Investigating Solid Waste Management on Environmental Hazard in Freetown, Sierra Leone: A Case Study at Bomeh Dumping Site Western Area Urban

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Abstract

This study seeks to explore the impact of solid waste and management in Bohmeh, Freetown, Sierra Leone. The strong waste administration frameworks in the review region (Bomeh) were frail and successful in administration thus resulting in natural and well-being risks. Given the fact that waste management authorities' activities were very unsatisfactory and extremely unacceptable, consequently, there is a need for help from the government, confidential areas and Non-administrative associations for the rebuilding of strong waste administration frameworks. The subject of "Solid Waste Management" has achieved an incredible implication as the entirety of our urban communities and Air, Water and Soil assets are profoundly dirtied imperilling mankind and the whole bio-arrangement of plants, creatures, marine life, and vegetation. Regardless of the earnestness of the issue of Solid waste in every aspect of our exercises from homegrown, business, modern, rural, etc. Not much is done particularly, our anxiety has been on the requirement for individuals' support in tackling in a maintainable way. The homegrown and business squander. Interest in purchaser merchandise is expanding step by step at an exceptionally quick rate because of fast industrialization and populace blast. This thusly brings about the creation of strong waste with the utilization and toss idea, the age of waste expanded alarmingly both in amount and intricacy. Unloading additionally gives revolting look, and foul smell yet additionally objective serious well-being risk through contamination of land, air and water asset.

Keywords: Solid waste, Management, environmental hazard, Bomeh dumping sight, Freetown & Sierra Leone.

Introduction

The technique of using and recycling materials most advantageously and practically throughout their full life cycle is known as solid waste management (SWM). Solid waste management practice lessens the environmental effects of the materials we use, decreases waste, moderate climate change, and conserves resources. The growing amount of waste produced and its discharge into the environment without recycling is seen to be a threat to the environment and human health (Shamsi, Sabzi Mohammadi and Mousavi Assessing the knowledge, attitude, and practice of the Kermanshah women toward reducing, recycling, and reusing municipal solid waste, p.1). (September 2021)

In Freetown, managing solid waste is a costly and frustrating challenge. Low service coverage, inadequate budgets, severely inadequate equipment, and significant inefficiencies like high costs, poor service quality, low labour productivity, negative public attitudes, and a widespread illegal dumping site are all included. The skeletal solid waste management (SWM) system was put under strain as a result of the increased population, domestic insurgency, political strife, and economic crises that followed.

Waste is everywhere, scattered or piled in small or large quantities, and much of it is frequently disposed of by burning. Waste production significantly outpaces waste collection and transportation in Freetown. The city's sharp rise in diseases carried by vectors is largely attributable to the persistent accumulation of waste. At the moment, waste has clogged most of the city's drains. Rubbish is frequently deposited outside in locations where specific dumps or public "dustbins" or containers—including skips—are available due to capacity issues, inadequate collection efforts, or public behaviour that is insensitive to the environment. Open dumps frequently produce noxious and hazardous odours and provide trash pickers, animals, and flies with unrestricted access.

As a result, solid waste management (SWM) is very important. It should take care of issues related to health, the economy, and the environment and be coordinated with other general social conditions. Congestion as a result of this has unavoidably resulted in the growth of downturns and casual networks with poor waste management practices. As a result, the streets, cleared and unpaved drains and drainage channels of numerous networks are irregularly covered in waste.

According to Chukwunonye Ezeah and Clive L. Roberts (Journal of environmental management, 2012, pp. 9–14), the inadequate management of solid waste in cities in developing nations is quickly growing into a significant environmental problem. Poverty, high population growth rates, and urbanization growth rates are the primary contributors to the waste issue, which is further exacerbated by inadequately funded infrastructure. Municipal solid waste (MSW) production has increased as a result of rapid population growth and urbanization, continuous economic development, industrialization, and an increase in people's well-being (Beerooznia, Sharifi, Alimardani, and Mousavi, composting, landfilling for municipal solid waste management, 2018, p. 1)

The waste that has not been collected is dumped aimlessly on roads, the banks of waterways, and in channels; merges with human and animal excrement; consequently, contributing to flooding, breeding bugs and rat vectors, and disease transmission. The destruction of surface and groundwater by leachate, soil pollution by direct waste contact or leachate, air contamination by consuming waste, the spread of diseases by vectors like birds, bugs, and rodents, and the uncontrolled arrival of methane by anaerobic disintegration of waste are all examples of environmental solid waste caused by a lack of waste removal. This has put people's and animals' well-being in jeopardy and is resulting in significant economic and other welfare losses.

The number of people living in cities will skyrocket worldwide in the next 20 to 30 years, particularly in developing nations (United Nations, 2014). As a result of this growth, it is necessary to properly manage the subsequent solid waste in a way that is truly beneficial to both humans and the environment. In light of the foregoing, solid waste management has attracted the attention of states, policymakers, and academics more recently due to its impact on the environment, the well-being, and prosperity of residents, as well as the economy. The construction of the site, the type and degree of waste fragmentation, the storage method, and the hydrogeological and hydrographic conditions at the landfill determine the risk of water contamination (Rapti-Caputo et al., 2006).

According to "Daniel Hoornweg; Perinaz, Bhada-Tata 2012. A Global Analysis of the Management of Solid Waste" One of the most important byproducts of an urban lifestyle, municipal solid waste (MSW), is growing even faster than the rate of urbanization as the world moves toward an urban future. Ten years ago, 2.9 billion urban residents produced 0.64 kg of MSW per person per day or 1.68 billion tons annually. According to this report, there are now approximately 3 billion residents producing 1.2 kilograms per person per day or 1.3 billion tons per year. This number is likely to rise to 4.3 billion urban residents who produce approximately 1.42 kg of municipal solid waste per capita per day (2.2 billion tons annually) by 2025.

Waste management has been a problem for a long time, especially in developing cities like Freetown City. In general, solid waste is the result of human activities, including those of individuals, families, communities, businesses, and others. The researcher gathered data for this study through the use of an interview and a questionnaire. The primary purpose of the study was to learn more about solid waste management in Freetown, Sierra Leone, to improve public health.

Freetown is the capital city of Sierra Leone. With a population of approximately 1,200,000, it experienced an average annual growth rate of 4.2 per cent between 2004 and 2015 (Statistics Sierra Leone (2016), 2015 Population and Housing Census). This is primarily due to the high rate of urbanization that occurred after 2002, which marked the end of the 10-year civil war.

According to studies, the amount of solid waste produced is inversely correlated with economic prosperity and population growth. The composition of waste has a significant impact on its density, proposed collection, transportation, and disposal methods, and calorific

value in waste management, as stated by Sankoh, F.P., Yan, and Tran (2014) in their assessment of Solid Waste Management in Freetown.

As a result, a strategy for reducing, and reusing waste must be chosen. The issue of waste is becoming increasingly pressing in terms of the development of novel, environmentally friendly methods for managing and reducing waste, particularly by enhancing citizens' habits and education. The lead council supervisor stated that the study area was established in 1989 with a total area of 4 5 acres, but that population growth and urbanization have reduced that to less than 10 acres.

Waste management is one of the greatest challenges facing mankind in modern times despite the numerous technological achievements that have been documented. Technology alone has not been able to effectively control waste generated in communities" worldwide. Rather it appears that new technologies bring new types of waste into the environment to add to the complex accumulation puzzle" (Kwawe, 1995:53) Solid management has been an integral part of every human society (Shekdar, 2009). This problem has been increasing with changes in consumption patterns; an increase in consumerism and the unavailability of waste management facilities. One obvious consequence of rapid urbanization is the growing generation of solid waste and many city authorities face unprecedented challenges in managing these, including problems of coping with their collection and disposal (2006. Sandra Cointreau)

Everywhere in the world, solid waste management is a challenge that is only getting worse as a result of industrialization and population expansion. More commercial activity and a wider range of consumption habits contribute to cities' economic growth by increasing the volume of solid waste. Due to rapid urbanization, expansion in human progress, and development in solid waste, the research area has been subject to the illegal evacuation of garbage for a long time, posing several environmental issues. Due to a shortage of resources, fast population growth, and rural-to-urban migration, solid waste management by local authorities is challenging in the study area.

There are significant problems with air, water, and soil pollution as a result of the spread of illegal solid waste dumpsites in and around Freetown, especially the study location, this has led to the spread of illnesses like cholera. The entranceway in the dump site offers less space for putting solid waste, hence the stack-up of garbage. As of now, most of the city's channels are overwhelmed with waste. Most of the solid waste that is conveyed in the city unendingly keeps on uncollected and also dumped in open zones, for instance, cleared and unpaved roadsides and fragmented houses.

The solid waste management scenario in Freetown is in danger of failing due to shifting waste management agencies. In addition to being a disaster for human health, Freetown's vast amount of uncollected or illegally deposited waste contributes to environmental destruction. Local health officials claim that dispersed wastes throughout the city are mostly to blame for the increased frequency of parasites, tetanus, malaria, hookworm, cholera, and diarrhoea in and around the city. As a result of the environmental impact associated with solid waste

management, the researcher decided to look into the impact of solid waste management and its potential environmental hazards.

Significance of the study

The significance of the study stems from the fact that it will assist the researcher in identifying issues with solid waste management. It will aid in raising public awareness of the dangers posed by improper waste management. The study will encourage additional research and assist policymakers in developing concrete plans to address solid waste management issues.

This study will also greatly assist in the decision-making process regarding the prevention of the toxic effects of organic and biodegradable waste components on the environment. It will also prevent households from experiencing the hazardous effects of solid waste by properly disposing of waste

Aim and Objectives

Aim: Investigating solid waste management on the environmental hazard in Freetown.

Research Objectives

1. To examine the types of waste produced by households and waste management practices.
2. The willingness of households to pay for their waste.
3. To evaluate the effects of residents' attitudes on waste management practices.
4. To assess how knowledge relates to waste management practices.

Research questions

1. How often do residents examine the types of waste produced and waste management practices?
2. To what extent are households willing to pay for their waste?
3. What are the attitudes and perceptions of the people given solid waste management??
4. To what extent does the resident's knowledge relate to waste management practices?

Justification

The study area has been dealing with illegal waste disposal for a long time, leading to several environmental issues as a result of rapid urbanization and population growth, both of which increase the amount of solid waste produced, which in turn causes social, economic, and environmental issues. The Freetown City Council, which is one of the institutions in charge of the municipality's solid waste management activities, was unable to meet the aforementioned requirements. The area frequently hosts diseases like malaria, typhoid fever, and diarrhoea. Poor waste management may result in the loss of human resources, which may have an impact on the region's productivity. The researcher investigated issues with solid waste management in the Bomeh community because it appears that the issue is neglected.

Scope of the Study

Although there are quite several dump sites in Freetown, the researcher decided to focus on the Bomeh communities for the household level. The reason is that it is normally in the community that refuse containers get full and garbage scattered around the containers more so high tons of waste deposal is experienced in this area

Limitation(s) of the Study

Various challenges were encountered in the process of conducting the whole study

1.   The time frame was limited. Considering the time frame coupled with academic work is very limited.
2.   No funds for mobilization and transportation. Due to a lack of funds, purchasing stationary and the cost of printing the entire work was a problem and transportation to the communities
3.   Some respondents put up criticism and argument which resulted in their inaccurate responses to the questionnaire.
4.   Some respondents wanted to be compensated for the time spent responding to the questionnaire. This made the administration of the questionnaire quite difficult.

