning the waste, significantly located next to the markets and suburban areas, together with the sewage system, obstructs solid waste management even more. Even though there was an increase in the efforts and awareness to implement solid waste management in African cities, this continues to be a chronic problem (Mbiba, 2014). However, sanitation services and solid waste management are among the services in developing countries that have received more noticeable attention through the United Nations Millennium Development Objectives (Tukahirwa et al., 2013).

Figures 2, 3, and 4 show this study's impact on the region and the people in the area, which has motivated the study of the situation.

As the generation of unsustainable amounts of solid waste increases worldwide, the concern for excessive consumerism and its consequences has increased significantly in the last decades (Da Silva, 2019). In addition to this, the few existing consumers are not enough to cover the entire city. The situation worsens even more with a population that does not respect the dates and times of voluntary waste delivery. As a result, they overflow the containers and incinerate trash in them, thus damaging their metallic structure.



Figure 2. Waste container in Quelimane



Figure 3. Broken glasses around the lake in Quelimane are used as a landfill

Even though solid waste management is an essential component of sustainability, it rarely gets any attention in most places (Burns et al., 2021). Waste deposits in mangroves are another factor that endangers life as well as the existing aquatic species in the area (Van Bijsterveldt et al., 2021), together with water pollution (Zeng et al., 2021), the sanitary situation of the populations which rely on these species, the local environment, and other related problems (Torell et al., 2012).

The main focalized problem in this study is the lack of sanitation associated with the inefficient solid waste management system. It is justified because Quelimane shows weakness as far as coverage of the urban solid waste sanitation system since the collection is concentrated more on certain regions with easier access. Hence, leaving the suburban area unprotected as far as trash collection is concerned, even though the people in those areas also pay the taxes. Nevertheless, solid waste management plays an important role (Tong et al., 2021; Chithra et al., 2016), and its correct application is motivated by international pressure in developed and undeveloped countries (Costa & Dias, 2020).



Figure 4. A man collecting reusable objects in Quelimane

Although plenty of regulations exist (Alzamora & Barros, 2020), compliance is still weak (Seror & Portnov, 2020). Also, to Bui et al. (2020), the lack of financial and human resources threatens the local management system, thus compromising the delivery of those essential services in Mozambique and many other parts of the world.

METHODOLOGY

The methodology in this research was based on three steps: literature revision, fieldwork and observation, and survey.

The first was based on the revision of scientific articles that report on the SWM in countries with the same issues as Mozambique, regulations, and laws from Mozambique

and Quelimane where the “state of the art” was determined. This research found the existing literature on solid waste management and the existing gaps in the matter, and this allowed the identification of the main theoretical and methodological obstacles to have a better understanding and analyze the Urban Solid Waste Management Bylaws (Decreto 94/2014, dated December 31, 2014) and the Hazardous Solid Waste Management Bylaws (Decreto 83/2014, dated December 2014), and to assess the weaknesses and the application of these legal documents.

The bibliographical revision contributed to obtaining information about the matter’s current situation and the problems that are the subject of this research. It is to insert the investigation within a theoretical reference framework to explain why these problems are theoretical rather than generated or presented by a particular theory. However, even in the bibliographical revision stage, it proceeded to conduct a historical revision and track the evolution of waste management and its handling locally and worldwide in Mozambique and Quelimane since the establishment of local state authorities, powers, and/or entities.

A list of problems related to urban solid waste management was created and consulted in the different institutional documents and sanitation guides, reports and waste inventories, judicial actions, and sanitation guides in scientific publications to develop the survey for the municipal managers. In the case of the people of Quelimane, the intention was to collect information related to the awareness of waste management services provided by the municipal government.

The second stage was composed of fieldwork. It was conducted a thorough analysis of the object of the study. Contact was made with the local authorities, such as managers, town assembly members, and neighborhood secretaries in close contact with the municipal authorities and the administrators.

The municipal management of urban solid waste in Quelimane is done by the Municipal Sanitation Company, which is responsible for urban sanitation, collection, transportation, and final disposal of urban waste.