Delimitation

The researcher chooses to limit this research to 171 households to represent the whole as time was not in favour to cover every single person as they will represent the rest of the people. The use of structured questionnaires and in-depth interviews were tools that aided the collection of data.

Ethical consideration

The respondents were assured of confidentiality and anonymity. Their right to privacy was Paramount to the researcher and that made them feel to provide the right information needed for the study.

Conceptual Framework

FIG$_1$
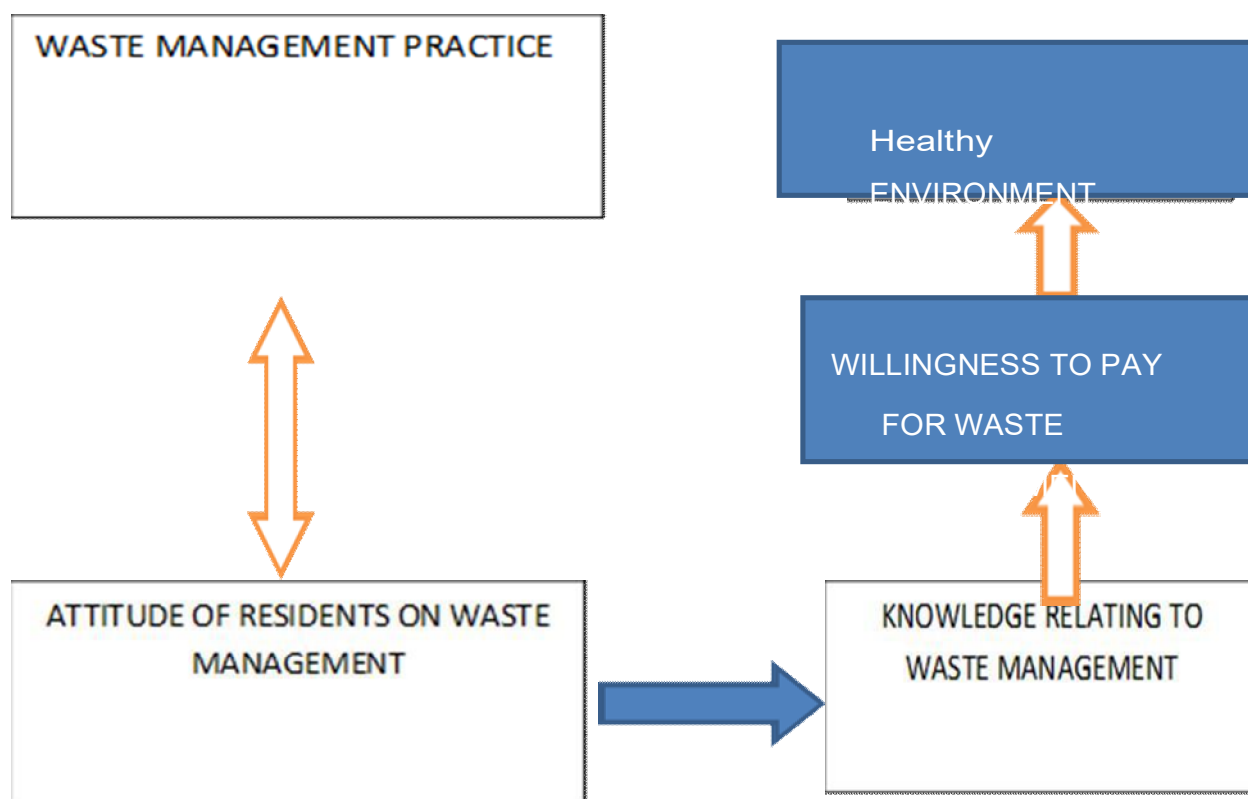
The conceptual framework explains the relationship between variables in this Study as shown in Figure 1. The hypothesis to be tested in this study are: How knowledge of sustainable waste management related to attitudes and how attitudes of residents related to sustainable waste management. To achieve sustainable and effective waste management, development strategies must go beyond technical considerations to formulate specific objectives and implement appropriate measures regarding waste management practices, the attitude of residents toward waste, and knowledge relating to waste management to obtain a healthy environment.

Literature Review

According to Beerooznia Sharifi and Mousavi, composting landfilling for urban solid waste management has increased as a result of people's quality of life improvements, ongoing industrialization, and increasing urbanization. A major cause for concern is the expectation that the cost of waste management will rise in developing nations. By 2050, the majority of developing nations' waste generation is anticipated to double or triple due to the rapidly expanding economy, industrialization, and population growth,(As per Justice Debrah, Diogo Vidal, and Pimenta Dinis (raising awareness on solid waste management through formal education for sustainability, Published: 22 January 2021).

Hence it is expensive and difficult to manage solid waste in Freetown there are significant inefficiencies such as high expenses, poor service delivery, low worker productivity, negative public perceptions and extensive illegal dumping sites aided with low service coverage, insufficient budgets, inadequate equipment and low equipment standards increased population domestic insurgency political unrest and related economic crises all had a significant impact on waste generation placing stress on the already precarious solid waste management system.

Hence, solid waste management (SWM) is crucial and should handle issues relating to the environment, economy, and health, as well as be connected with other broad societal concerns. In addition to contributing to flooding, bug breeding, rat vectors, and disease transmission, the uncollected waste is dumped carelessly on highways, the banks of waterways, and in channels. The destruction of surface and groundwater through leachate, soil pollution through direct contact with waste or leachate, air contamination from eating waste, the spread of disease by vectors like birds, bugs, and rodents, or the uncontrolled arrival of methane due to anaerobic waste disintegration are all examples of environmental solid waste caused by inadequate waste management.

This has seriously harmed the welfare of both humans and other animals, and it continues to hurt the economy and other aspects of welfare. Throughout the following decades, city populations will significantly increase. Freetown, the nation's capital, has a population of over 1,200,000 and experienced average annual growth of 4.2% between 2004 and 2015 (Statistics Sierra Leone (2016) 2015 Population and Housing Census). This growth is primarily attributable to the country's rapid urbanization after 2002. (The end of the 10-year civil war). According to studies, the amount of solid trash produced is correlated with both population and economic growth. An interview and a questionnaire were used by the researcher to collect data for this study. To improve public health in Freetown, the capital city of Sierra Leone, the study's main goal is to obtain a comprehensive understanding of solid waste management. Hence it has long been difficult to manage waste, especially in emerging towns like Freetown City. In general, solid waste is a byproduct of human activity and might originate from people, families, communities, businesses, etc.

According to Sankoh, F.P., Yan, and Tran (2014) Assessment of Solid Waste Management in Freetown, Sierra Leone towards Sustainable Development. Journal of Applied Sciences, 14). The composition of trash is particularly important in waste management because it influences the calorific value, density, and recommended collection, transportation, and disposal methods of the garbage. Thus, it is necessary to determine the strategy for waste reuse, reduction, and recycling. As cities are rapidly expanding and their populations increasing, the topic of waste is becoming urgent in terms of new innovative and sustainable solutions to manage and reduce the amount of waste, particularly through improving citizens' education and habits. The lead council supervisor at the dump site Malligie Koroma stated that the study area was established in 1989 with a total area of 45 acres which has decreased drastically to less than 10 acres as a result of population growth and urbanization.

You can find garbage everywhere—spread out, in small or large piles, or even set on fire as a

waste disposal option. In Freetown, waste production is significantly greater than its collection and transportation. The city's significant increase in the prevalence of diseases transmitted by vectors is largely attributable to the widespread accumulation of garbage. The majority of the city's drains are currently clogged with trash. To allow garbage to be deposited there, several manhole covers have been removed. Due to insufficient capacity, poor collection, or public indifference, garbage is frequently dumped outside of special dumps or public "dustbins" or containers (skips included). Animals, flies, and waste pickers can freely enter Open Dumps; and frequently release harmful and unpleasant smoke from slow-burning fires.

Tchobanoglous et al. claim that By the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, as well as being responsive to public attitudes, solid waste management is a discipline associated with the control of generation, collection, transfer, and transport, processing, and disposal of solid waste. According to Onibokun (1999), recent events in Africa's major urban centres have demonstrated that "the problem of waste management has become a monster that has aborted most efforts by city authorities, state and federal governments, and professionals alike." According to Gouley (1992), something can become waste when it is used in a way that does not serve its intended purpose or when it no longer serves the owner's needs. Miller (1988) defines solid waste as any unused, undesirable, or discarded material that is not gas or liquid.

Functional Elements of Solid Waste Management System

There are six functional components in the exercises to relate to the management of solid waste management from the place of age to the o definite removal site.

1. Waste generation
2. On-site dealing with (arranging, stockpiling, and handling)
3. Collection
4. Transfer and transport
5. Processing
6. Disposal

Waste Generation

The act and process of producing waste from human activities are known as waste generation. It is closely linked to people's consumption patterns and socioeconomic characteristics. People's attitudes toward waste, their patterns of material use and waste handling, their interest in waste reduction and minimization, the degree to which they separate waste, and their abstinence from indiscriminate dumping and littering all have a significant impact on waste generation (Schübeler et al., 1996).

In Freetown, the majority of waste comes from households. Agriculture, businesses, institutions, commercial areas, construction sites, and medical facilities are additional sources. However, urban areas' limited agricultural activities frequently result in the disposal

of organic waste at dumping or landfill sites. Similarly, due to the country's low level of industrialization, the amount of waste produced by industries and other sources is lower than in other developing or developed nations.

Transfer, Transportation, and Disposal

The transportation of solid waste to transfer stations, processing and recovery facilities, or final disposal sites is part of the collection process. Typically, smaller vehicles are used to collect the waste and take it to a transfer station before larger vehicles take it to the final disposal location. The overall cost of collecting and transporting waste from onsite storage to final disposal sites typically decreases with a well-designed transfer and transport system.

However, as much as 80% of the collection and transportation equipment in most developing nations needs repair or maintenance (The World Bank, 2016). The traditional municipal function has always been street and major public space cleaning. In Freetown, the traditional municipal service associated with MSWM has always included the cleaning of major public areas and streets. Transportation of waste from various municipal sources to a disposal site (either traditional open sites like river banks or forests, for example)

Resource recovery includes recycling, composting, and energy recovery, as well as a variety of processes for recycling materials and recovering resources from waste. The informal sector typically handles recycling and recovery in many nations with low incomes. This kind of work requires a lot of labour, is risky, and pays very little. Waste pickers or scavengers collect materials from waste bins and dumping sites, waste collectors separate materials that can be sold as they load their trucks, and scrap dealers buy directly from HHs and businesses.

The situation is very different in industrialized nations because resource recovery is done by the formal sector, driven by law and public concern for the environment, and often at a high cost. Even though organic waste still accounts for more than half of all waste, it still has a limited but significant recovery potential. Since organics are largely to blame for the polluting leachate and methane issues, it reduces the environmental impact of disposal sites and reduces the costs of disposal facilities (Zurbrugg, 2002). Another method of recycling is composting, which involves the controlled aerobic biological decomposition of organic matter into humus from plant and food scraps.