The interviews with the municipal administrators were done individually, and they all had management positions within the hierarchical municipal structure.

Before conducting the surveys and interviews, the purpose of the research was clarified. At this stage, it was possible to level the issues on sustainability and its terminology, and the list of problems was presented to the interviewed subjects. They were asked about their opinion and to point out the specific problems in Quelimane and identify other issues in case those were not on the list presented to them.

The third stage deals with the analysis of the results and the interpretation of the interviews. An intentional sample was selected, and people who worked directly in the Municipal Council and those most affected by the waste management problems were chosen. For this, 219 individuals of both sexes were selected and classified: Municipal

Council President/advisor (1), members of the Municipal Assembly (4), Chief of Urban Services of the Quelimane Municipal Council (1), Councilmember from sanitation and environmental affairs (1), Technician of the Municipal Sanitation Company (4), Non-government organizations where a member of each organization was chosen (4), and Administrators of the city of Quelimane (204), where two from the 51 existing neighborhoods were chosen.

The following elements to collect data were used within the research instrument: (1) observation sheets recorded the types of local solid waste deposited, the collection times, and the frequency, and (2) semi-structured interviews were adapted to exploit all verbalizations, including those with affective content. Interview guides were addressed to the administrators and the Public Entities and NGOs.

Interviews were directed to the following social role players: (1) Members of the Municipal Assembly, (2) Technicians of the Municipal Sanitation Company, (3) The Advisor of the Municipal Council President, and (4) Council Member on Sanitation and Environmental Affairs.

The objectives of the interviews contained the following aspects for each area:

(1) Municipal Council: To evaluate the urban solid waste management process in the town of Quelimane and get insight into the urban solid waste management public policies.

(2) Municipal Assembly: To verify the regulations' enforcement and the relations between the legislators or enforcers and the city administrators.

(3) The Municipal Sanitation Company: To verify the concept of environmental education adopted by the Municipal Sanitation Company to mobilize a social change of attitude and behavior, identify the educational and technical procedures for urban solid waste management, as well as to point out the restrictions that the transportation sector faces when collecting waste and the status of the infrastructure through the eyes of the technicians. Figure 5 shows an interview with the inhabitants of Quelimane.

The knowledge in the area of study was taken into consideration to select the parties that would be interviewed: A range of ages higher than 30 years old and the profession of the interviewed person.



Figure 5. Interview with inhabitants in Quelimane

RESULTS AND DISCUSSION

To analyze and interpret the data, three questions that were considered to be important in urban waste management were applied: the organizational structure of the Quelimane Municipal Council, the deposit sites of urban solid waste at the voluntary delivery posts, and economic and financial sustainability to provide basic services for the administrators in the city of Quelimane.

In the question regarding the structure of the Quelimane Municipal Council for urban solid waste management, the study tried to understand the responsibility of environmental sanitation in the town. This question was answered by the Public Branch, where two out of the four municipal council members answered that a company in Quelimane was created within the Municipal Council and is responsible for solid waste management. In contrast, of the four members of the Municipal Assembly, three have acknowledged the existence of the Municipal Sanitation Company, but they affirmed that the service provided to the population is deficient. It can also be highlighted that one member of the Municipal Assembly stated that he did not know of a company dedicated to solid waste management. If there were one, the city would not be filled with trash and foul odors.

Analyzing the answers of the four Assembly Members, it is possible to say that despite the divergence between the structure of solid waste management in Quelimane, they were unanimous when affirming that the town is facing many challenges and that the means available to the city are not sufficient to provide solutions to the real sanitation needs. Additionally, they emphasized that everyone working at the Municipal Sanitation Company requires training on the matter.