Compost reduces the need for chemical fertilizers and pesticides in landscaping and agricultural activities by providing nutrients to the soil, increasing beneficial soil organisms, and suppressing certain plant diseases (EPA, 2002). The organic portion of solid waste is typically higher in developing nations; Insofar as it is possible, composting is the best option. It has been discovered that between 15 and 100 per cent of HHs in rural areas practice it, but less than 10 per cent of HHs in urban areas, where less land is available within a HH, do not. is typically completed by the Freetown casual area. Scrap sellers simply collect recyclable strong waste from the HH, whereas cloth pickers and foragers do so directly from the unloading locations. Paper, plastic, metal, bottle, can, and other recyclable materials are collected and offered to reuse sellers or organizations.

DISPOSAL (Landfilling and Combustion) the controlled burning of waste in a designated facility to reduce its volume and, in some instances, generate electricity is known as combustion. When there isn't enough room in the landfill, communities may choose to burn waste that can't be recycled or composted. Combustors can be equipped with control devices like acid gas scrubbers and fabric filters to control the toxic air emissions caused by combustion.

Solid waste combustion that is out of control pollutes the environment and poses serious health risks. Waste that is not disposed of in a controlled manner can cause fires, spread disease, pollute groundwater and soil, and attract and transmit insects and rodents.

The majority of municipalities in the study area, including Freetown, use open dumping and riverbank dumping as methods of disposal. Cover material, a leachate collection mechanism, drainage facilities, and fencing are typically absent from these sites to prevent unauthorized personnel. Only a few municipalities use landfills to dispose of solid waste.

Characteristics of Urban Solid Waste Management

Political and legislative aspects the government should set the MSWM's goals and priorities, as well as the legal and regulatory framework, roles, and jurisdiction. The authorities in question won't be able to effectively control and manage MSW unless there are clear bylaws, ordinances, and regulations for MSWM.

To ensure MSWM systems' political viability, it is essential to clearly define roles and jurisdiction. According to Schübeler (1996), the "strategic plan" for 30 MSWM serves as the foundation upon which the established roles of government authorities and other actors can be carried out. The majority of developing nations have ineffective SWM legislation.

In developing nations, SWM-related legislation is typically fragmented, with multiple laws (such as the Public Health Act, Local Government Act, Environmental Protection Act, etc.) including a few clauses regarding SWM regulations (Hisashi, n.d.).

The corresponding distribution of powers and capacities is required for the decentralization of responsibility for MSWM in Freetown. It typically requires the local agencies in question to update their job descriptions, staffing plans, and organizational structures. SWM typically involves multiple national agencies at least partially in developing nations. However, the various national agencies' roles and responsibilities regarding SWM are frequently unclear, and neither a single agency nor committee is designated to coordinate their projects and activities.

The public's awareness of waste and attitudes toward it can have an impact on the entire SWM system

From HH waste storage to waste segregation, recycling, collection frequency, littering, waste management services, and opposition to the location of waste treatment and disposal facilities, all aspects of sustainable urban and rural management (SWM) are dependent on

public awareness and participation. According to Zurbrugg (2002), this is also a crucial factor in an SWM system's success or failure.

SWM workers generally have low social status in both developed and developing nations, with developing nations having lower social status than developed nations. This is largely due to people's negative perceptions of jobs that involve handling waste or unwanted materials. According to Hisashi (n.d.), this perception causes workers to treat their jobs with disrespect, which in turn results in poor work ethics and quality (Hisashi, n.d.). In urban areas of developing nations, the main obstacles to effective SWM are traditional values, religious beliefs, and the caste system that is already in place.

Budgeting, cost accounting, capital investment, cost recovery, and cost reduction are all connected to the financial aspects of MSWM. In developing nations, MSWM receives very little attention, possibly except in capitals and large cities. As a result, governments only give the SWM sector very little money, and the services needed to protect public health and the environment are not provided. The local government of developing nations lacks effective

Financial planning and management

At the local government level, where the local taxation system is inadequately developed and the financial foundation for public services, including SWM, is weak, the issue is particularly acute. The collection of user service fees can help local governments make up for their lacklustre financial foundation. In poorer developing nations, however, users' ability to pay for the services is severely limited, and the services frequently operate irregularly and are ineffective.

The production of solid waste and the need for services to collect it typically rise with economic growth. The life-cycle costs of facilities and equipment as well as the long-term economic impact of services provided determine the MSWM system's economic effectiveness. An important component of MSWM's strategic planning and investment programming is economic evaluation. It is necessary to implement measures that discourage resource wasting and promote waste minimization. Internalizing the costs of waste management as much as possible in the production, distribution, and consumption phases is the best way to encourage efficient use and resource conservation (Schübeler, 1996) because developing nations lack sufficient financial resources for the sustainable development of SWM systems. The most cutting-edge MSWM facilities and equipment are beyond the means of local governments. Additionally, the lack of industries capable of receiving and processing recyclable materials has an impact on waste recycling activities in small developing nations. The volume and composition of waste produced by residential and other industries are significant determinants of economic development.

The planning and implementation, upkeep of collection and transfer systems, waste recovery, final disposal, and hazardous waste management are all technical aspects of MSWM. The technical systems established for the primary collection, storage, transportation, treatment, and final disposal in developing nations frequently are not well-suited to the city's

operational requirements. According to Schübeler (1996), the provision of imported equipment from international donors frequently results in the utilization of inappropriate technology and/or a variety of equipment types, both of which reduce the effectiveness of operations and maintenance tasks.

It is quite common for developing nations to lack the human resources and technical expertise necessary for SWM planning and operation. The absence of comprehensive plans for SWM at the local and national levels is another technical constraint in developing nations. As a result, solid waste technology is frequently chosen without taking into account how well it fits into the SWM system as a whole. In terms of the technical system, developing nations frequently employ the "conventional" collection strategy, which is developed and utilized in industrialized nations.

The vehicles that are utilized are sophisticated, pricey, and difficult to operate and maintain, making them frequently unsuitable for the conditions that exist in developing nations. Typically, only a small portion of the vehicle fleet remains operational after a brief period (Zurbrugg, 2002). Globally, waste management has been a major problem for public health. Public participation, public knowledge, attitudes, and behaviours, as well as a willingness to pay for services, are essential components of any waste management program (KAPW). The extent of KAPW and its impact on Freetown's waste management As a result, the purpose of this study was to assess the citizen's knowledge, attitudes, waste management practices, and household willingness to pay for their waste.

Description of Freetown's Solid Wastes in Freetown, the majority of the waste stream is garbage, which accounts for between 50 and 85 per cent of all waste. Household waste, garbage from markets, and garbage from handling storing, and selling food items are all examples of garbage. Non-biodegradable strong waste or trash (paper, containers, cardboard, plastics, garments, elastic, glass, ceramics, metal jars, and so forth.) is also included in this waste. Additional wastes include ashes, bulky waste, street sweeping, vehicles that have been abandoned, non-hazardous industrial waste, and construction and demolition waste, among other things Septic tanks in cities and private and public institutions also produce waste. One more source of solid waste in Freetown, though in smaller quantities, is secondhand goods imported from developed nations. Computers, refrigerators, and other outdated items are typically close to the end of their life cycle and rarely interact with their intended owners before being discarded. Solid Waste Management Study for Freetown, Sierra Leone, 2004, page 12 (Sood).

Freetown's waste streams' characteristics and total quantities of waste are unknown. What has been stated above is based on field observations made during the study and work done in cities of comparable size, population, and climate. According to these estimates, vegetable and biodegradable organic waste accounts for more than 85 per cent of this garbage. It is subject to faster purification, stronger odours, and more flies if it is poorly collected. Being uncovered during the long rainy season in Freetown makes it difficult to collect and transport waste because it becomes soggy, stale, and smelly.

The waste densities, which are estimated to be 480 kg/m3, are high given these characteristics. The selection of waste collection methods is heavily influenced by the waste's density. The weight of one cubic meter of solid waste is referred to as its density. A high-density waste, like the Freetown solid waste, may contain a lot of soil, plant matter, and moisture, whereas a low-density waste may be mostly paper and plastic packaging with little moisture.

The estimated daily waste generation total is 745 tons, based on estimated rates of 0.45 kg per person per day. This estimate does not include yard waste, construction debris, or debris from a demolition project because these items are highly variable and skew quantity assessments.

Waste Management Practice

In the slums, solid waste management practices like storage and disposal were unsatisfactory, and separation and composting were rarely used. Poor waste management can have serious repercussions, and slum dwellers' behaviours, concerns, and attitudes indicate a lack of awareness of these issues. However, the willingness of slum dwellers to participate in waste separation and composting was high. As a result, authorities must encourage residents of urban slums to improve their solid waste management practices, such as waste separation and disposal.

According to Nyang' echi (1992, p. 45), when solid waste is left to pile up on the ground, it begins to decompose, causing unpleasant smells, flies, and rodents to take over. Composting these waste products from decomposition can be used as farm manure. As a result, he explains that when waste is compacted, it can be used for a variety of purposes, which is called composting. Benneh and others 1993) found that the majority of solid waste generated in urban areas comes from residential household waste. The majority of waste management issues have remained unresolved throughout Freetown's history of institutional trials and abandonment. The management of solid waste in Freetown is in danger of failing. Due to inadequate budgets, a lack of qualified personnel, a lack of institutional authority with experience in waste management, and shifting waste management authorities, the large proportion of waste that is either not collected or illegally dumped in Freetown is a disaster for human health and the environment.

Even in developed, transition economies, or developing nations, where rural areas are frequently exposed to environmental threats, illegal waste dumping of solid waste raises numerous issues (Zeng, 2015). In the waste management system, recycling and reusing should be taken into consideration. In the capital of Sierra Leone, recycling is currently extremely restricted and practised extremely casually. Waste that is not managed sustainably has a greater impact on people living in developing nations, particularly the poor in urban areas.

Over 90% of waste is frequently disposed of in unregulated dumps in low-income nations. or burned in public. These practices have serious effects on health and the environment. Waste that is not properly managed is a breeding ground for disease vectors, generates methane, and

can even encourage urban violence (The World Bank, 2019). According to UNEP (2015), low- and middle-income nations face significant obstacles in moving toward environmentally responsible waste management, eliminating uncontrolled burning and disposal, and ensuring universal access to waste collection services.). 39% of the world's population does not appropriately dispose of waste. There were still approximately 1.1 billion people who disposed of waste outdoors. People in rural areas face numerous health issues as a result of improper waste disposal (Shahzadi, 2018).

Minimization, reuse, recycling, and energy recovery are more environmentally friendly alternatives to traditional methods of disposing of waste at landfills or dumpsites for efficient waste management. The indiscriminate disposal of MSW (Sankoh, 2013) has resulted in clogged sewers, suffocation, and ultimately street flooding during heavy rains. These actions not only help to protect the environment but also help to create jobs and boost the economy (Salman, 2019).

The available resources cannot keep up with the growing demands and complexity of waste management. As a result, the most effective strategy ought to be put into action right away, taking into account economic, social, and environmental considerations (Aye & Widjaya, 2006). The study area, Freetown, and its unattractive piles of solid waste have significantly harmed the environment. Waste is now an essential component of our economy because it is a byproduct of economic activities and comes from households, businesses, and the government. A World Bank report revealed, according to Aaron Kwasi Nartey (Solid Waste Management Practices, forthcoming in July 2020), that waste generation has been on the rise, with the world's cities producing 2.01 billion tons of solid waste in 2016. Due to 70% growth in urbanization, this number is expected to reach 3.40 billion tons per year by 2050. The rate of municipal waste generation in the United States, a developed nation, has increased from 217.3 million tons per day in 1995 to 254.1 million tons per day in 2013 3. On the other hand, developing countries in sub-Saharan Africa produce 62 million tons of solid waste annually, demonstrating that the wealthier a nation is, the more waste it produces.

For effective waste management, waste minimization, reuse, recycling, and energy recovery are more sustainable than conventional landfill or dumpsite disposal techniques. These actions not only help in protecting the environment but also help in employment generation and boosting the economy, (Salman, 2019). The indiscriminate disposal of MSW (Sankoh, 2013) has led to blocked sewers and suffocation, and ultimately to flooding of streets during heavy rains. Waste management becomes complex and the resources provided cannot cope with its growing demand and needs. Therefore, the best approach should be implemented immediately, taking into account environmental, social, and economic aspects ((Aye & Widjaya, 2006)). The unappealing piles of solid waste in Freetown including the study area have greatly compromised its environmental quality. Nowadays waste has become a vital part of our economy, being a by-product of economic activities and originating from businesses, the government, and households.

Willingness to Pay for Improved Waste Collection Service

It should be possible for households that suffer from the effects of uncollected solid waste and are the primary producers of solid waste to participate in improving SWM. As a result, the contribution of urban dwellers to SWM service greatly contributes to community WM improvement. In the study area, however, there is insufficient evidence regarding the willingness to pay (WTP) and associated factors for improved solid waste management (ISWM). Globally, waste management is a crucial development issue, particularly in developing nations like Ghana. Sustainable financing is a major obstacle in developing nations when it comes to waste management. Kofi Sekyere Boateng (Journal of Environmental and Public Health, 2019(2):1– 9), January 2019.

According to keinerugaba Nicholas, (factors affecting household's willingness to pay for garbage collection services, 2022) Waste management has become inevitable in the global development process. Thus the sustainability of funds to manage solid waste is paramount. The determinants of the willingness to pay for improved waste management systems have been widely suggested to have a significant influence on the willingness of the respondents to pay for waste collection. Willingness to pay for effective waste management service and environmental protection. The solid waste disposal menace can lead to offensive odour, and fire outbreaks and causes air, water, and sanitation-related diseases and land pollution.

There are no waste collection containers to receive refuse and residents do not pay for waste disposal services. The issue of SWM is a significant concern for Sierra Leone's public and local legislatures. As it consumes a significant portion of the city's civil spending and has the greatest impact on metropolitan life, the collection and transportation of solid waste constitute the majority of metropolitan solid waste (Manus Coffey and Coad, 2010). In the case of Freetown, virtually all of the city budget allocated for SWM is used for solid waste collection, transportation, and road clearing

However, the majority of regions lack a proper framework for imposing fees on SWM-related services (ADB, 2013). As a result, the most effective barrier to providing sufficient SWM services in Freetown is financial necessity. In any case, raising funds from the general public to expand the assistance seems to be the most sensible option. Since family residents do not pay for the administration of waste in the city, the strong waste administration framework's manageability over the long term is crucial.

In Freetown, no waste collection service goes door to door. The residents' unwillingness and inability to pay for these services is one of the major issues. In a similar vein, a significant portion of the city, or more than sixty per cent of the total, is severely congested. Low-paying networks typically have these. Additionally, unfortunate capacity works on solid waste capacity at homes, which adds to the variety of difficulties. Without organization, waste is frequently disposed of in shabby old containers that use paper sacks rather than plastic-lined containers Gloves and safety equipment are not provided to assortment workers. Pre-assortment from homes to the general public or collective avoids set at important city locations must be coordinated by families or a few casual confidential gatherings due to the

lack of door-to-door assortment.

In many developing nations, the amount of waste produced grows faster than the resources available to the local authorities to collect and dispose of it in urban areas. James otai, 2020 assessing household willingness to pay for solid waste management services in Uganda found that the majority of household solid waste is disposed of through open dumping, burning, and throwing into bushes, streets, and holes in residential areas. Households mix all kinds of solids, including hazardous waste, during storage before disposal, so there is no waste separation.

Local authorities need sufficient funds to collect, transport, and dispose of urban solid waste to provide better HSWM services. Effective governance, sufficient resources, and household participation are explicitly required for this. However, this is far from the case in most developing nations, such as Uganda, where households and businesses in the cities produce waste that is not adequately collected or managed due to a lack of funds.

The local and national governments of Sierra Leone face a significant issue with SWM. According to Manus Coffey & Coad (2010), the collection and transportation of solid waste is the most significant aspect of urban solid waste because it consumes the largest portion of the municipal budget and has the greatest impact on urban life. In Freetown, solid waste collection, transportation, and street sweeping consume almost all of the municipal budget set aside for SWM. However, the majority of municipalities lack a formal fee structure for SWM-related services (ADB, 2013). As a result, the greatest obstacle to providing adequate SWM services in Freetown is financial constraints. However, it appears that the only viable option is to collect fees from the public to improve the service. Since household residents do not pay a user fee for the city's waste management, the solid waste management system must last over time.

Waste is not collected from house to house in Freetown. The residents' unwillingness or inability to pay for these services is one of the major issues. Additionally, large portions of the city, or more than 60% of all city neighbourhoods, are extremely congested. These are mostly home to low-income communities. Additionally, improper waste storage at residences contributes to collection difficulties. Without sorting, waste is frequently stored in dripping buckets and paper bags rather than in a bin lined with plastic bags. Gloves and other safety equipment are not provided to collection workers for use. Pre-collection from homes to public or communal skips placed at strategic locations in the city must be organized by households or some informal private groups due to the lack of house-to-house collection.

The Attitude and Perception of People Towards Solid Waste Management.

"The imbibed behavioural patterns and acquired values are superimposed on the environment" is the method by which "the imbibed behavioural patterns and acquired values are superimposed on the environment," according to Agbola (1993). Experiences and leadership influence attitudes. He went on to say that attitudes, perceptions, and beliefs are all learned response sets that can be altered through education. An article titled "Does Attitude

Matter" asks: Waste Disposal and Wetland Pollution in the Cape Coast Municipalities of Ghana " Kendie (1999) investigated the connection between perceptions, attitudes, and beliefs on the one hand and sanitation practices on the other to gain a comprehensive understanding of sanitation practices and the underlying factor that is responsible for the state of environmental sanitation in Cape Coast. Kendie was quick to dismiss the argument that there was insufficient funding and rapid urbanization in this article.

The solid waste management system—the entire set of activities related to the generation, collection, transfer, transportation, treatment, and disposal of solid wastes—is referred to as the waste management system. People's incorrect attitudes and perceptions regarding sanitation issues will hurt the system's effectiveness toward sustainable development. Stakeholders play a crucial role in sustainable solid waste management, and they need to be more aware of recycling, segregation, and reduction (Demirbas, 2011). The public's attitude toward sanitation issues will influence their willingness to collaborate and participate in appropriate waste management practices. Therefore, environmental awareness, information on health risks, and solid waste management are essentials that must be consistently communicated to all or any segment of the population.

According to Navez-Bounchaire (1993), the management of garbage in a household is tied to how people see the world and how social and cultural practices are used. This leads to different ways of appreciating space depending on whether the space is private or public. Due to the diversity of the population, this is important. According to Abrokwah (1998), there are three main reasons why there are problems with waste management in Freetown and the study area: ignorance, carelessness, and a lack of laws to punish those who break the rules of sanitation. The residents should be taught how to manage household waste and the dangers that waste disposal could pose to the environment and them.

According to Kendie (1999), "attitude and perception towards waste and rating of waste disposal issues in people's minds and scheme of official development plans have not been adequately considered" is the cause of the recent upsurge in waste disposal issues. Instead of considering the issue from a governance point of view, there has been a tendency to concentrate on the design of waste management technologies and how to implement them in context. Attitudes appear to influence how residents and the government manage solid waste in expanding urban centres. Acceptance of the pay-as-you-throw system, household garbage disposal, children's involvement in solid waste management, and people's opinions regarding who is accountable for maintaining clean environments are among these concerns. A.B. Gogra, J. Yao, and V.T.S. Kabba)

Knowledge

According to Oribe Garcia, Kamara-Esteban, Martin, Macarulla-Arenaza, and Alonso-Vicario (2015), advanced education is typically associated with a higher level of ecological awareness. However, over time, this relationship may be inverse because the combined idea of education increases with the number of graduates consistently, whereas natural awareness (the same effect of higher waste age) does not grow at the same rate.

Therefore, environmental education is crucial for bridging the generational divide regarding waste management, waste segregation, and waste sustainability in developing nations. Through environmental education, people can become more aware of the challenges posed by the environment. It promotes attitudes, motivations, and commitments to make decisions and act responsibly, as well as the specific skills and expertise needed to deal with environmental issues. Environmental education encompasses more than just environmental knowledge. It improves critical thinking, aids in problem-solving, and facilitates active decision-making. In addition, it enables individuals to provide facts or opinions on environmental issues to make responsible decisions and raises public awareness of and knowledge of environmental issues.

The methodology of mental hypotheses about the connection between information, perspectives, and conduct can be used to understand waste management behaviour and make sense of it. Because mental information is a crucial space for the development of an individual's activities, knowing as a matter of fact and exploring results turned out conduct in light of information will be preferable to not in light of information. The study of KAP—information, perspectives, practices, and eagerness to pay—focuses on examining the connection between mentalities, behaviours, and information.

The family is the smallest unit of human history in every community (Monavari et al. 2012). Due to cultural shifts, the family plays a significant role in ecological issues associated with the growth of strong waste. The size, pay, marital status, and education levels of a family are all affected by these cultural shifts. Poor environmental management practices are typically correlated with individuals' lack of environmental knowledge (Licy et al., 2013).

By Justices Debrah, Diogo Vidal, and Pimenta Dinis (raising awareness of solid waste management through formal education for sustainability), February 22, 2021). In developing nations, the gap in environmental knowledge between the young and the old contributes to ecological issues or waste management issues, resulting in unsustainable development, which has significant effects in low-income nations. Environmental sustainability education ought to be incorporated into all levels of schools in developing nations to close the knowledge gap that exists between the younger and older generations regarding SWM.

Diogo Vidal and Pimenta Dinis, "Raising awareness about solid waste management through formal education for sustainability," February 22, 2021). By providing students with all the necessary tools for widespread positive societal effects, environmental education encourages sustainable lifestyles and discourages unsustainable lifestyles. Environmental education is more than just passing on information in one direction. It also helps people develop environmental attitudes, awareness, knowledge, and the skills they need to take positive environmental actions.

Effective environmental education can lead to SW's long-term viability both inside and outside of school. The majority of authors involved in SWM studies reported that waste segregation, which contributes to the sustainability of SWM, is either not done or not well practised in most developing nations. The majority of developing nations have witnessed the destruction of their environments as a result of a lack of useful environmental knowledge.

The majority of teachers in developing nations lack practical knowledge of SWM or environmental knowledge, which hurts students' knowledge environment and attitude toward SWM. In recent years, it has become increasingly difficult for the majority of developing nations to properly manage solid waste. The difficulty of properly managing waste in urban areas of developing nations is linked to urbanization, population growth, and wealth. Since the amount of solid waste produced rises with income and urbanization rate. In general, there was a lack of information, perspectives, board practices, and willingness to pay. Word-related status, housing residency, and mentalities were identified as the variables that had a significant impact on the population's high level of information. Room accessibility and adequate information were identified as factors associated with a respectable demeanour. Respondents' excellent practices were fundamentally influenced by the excellent information and a decent demeanour.