Regarding the existence of a voluntary solid waste deposit and the hours established for the delivery, the Advisor for the Municipal Council President stated that, most positively, the Municipal Council has sent efforts so that the trash is deposited in a safe place and that the current City Mayor of Quelimane was very adamant about ordering the construction of voluntary trash delivery posts in the areas where there were no containers. Nevertheless, the situation in the city needs to be analyzed holistically. The citizens of the town are not prepared to live in an urban environment, and many of them arrived during the armed period. They were living in the housing centers, and after that period, they did not return to their places of origin; they stayed in the suburban area. With the city expansion, these areas are part of the city, and the people still keep the bad habit of throwing trash irresponsibly.

The Advisor for the Municipal Council President talked about the trash reception hours that the municipality established in the period from 18–20h for trash reception but that the administrators never upheld the schedule. He also stated that people threw the trash when the trash collecting truck was about to collect the garbage and that many people from the town threw the garbage outside the container, thus making the job more difficult for the people in charge of the collection.

The third question concerns economic and financial sustainability in providing essential services for the administrators of Quelimane. Eight members of the Public Branch, four Municipal Council Members, and four Municipal Assembly Members agreed to say that the municipality gets money from the Central Government from the so-called autarchic compensation fund. They also stated that Quelimane has funded through the payment fees of trash collection, Mozambique's electrical energy, and water consumption.

Out of the 204 administrators that were interviewed about the trash collection fee, 150 answered that this fee does not satisfy the administrators since there are times when the garbage is not collected and that indigents light the containers on fire, that the collection favors the paved and easy to access areas, and there is no discount for the areas that are affected by the collection. The remaining 54 citizens said they did their part and deposited the trash in the allocated times and containers. However, they lack the human and material means to cover the entire city, and the town has to double the efforts to fulfill the population's basic needs.

With this study, it was possible to identify different problems related to urban solid waste management in Quelimane. Due to the lack of direction and the deficiencies in the legislation for urban sustainability, people in the area do not have the correct guidance and tools to follow a protocol that reduces solid waste generation, allowing sanitation promotion for a healthy town.

CONCLUSION

It was possible to verify that urban waste management in Quelimane poses a somber scenario regarding coverage in the provision of essential urban sanitation services, and solid waste collection in the paved areas was considered the most privileged in the suburban area.

The issues mentioned earlier are due to a lack of efficient management mechanisms and an organizational structure that responds to the expectations of the administrators. In addition, the voluntary delivery posts built in the neighborhoods were not enough since the waste should be separated before they were sent to landfills.

Regarding solid waste management, this study corroborated that the people who live in the central areas are more privileged regarding trash collection. In contrast, most people bury their trash in their backyards.

In the town of Quelimane, there is no landfill, and the trash is deposited outdoors, thus creating public health risks during the rainy season. The city suffers from diseases such as malaria, diarrhea, and cholera.

Also, in addition to the trash containers, it is common to find trash in abandoned lots where animals fight over food with indigent people.

It is essential to create a multisectoral technical group to aid the Municipal Council in creating action plans regarding urban solid waste management, train the Environmental

Municipal Sanitation Company workers, as well as to implement a monitoring system of urban solid waste management, its collection, treatment, transportation, and final destination. The participation of all actors to establish a correct SWM group, such as the government, waste collection companies, and the inhabitants, is required because the problem cannot be solved by only one of the actors. It is necessary to revise the regulations on fines and penalties for those who fail to dispose of the trash in the allocated places, revise the trash collection fee, and follow up on the correct usage of the resources obtained from it to create a management plan for urban solid waste for the people.

Finally, Quelimane needs a sanitary landfill that complies with current regulations so that it does not generate a risk to the health of its population, especially during heavy rains, since there is a high rate of malaria, cholera, and diarrhea in the region, which is fatal to the infected people. The results of this study are a precedent for the challenges that many regions in the world, such as Quelimane's, will face nowadays derived from social exclusion, intensive exploitation of natural resources, and the spiral of environmental degradation associated with water management.

ACKNOWLEDGEMENT

The authors thank the National Polytechnic Institute (IPN), and the Polytechnic University of Maputo for supporting the research, especially the people who participated in the interviews.

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