As a result, to create a waste management framework that can be maintained, it is essential to work on excellent information, positive outlooks, and excellent practices. For the provision of every social service, including the collection of solid waste, it is essential to be willing to pay. The present study found that respondents' willingness to pay for better waste management is unaffected by their level of education, income, age, or occupation. However, the study found that the community's unwillingness to pay for better waste management services may be due to illegal burning, open dumping, and a lack of waste collection containers to collect waste.

Overall, knowledge, attitudes, management practices and willingness to pay were limited. Occupational status, housing tenure, and attitudes were identified as the factors having a significant association with the good knowledge level of residents. Availability of space and good knowledge were identified as factors that have associations with a good level of attitude. Good knowledge and a good attitude were identified as factors that contributed significantly to respondents' good practices. Therefore, it's important to improve good knowledge, positive attitudes, and good practices to achieve a sustainable waste management system.

Research Methodology

Study design

The study adopted a descriptive research design to investigate the impact of solid waste on environmental hazards in Freetown using Bomeh as a case study. In conducting this research, the researcher utilized a questionnaire-based approach, the study employed two-stage sampling to reach as many residents as possible. The first stage used stratified sampling, which divided households into two groups, while the second stage used simple random sampling. This was because there was not much time or money available. A survey questionnaire was created and made available on paper. Before proceeding to fill out the questionnaire, respondents were asked to consent to the survey, and no personally identifying information, such as emails, and addresses, except for names and telephone numbers.

Population and Sampling

Target population

The targeted population in this study is 300 representing the household respondent in the study area.

Sample Size

The sample size of this study was determined by the researcher from a target population of 300 households using the Yamane formula

$n=N/1+Ne^2$

Where n=sample size N=population size E=error (0.05)

For N=300

n=300/1+300(0.05) ^2 therefore sample size n=171

Sampling technique

The study used simple random and stratified sample techniques to select the sample size. This was done without bias from the target population. The sampling technique was selected because every member of the target population has an equal opportunity to be selected. This sampling technique is appropriate for this study because it is related to finding everlasting answers to solve a problem that has been in existence for a long time. For this investigation, the researcher considers utilizing stratified sampling procedures because here examining the choice of the assessment is done in that every member of the population in the study area gets an equivalent possibility of determination

Study Site/Location

According to site supervisor Maligie Koroma the study area was established in 1989 and it was originally 45 acres the said site was reduced to 10 acres due to urbanization. It is which is located at the focal eastern piece of Freetown, the capital city of Sierra Leone. It can be found 10 meters toward the Acram Community which lies along the Bai Bureh road Ferry intersection and Upgon Pivot. As per research, the study area and its environment have a population of around 15000 individuals. in the wet seas, the waste might result in a staggering impact which incorporates water contamination which thusly prompts water consumption sicknesses, for example, cholera typhoid and so on this can likewise prompt gradually expanding influences of obstructing storm channels which in turn causes flooding.

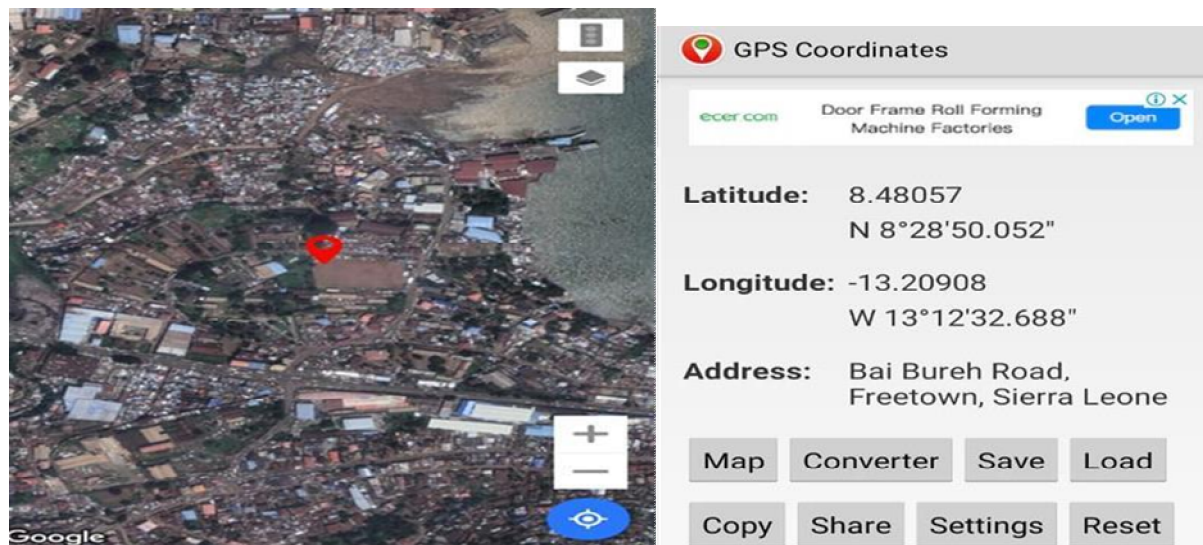## Site Analysis of The Study Area Google Earth Map of Burmeh Dumping

Figure 2

Source of Data

This study relies on primary data gathered from individual HHs using semi-structured questionnaires. A field survey was conducted in two phases. The first survey was conducted in the first week of January using the face-to-face interview method.

Data Information Analysis:

Analysis of information produced was analyzed both qualitatively and quantitatively by involving a measurable package for (SPSS) delicate wear, information acquired will be dissected by involving both inferential and expressive measurements by taking into the thought of several relevant statistical tools and econometrics models such as percentage, mean, standard deviation, histogram, regression soft wear.

Sample Size Formula Sample Size Formula

The formula helps us locate the correct sample size through the distinction between the populace and the sample. To recall, the range of observations in a given sample populace is acknowledged as sample size. Since it is no longer feasible to survey the entire population, we take a pattern from the population and then conduct a survey or research.

Formula 1: Sample size measurement for limitless population

Where n is the sample size, p and q are assumed to be 0.5 since there's an equal chance of getting the required information from every respondent sampled z is the statistical value of the level of precision assumed which is 95%, and e is the margin of error

The Margin of Error

It is characterized as a modest quantity that is considered in the event of error or change of

conditions. By and large, the wiggle room is taken as 5% or 0.05.

Determination of Marginal of Error

The safety buffer is a rate that shows how close the example results will be regarding the genuine worth of the general populace that is considered in the study. The margin of mistake likewise alluded to as "certainty stretch," alludes to how many blunders you wish to permit in your outcomes. For this exploration, I will think about utilizing a peripheral blunder +/ - 5%

Confidence Level

Certainty level is firmly connected with certainty span (safety buffer). This is worth estimating your level of sureness in regards to how well an example addresses the general populace inside your picked safety buffer. Subsequently, for this examination, I will think about utilizing a 95% certainty stretch.

Determine the Standard of Deviation

The norm of deviation demonstrates how much variety you expect among your reactions. Most scientists set this worth at 0.5 (half). This is the direst outcome imaginable rate, so staying with this worth will ensure that my determined example size is sufficiently huge to precisely address the general populace inside the certainty stretch and certainty level.

Finding Z-Score

The Z-score is a consistent worth naturally set in light of your certainty level. It demonstrates the "standard typical score," or the number of standard deviations between any chosen esteem and the normal/mean of the populace. Since certainty levels are genuinely normalized, most analysts just remember the important z-score for the most well-known certainty levels.

Presentation, Interpretation and Discussion of Findings

Tables and figures as well as percentages and frequencies were used for the presentation of data. The data which are quantitative will be presented in tables and figures with specific headings. While the qualitative information will be presented in a descriptive format to help portray the usefulness of the data collected. Results which were obtained from primary and secondary data are discussed under the following headings

An increase in population, income level and urbanization increase the amount of solid waste generation, and if not managed properly, it creates a serious negative impact on human health, the environment and also the economy (Hoornweg & Bhada-Tata, 2012). The most significant aspect of urban SWM is the collection and transportation and deposition of solid waste as it demands the major share of the urban budget and has the greatest impact on urban life (Manus Coffey & Coad, 2010). In the case of Freetown, almost all of the municipal budget allocated for SWM is spent on solid waste collection, transportation and street-sweeping.

Description and measurement of selected variables of households on waste generation

TAble 1

| NO	Variables	Description	Unit of measure
	HH waste	Solid waste generation by the HH	Kg/day
	Gender	Gender of household head(HHH)	1 = Male; 0 = Female
	Education	Educational attainment of HHH	Years
	Occupation	Occupation of HHH	Employed = 1; Unemployed = 0
	HH size	Total number of family members currently residing	Number of individuals
	Income	Total monthly income of HH	In Leones
	Environmental awareness	Whether the respondent is aware of the environmental impacts of waste or no	Yes

Presentation of findings in tables and figures:

SECTION A: **TYPES OF WASTE PRODUCED AND WASTE MANAGEMENT Practices**

Type of Waste Generated

Table 2

Valid			Frequency	Per cent
KEY 1=DOMES TICS		1	74	43.3
		2	68	39.8
		3	29	17.0
		Total	171	100.0
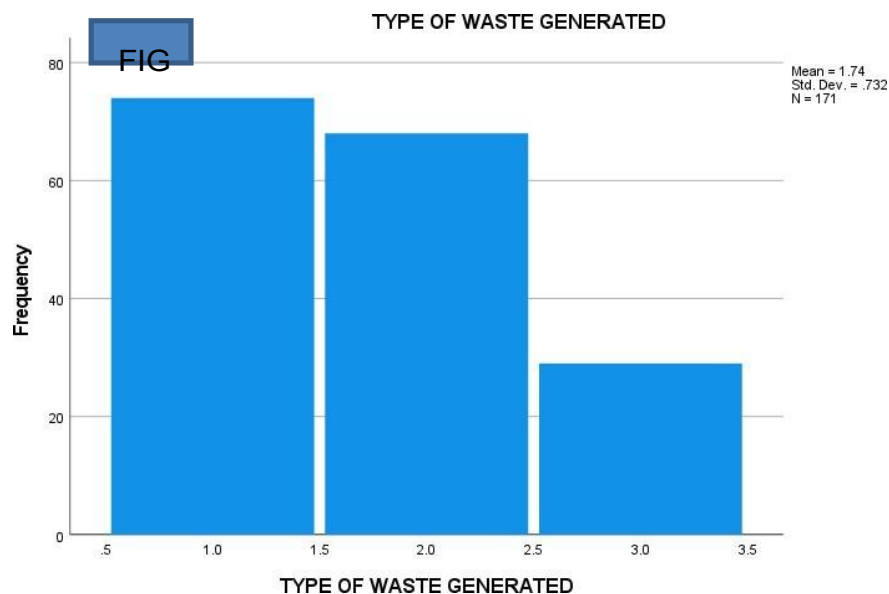
The analysis and chart above show the types of waste generated by the household from the research 43.3% represent domestic waste, 39.8% industrial and 17.0% medical waste.

Types of Waste Deposition Method by Households

Table 3

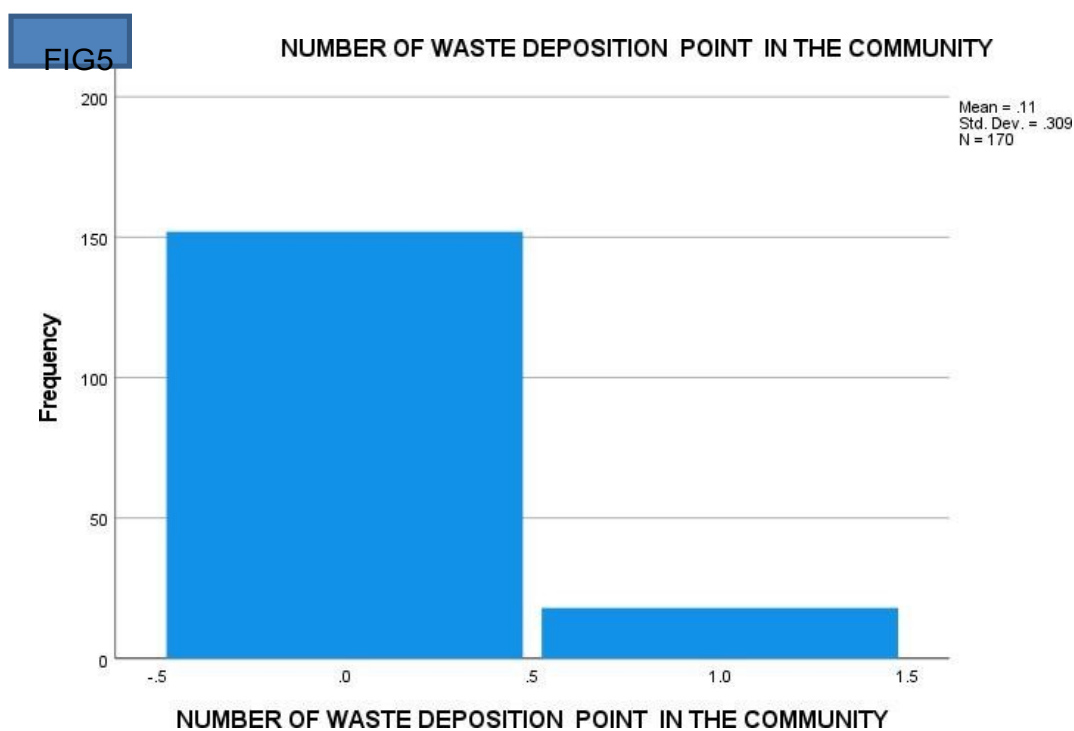|		Frequency	Per cent	Key
Valid	1	98	57.3	1=OPEN CtfANELS
	2	47	27.5	2=BURNING
	3	16	9.4	
	4	10	5.8	
	Total	171	100.0	
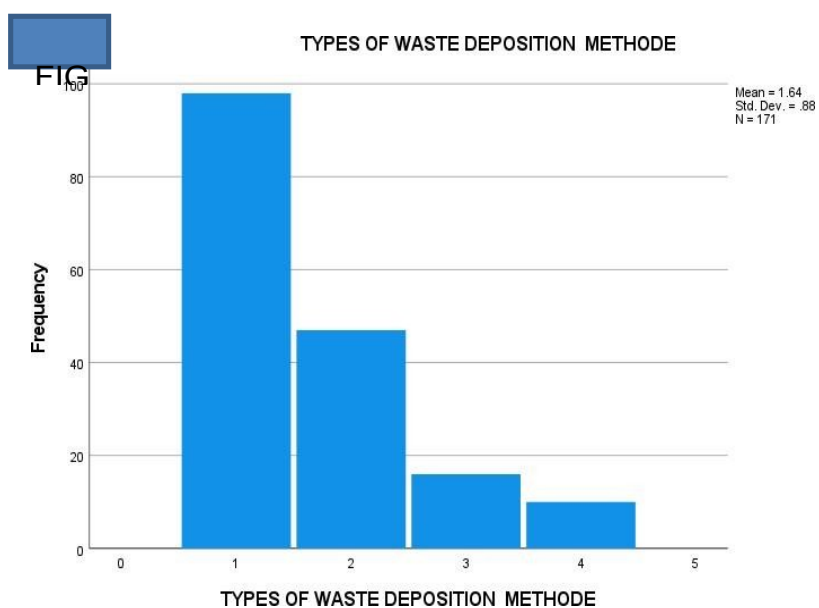
From the table and figure above regards result obtained from respondent relating to the types of waste deposition method by households, it shows that 57.3% deposit their waste in open channels 27.5% burnt their waste,9.4% practice composting and 5.8%of they're been deposit at dumpsite by waste organizations.

Number of Waste Deposition Points in the Community

Table 4

		Frequency	Percent	
Valid	0	152	8	Legend 0=No deposition point 1=few
	1	18	1	
	Total	170	9	
Missing	System	1		
Total		171	10	

FIG5

NUMBER OF WASTE DEPOSITION POINT IN THE COMMUNITY

Mean = .11
Std. Dev. = .309
N = 170

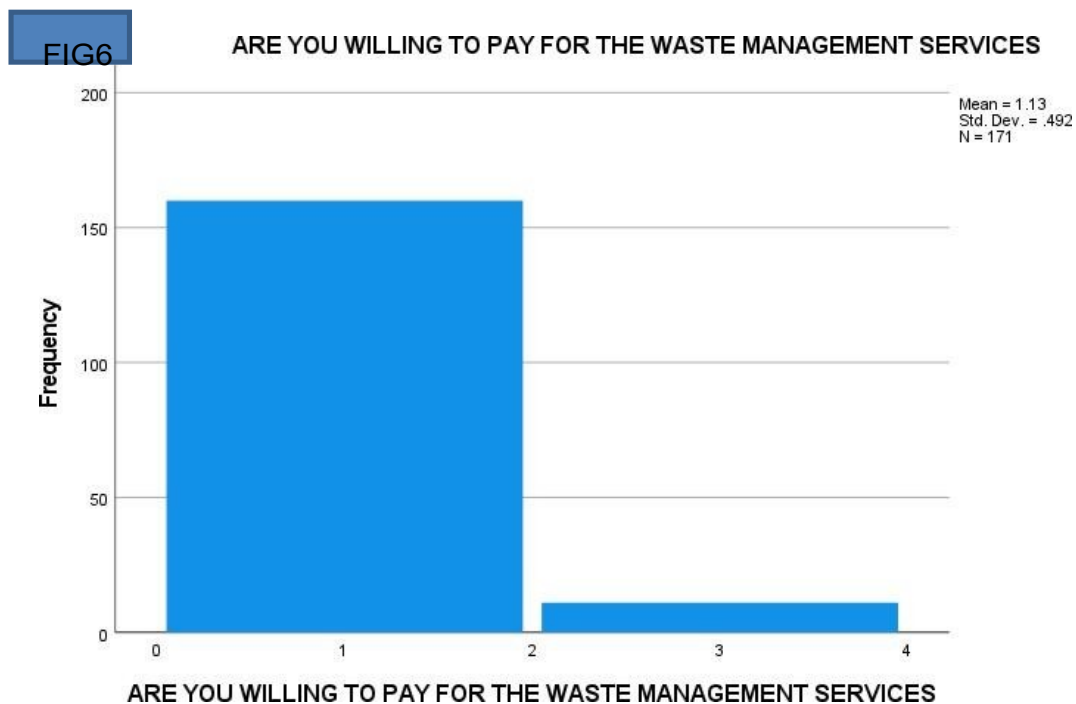NUMBER OF WASTE DEPOSITION POINT IN THE COMMUNITY

From the figure and chart above 89.8% of the respondent reveal that there is no waste deposition point in the community, while 10.2% says there is a waste deposition point in the community.

SECTION B: WILLINGNESS OF HOUSEHOLD TO PAY FOR WASTE MANAGEMENT SERVICES

ARE YOU WILLING TO PAY FOR THE WASTE MANAGEMENT SERVICES

Table 5

		Frequency	Per cent	
Valid	1	38	22.	
	3	11	6.	
	Total	49	28.	
Missing	System	122	71.	
	Total	171	100.0	

Legend
1=willing to

FIG6 ARE YOU WILLING TO PAY FOR THE WASTE MANAGEMENT SERVICES

From the table and figure above 77.6% of the respondent are willing to pay for waste management services while 22.4% says they don't know yet.

How Much are You Willing to Pay

Table 6

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	0	1	.6	.6	.6
	10	3	1.8	1.8	2.3
	15	3	1.8	1.8	4.1
	20	146	85.4	85.4	89.5
	25	1	.6	.6	90.1
	30	9	5.3	5.3	95.3
	50	7	4.1	4.1	99.4
	70	1	.6	.6	100.0
	Total	171	100.0	100.0	

HOW MUCH ARE YOU WILLING TO PAY

From the chart and figure above 85.4 %of the respondent agreed to pay Le20 per month for waste management services which is in majority.
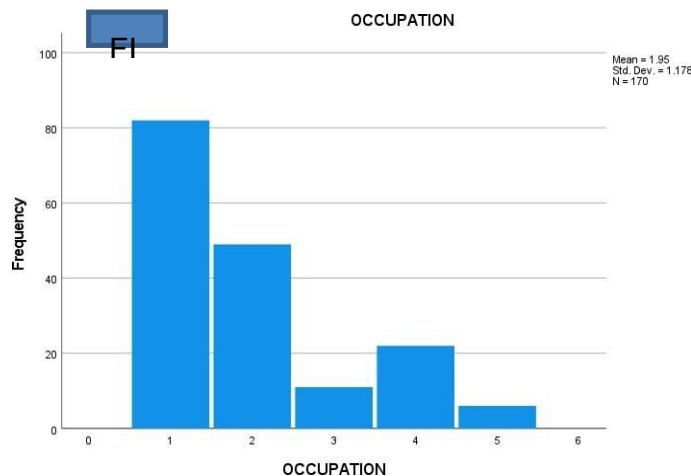
Section C: **Attitudes and Perceptions of the Households on Solid Waste Management**

<div align="center">Table7</div>

		Frequency	Per cent	Valid Percent	Cumulative Percent	Legend 1=teACHer 2=business people 3=MedicAl
Valid	1	82	48.0	48.2	48.2	
	2	49	28.7	28.8	77.1	
	3	11	6.4	6.5	83.5	
	4	22	12.9	12.9	96.5	
	5	6	3.5	3.5	100.0	
	Total	170	99.4	100.0		
Missing	System	1	.6			
Total		171	100.0			

Occupation

OCCUPATION

From the figure and chart above 48.2 % represent teachers 28.8% business people, 6.5

% represents medical staff, 12.9% drivers and 3.5% unemployed.

Number of Waste Deposition Points in the Community

Table 8

		Frequency	Per cent	
Valid	0	152	88.	LENGE
	1	18	10.	
	Total	170	99.	
Missing	System	1	.	ND
Total		171	100.	

From the table 89.4%represent no deposition point and 10.6% waste deposition point in the community

FIG9

NUMBER OF WASTE DEPOSITION POINT IN THE COMMUNITY

Mean = .11
Std. Dev. = .309
N = 170
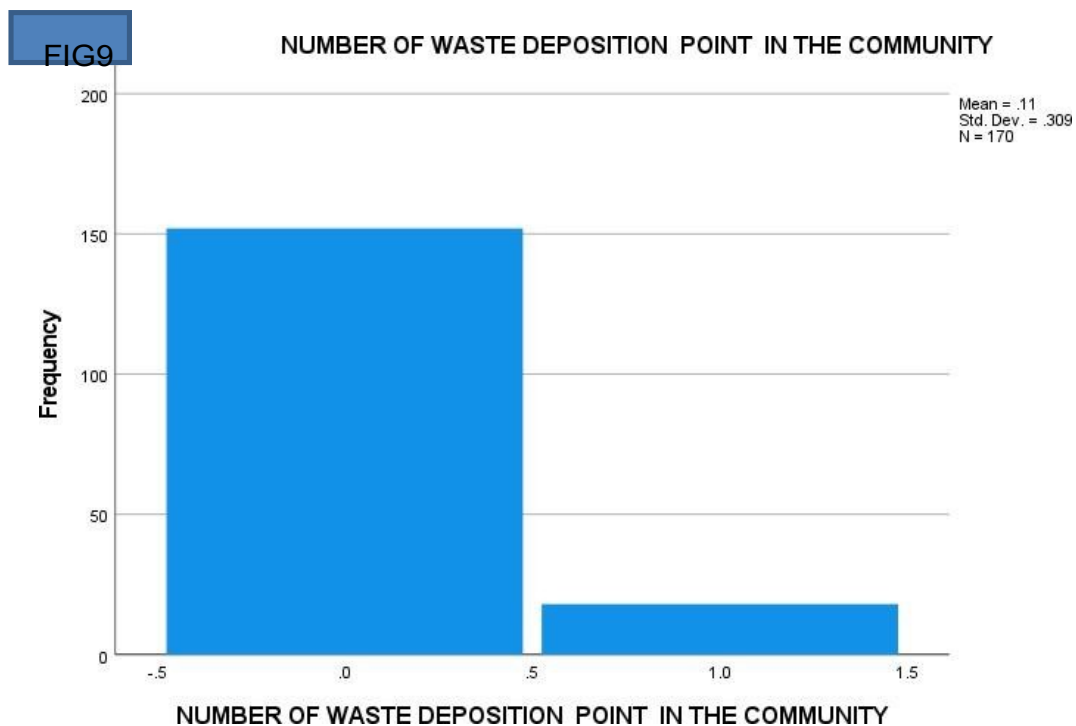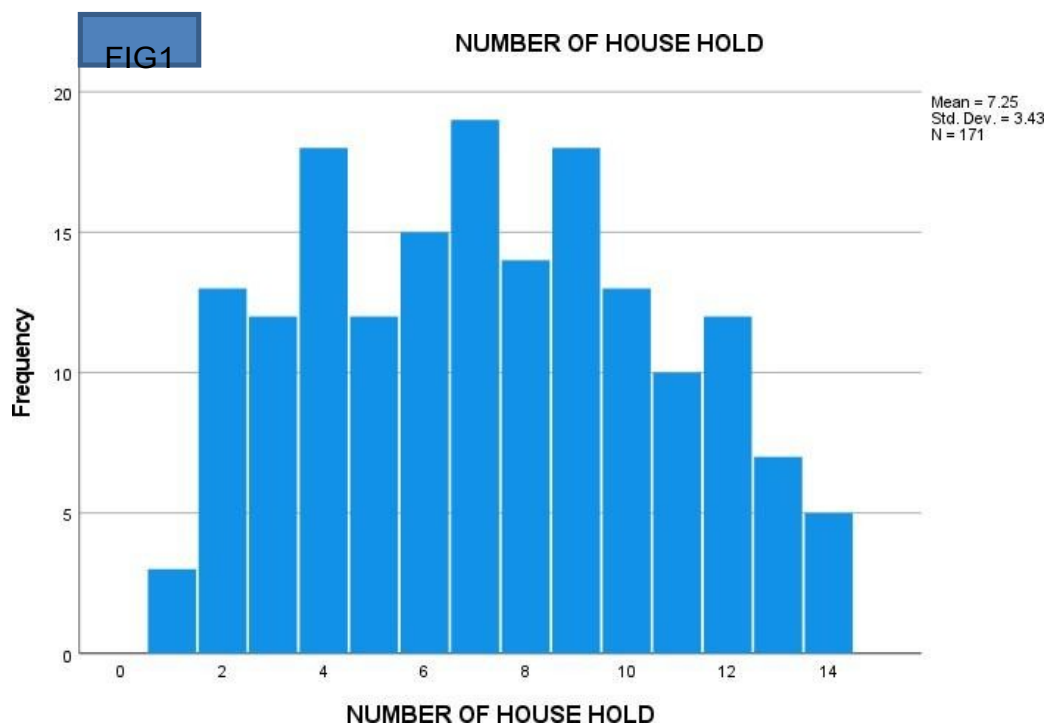
Number of Households

Table9

|		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	1	3	1.8	1.8	1.8
	2	13	7.6	7.6	9.4
	3	12	7.0	7.0	16.4
	4	18	10.5	10.5	26.9
	5	12	7.0	7.0	33.9
	6	15	8.8	8.8	42.7
	7	19	11.1	11.1	53.8
	8	14	8.2	8.2	62.0
	9	18	10.5	10.5	72.5
	10	13	7.6	7.6	80.1
	11	10	5.8	5.8	86.0
	12	12	7.0	7.0	93.0
	13	7	4.1	4.1	97.1
	14	5	2.9	2.9	100.0
	Total	171	100.0	100.0	

From the table above 11.1% shows the highest percentage of households interviewed which is in majority

Challenges Faced

Table 10

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	1	108	63.2	63.2	63.2
	2	43	25.1	25.1	88.3
	3	12	7.0	7.0	95.3
	4	8	4.7	4.7	100.0
	Total	171	100.0	100.0	

FIG1

LEGE ND

1= LIMITED WASTE DEPOSITION POINT
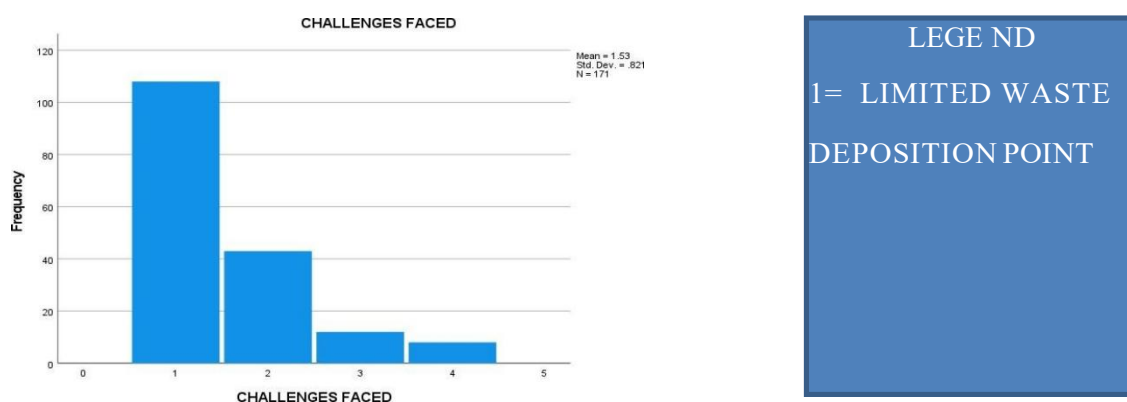
From the table and figure above 63.2 % of respondent faces problems with limited waste deposition point, 25.1% faces problems with waste odour and 7.0% have environmental sanitation

Section D: Household Knowledge of Waste Management Practices

FIG
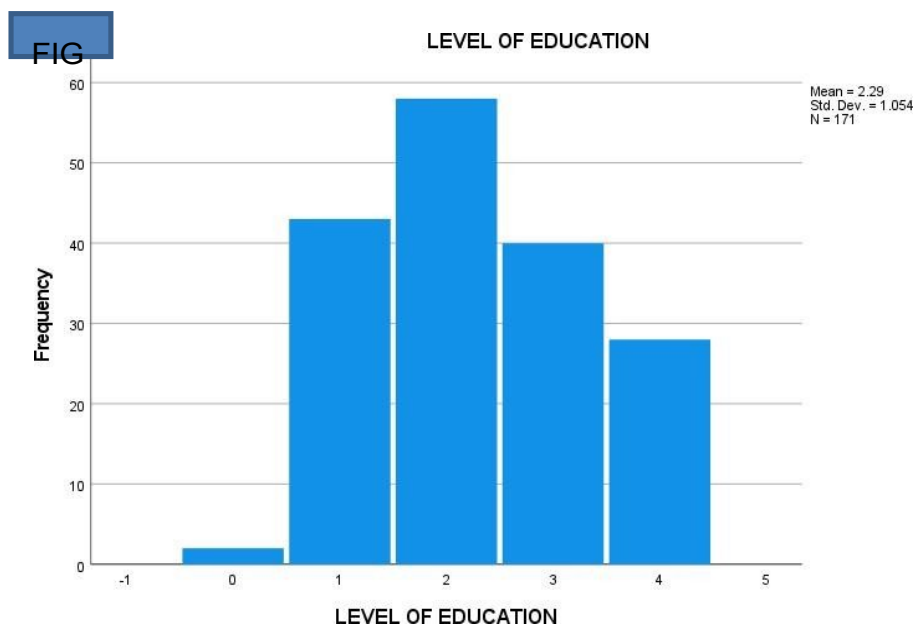
Level of Education

Table 11

		Frequency	Per cent	LEGEND
Valid	0	2	1.2	0=medicA1 school
	1	43	25.1	1=tfIGtfER EDUCATION
	2	58	33.9	
	3	40	23.4	
	4	28	16.4	
	Total	171	100.0	

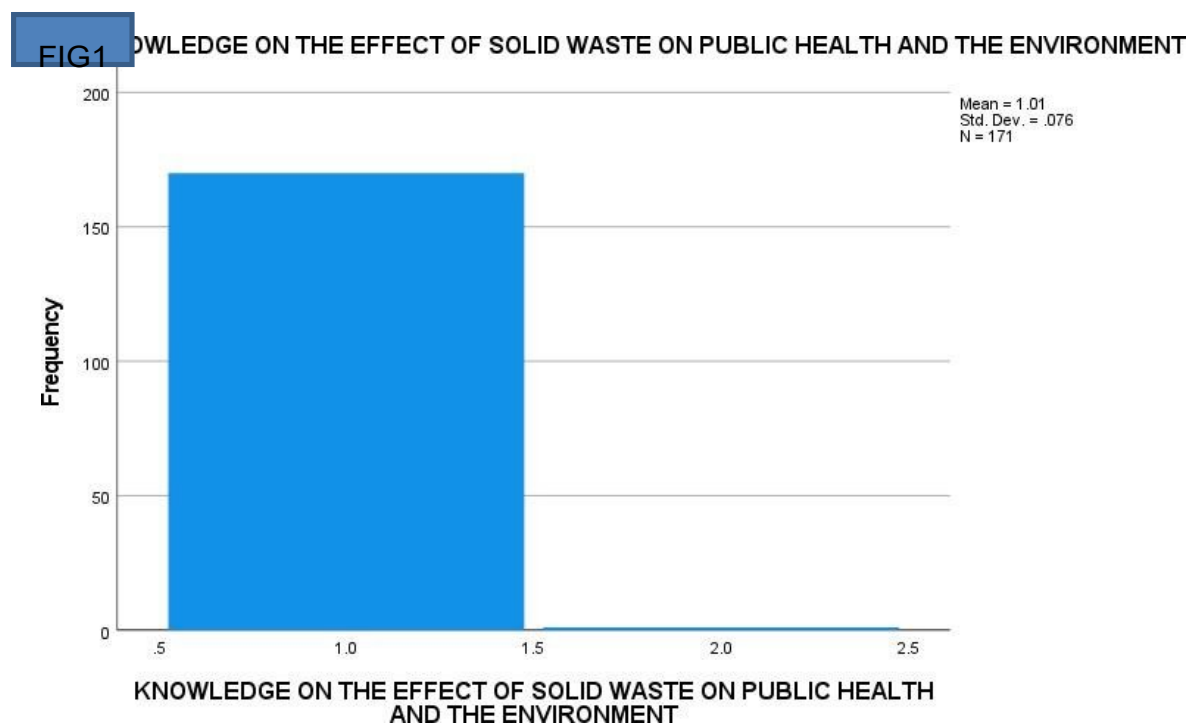From the research, the figure and table above show 1.2% represent respondents with medical education, 25.1% medical education,33.2% university degree,23.4 % secondary school education and 16.4%with no education.

Knowledge of the Effect of Solid Waste on Public Health and the Environment

Table 12

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	1	170	99.4	99.4	99.4
	2	1	.6	.6	100.0

Total 171 100.0 100.0

FIG1 OWLEDGE ON THE EFFECT OF SOLID WASTE ON PUBLIC HEALTH AND THE ENVIRONMENT

Mean = 1.01
Std. Dev. = .076
N = 171

KNOWLEDGE ON THE EFFECT OF SOLID WASTE ON PUBLIC HEALTH AND THE ENVIRONMENT

From the figure and table above 99.4% of the respondent interviewed has knowledge of the effect of solid waste and 0,6% do not know the effect of solid waste on public health.

Analysis of Findings

The development of a household-wide integrated solid waste management system is hampered by improper waste disposal methods. To make accurate decisions in the direction of a strategy that is more sustainable, it is necessary to know the practices that are currently in use and how people view the management of household solid waste. The practices and perceptions of household waste management are the subjects of this study of the Bomeh community.

A stratified random sampling technique using a cross-sectional survey questionnaire was used to collect data. A total of 171 households were interviewed in the survey and data were analyzed using SPSS. Histograms were used to determine the relationships between categorical variables.

Based on the research analysis (table 2 fig3) above 43.3.7% represents domestic waste, 39.8% industrial, and 17% medical waste generated by households within the study area, the findings also reveal in (table 3 fig4) that 57.3% of the respondent deposit their waste in open channels 27.5% burnt their waste, 9.4 practice composting and 5.8%of been deposited at dumpsite by waste organizations. (Also in table 4 figure 5)89.8% of the respondent says that there is no waste deposition point in the community, while 10.2% represents waste deposition point in the community.

Hence, Solid waste management (SWM) in the majority of developing countries including Freetown is dominated by open dumping due to lower capital, operational, and maintenance costs. This non-sanitary and non-engineered approach exposes the surrounding environment to multiple air, water, and soil pollution issues. Because people's attitudes and perceptions are linked to their waste management practices, this study takes a behavioural approach. According to Kaoje et al. (2017), an individual's perception is influenced by their values, moods, social circumstances, and individual expectations.

Willingness to pay for waste management services: Households suffer from the effects of uncollected solid waste, as a result, urban dwellers' participation in SWM service greatly contributes to the community's improvement of SWM. One of the goals of this study is to estimate households' willingness to pay for improved waste management services and examine the factors that determine this willingness. The analysis of this study in(table 5 fig6) shows that 77.6%of the respondents are willing to pay for the waste management services and 22 say they don't know. in the same vail (in table 6) 85.4 % of the respondents agree to pay the sum of Le20 per month for waste management services.

According to Nicholas Keinerugaba, (factors affecting households' willingness to pay for garbage 2022, p.7) illiteracy, a lack of understanding of the repercussions of poor waste disposal, free-rider mentalities, low-income levels, and poor residential area planning causes households to act recklessly when managing waste. It will be interesting to find out how

much households are willing to pay for improved waste management services. Structured questionnaires were distributed to participants using a stratified sample survey for selected households from various locations. The purpose of the quantitative cross-sectional survey of selected households was to examine the household's willingness to pay for garbage and the demographic and socioeconomic factors that influence it. The statistics, significance, and relationship between the dependent and independent variables were efficiently measured using descriptive, bivariate, and multivariate analyses.

Section C: Attitudes and Perceptions of the Households on Solid Waste Management

Analysis in (table 7 figure 8) shows that 48.2% of the respondent interviewed are teachers 28.8 % are business people, 6.5 %are medical staff, 12.9 % are drivers and 3.5% are unemployed. From (table 8 and fig 9) reveal that 11.1% represents the highest percentage of households interviewed which is in majority.

According to Navez-Bounchaire (1993), the management of garbage in a household is tied to how people see the world and how social and cultural practices are used. This leads to different ways of appreciating space depending on whether the space is private or public. Due to the diversity of the population, this is important. According to Abrokwah (1998), there are three main reasons why there are problems with waste management in Freetown and the study area: ignorance, carelessness, and a lack of laws to punish those who break the rules of sanitation. The residents should be taught how to manage household waste and the dangers that waste disposal could pose to the environment and them

Section D: Knowledge of Households Regards Waste Management Practices

Cognitive knowledge is a very important domain for the formation of a person's actions; knowing from experience and research results turned out that behaviour based on knowledge will be better than not based on knowledge. The approach of psychological theories about the relationship between knowledge, attitudes, and behaviour can be used to understand and explain the behaviour of waste management. The term "KAP" (knowledge, attitudes, practices, and willingness to pay) refers to research that looks into the connection that exists between attitudes, behaviours, and knowledge .from the analysis above 99.4% of the respondent has knowledge of the effect of waste management, and 0.6% represent those that do not know the effect of solid waste.

Discussions

Managing solid waste is a growing problem in urban areas around the world that is increasing faster than the rate of urbanization. More so, lower-income countries are expected to be affected more by it because of the lack of technological advancement and socio-political settings favourable to overcoming the such condition. The uncollected waste is dumped indiscriminately on streets, banks of the river and in drains; gets mixed with human and

animal excreta; thus, contributing to flooding, breeding of insects, and vectors, and spreading of diseases. Even the limited waste that gets picked is often disposed of in uncontrolled dump sites and burnt; thus, polluting water resources, air and the environment. Freetown, one of the least developed countries in Africa, is no exception to such a situation. Rapid population growth in urban areas has also contributed to growing solid waste.

Cities and community groups in Freetown are mainly characterized by having limited access to information, especially on improving the waste management system and using waste in an economically productive way. Within the existing SWM situation, there is no proper and effective waste collection system and no recycling and composting activities practised all over Sierra Leone except for a limited number of the population practising scavengers. Haphazard depositing and burning piles of waste along the roads and riversides is a common sight, causing health hazards and environmental problems. This has caused SWM to be the most important environmental problem in urban areas of Sierra Leone inclusive of the study area.

Before deciding upon the most effective waste management option, the current status of waste-related issues should be identified. It includes how much waste is generated, what kind of waste is mostly produced, how it is managed, who the actors are involved in its management, what resources these actors already have to manage the waste, etc. Although the characteristics among urban areas of developing countries are quite common, waste management tactics should be context-specific, locally sensitive, critical, creative, and owned by the community of concern; as their specific circumstances may be significantly different. This is why there is a need to do a comprehensive study on waste, particularly in a country like Sierra Leone and Bomeh to be specific where there is barely any detailed analysis of waste generation and management practices to suggest the most effective solution.

This study analyzed the current solid waste situation in Freetown city, to identify effective methods for its management. Bomeh is selected for this study because it is one of the least resource-intensive areas in Freetown but does not fall under the priority of SWM researchers or implementers. However, a growing amount of waste nonetheless demands proactive action. The municipality owns about thirty tractors serving the entire city and thus only a few areas have regular waste collection services. This research assessed socioeconomic factors affecting households' waste generation and conducted a characterization study of households' waste, assessed households' socioeconomic factors affecting willingness to pay for solid waste collection service, and evaluated households' compost-making practices using organic waste.

In Freetown, it is assumed that HHs account for a greater amount of municipal waste generation. This study was done in two phases. The first survey was conducted in January 2023 to collect data relating to socio-economic background, amount and types of waste generated, waste management practices, willingness-to-segregate waste and WTP for improved waste collection service. The data was collected from 171 individual households using a stratified sampling method.

Recommendations

The best strategy would have been to promote HH composting as managing at source would lead to environmentally sound and economically feasible means, but most importantly it reduces the waste volume that needs to be transported to the dumpsite. Even though there is no recycling institution within Freetown, the current waste pickers who collect recyclable waste from landfill should be institutionalized to effectively channel recyclable waste to junkshop owners who are responsible for transporting these materials in cities where recycling exists. This might also increase the local job opportunity for recyclable waste collection and transportation.

If waste from other sources such as commercial, industrial or institutional entities were to be included, the total waste generated in the municipality would be much higher. Amid waste management, waste segregation should be the most important step that assures waste management in an environmentally sound and economically feasible way. The local government should encourage all HHs through environmental education, training and awareness programs that will gradually instil value, followed by action. The researcher suggests that HHs realize the importance of segregating waste for proper management of waste and they want to be a responsible citizen by obeying the law.

In Freetown, females are responsible to do household errands, which also includes the management of household waste. Hence, they are more affected and concerned about the proper management of waste. Policy implementation is a huge challenge for the government and so the findings from this study could be taken into consideration to enforce the law of waste segregation at source in the study area as well as other urban places in Sierra Leone and other developing countries as well.

With the growing amount of MSW and municipalities' inability to manage it properly mainly due to financial constraints, collecting fees from the public for improving the waste management service seems to be the only viable option. The waste collection service is restricted only to limited areas in Bomeh.

Although some of the reasons for both willingness and unwillingness to pay are more or less interrelated, it can be generalized that those willing to pay are more concerned about the cleanliness of their house and surrounding, want better waste collection service and feel responsible to share the cost of proper waste disposal. Similarly, HHs who are not willing to pay do not feel that it is their responsibility as they are already paying the city tax and that it should be managed by the local government without any additional fee being imposed on them The significant factors that influence the maximum amount of money HHs are willing to pay for improved waste collection are monthly HH income, environmental awareness and waste collection service.

Concerned stakeholders and policymakers should consider these traits of HHs before enforcing waste collection fees. For instance, since HHs' awareness about environmental impact is positively significant to both WTP and the maximum amount of waste collection

fee they are willing to pay, the government and concerned stakeholders should educate the HHs about the adverse effects of indiscriminate disposal of waste on the environment to raise more funding for SWM. The explanatory variables used in the model analyses to identify factors influencing waste generation, willingness-to-segregate waste and willingness to pay were based on relevant literature. However, the same variables should be used in future research to make consistency in findings, which will help to make robust discussions. A follow-up study should be carried out to evaluate the compost-making practices at the household level and also to understand the ongoing challenges faced by the households.

The role of informal sectors and the flow of recyclable materials should also be studied. Traditional values, religious beliefs and the existing caste system are the major factors acting against effective solid waste management in urban areas of developing countries. Therefore, these aspects should also be considered in future research.

Proposed Design

the study on Zero Waste by applying the Architectural concept Rethink, Reduce, Reuse and Recycle Human economic activities are naturally dependent on the overall environment, and possibilities for economic growth may be limited by the lack of raw materials to supply factory and trade stocks. While for some resources there are still untapped stocks, such as certain metals and minerals, there are others, such as fossil fuels and even water, with serious availability issues in many locations.

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