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Challenging in Waste Management in Kenema

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Abstract

Solid waste management is a major problem in Kenema, as the city efforts to keep up with the fast growth in population and urbanization. Over 200,000 people live in the city of Kenema, and as such, generate a tremendous amount of waste on a daily basis. Due to a lack of appropriate waste disposal facilities and poor waste management practices solid waste has excessively accumulated in the city. This has resulted in health risks, environmental destruction, and negative effects on the quality of life of residents. To address the issue of solid waste management in Kenema, the government and local authorities have implemented a number of initiatives, including community mobilization and garbage segregation at source. However, the lack of funds, inadequate waste-collecting tools, and inappropriate landfill locations prevent these steps from being successful. This chapter aims to examine the existing state of solid waste management in Kenema, along with its difficulties and potential for development. It will highlight the significance of effective waste management in fostering sustainable development as well as the requirement for sufficient funds to support waste management initiatives.

Keywords
Waste, Management, Kenma

1. Introduction

Solid waste refers to any garbage generated by human and animal activities as well as by-products of operations that are generally solid and are abandoned as worthless or undesired items that may be required by law to be disposed of. They can be categorized in a variety of ways based on its origin, environmental dangers, utility, and physical characteristics. Mainly into three types based on their origin or source these are, municipal solid waste, industrial solid waste, and agricultural solid waste (Omang et al., 2021). Soni et al, 2022) describe solid waste as a generated byproduct of human activity with significant impacts on public health and the environment. Its definition may vary depending on the perspective of individuals. The engineers see waste as some discarded materials (Williams, 2005; Norazli et al., 2015). In regard of the various definitions, solid waste when improperly dispose of poses a great threat to society,

leading to health issues, unsanitary living conditions, and potential harm to water sources and the environment (Abubakar et al., 2022). The management of solid waste encompasses various complex challenges related to technology, economics, sustainability, and recycling requirements (Soni et al., 2022; Management et al., 1994). Solid waste management is a critical concern, particularly in urban areas experiencing rapid population growth (Bundhoo, 2018). As waste generation increases there is added more strains on existing waste management systems, potentially causing social conflicts (Medina, 2009). The authorities in both small and large cities of developing countries face significant challenges in managing solid waste due to financial constraints and a lack of understanding about the various aspects of waste handling (Abdel-Shafy & Mansour, 2018). Municipalities responsible for waste management often struggle to provide effective and efficient systems due to limited resources, complexity, and multidimensionality (Sujauddin et al., 2008; Burntley, 2007). Therefore this work focus on the challenges of solid waste management in kenema.

2. Overview of solid waste management in Kenema

Kenema District, located in Sierra Leone's Eastern Province, is home to the city of Kenema, the third most populous city in the country after Freetown and Bo. The district covers an area of 6,053 km^2 and consists of sixteen chiefdoms. With a population of 609,873, it is the most populated district in the Eastern Province. Kenema District shares borders with Bo District to the west, the Republic of Liberia to the southeast, Tonkolili District and Kono District to the north, Kailahun District to the east, and Pujehun District to the southwest (Figure 1).

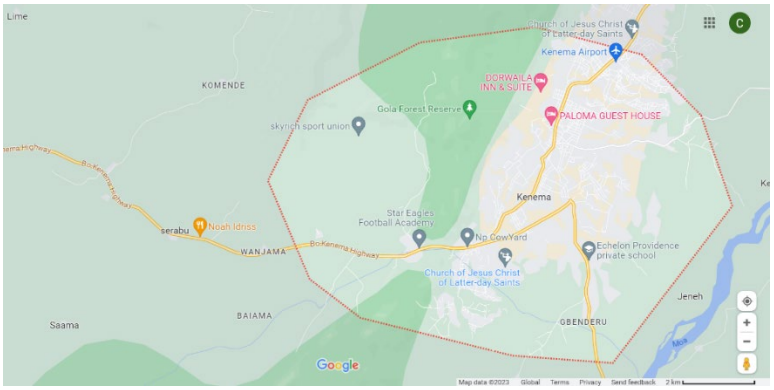

Figure 1. solid waste management in Kenema

The economy of Kenema District is primarily based on farming, diamond mining, and trading (Samuel Beresford Weekes, 2017). Kenema is known for its ethnic diversity and serves as a significant economic center in the Eastern Province (TPD, 2021). The city has experienced rapid population growth, with a current population of 242,364 people, indicating a high growth rate compared to previous years (TPD, 2021). However, residents of Kenema face various challenges regarding solid waste management. These challenges include a lack of proper waste collection management, limited machinery and advanced technology, insufficient knowledge about waste management, and a lack of community involvement in waste disposal. Issues such as poor sanitation, air pollution, inadequate water supply, overcrowding, substandard housing, and improper waste disposal systems contribute to the propagation of illness (Macarthy & Conteh, 2018). Urbanization is on the rise in Sierra Leone, and the urban population is projected to continue growing (Kelly, 2015).

Therefore, is growing concern about the health risks faced by urban dwellers, especially those living in informal settlements in cities like Kenema. However, the inadequacy of infrastructure and land use planning, including waste management strategies, poses a significant concern. Waste generation is expected to increase due to industrialization, urbanization, population growth, and agricultural modernization, exacerbating existing waste management capacity issues (HARPIS-SL, 2016). Major cities like Freetown, Bo, Kenema, and Makeni have been severely affected by the rapid population growth and the associated demand for waste management. Inadequate solid waste management practices in Sierra Leone have previously contributed to a cholera outbreak in 2012, leading to numerous fatalities (HARPIS-SL, 2016). Addressing the challenges of solid waste management is crucial, particularly in informal settlements that constitute a significant portion of urban areas in the country. However, the lack of sufficient data on the extent of health risks faced by residents in informal settlements makes it challenging for the government and aid

organizations to plan and implement effective measures to alleviate the health burdens of urban dwellers (Macarthy & Conteh, 2018).

3. Solid Waste Composition and Sources in Kenema

Household or municipal garbage is typically created from a variety of sources associated with various human activities. Several studies have found that the municipal solid trash that is generated the majority of the revenue earned in developing countries comes from families (55-80%), followed by market or commercial regions (10- 30%). The latter is made up of variable quantities generated by industries, streets, institutions, and many other sources (Nabegu, 2010). In general, solid waste from such sources is highly; diverse in nature (Table 1). As a result, their physical and chemical properties vary depending on their initial source (Sujauddin et al., 2008). They are made up of yard trash, food waste, plastics, wood, metals, papers, rubbers, leather, batteries, inert materials, textiles, paint containers, demolition and building debris, and a variety of other things that are difficult to categories. The solid waste in Kenema consists of a variety of these items generated by home, commercial, industrial, agricultural, and other sources. Plastics, paper, cartons, tin cans, glass, and rubber are examples of non-biodegradable garbage. The informal sector contributes significantly to garbage generation, with a large amount of waste disposed of in landfills and open burning, contaminating the air, water, and soil (Abdel-Shafy & Mansour, 2018).

Table 1. Solid Waste Composition and Sources in Kenema

Source	**Typical waste generators**	**Types of solid wastes**
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, Textiles, leather, wood, glass, bulky items, and household hazardous wastes.
Industrial	Light and heavy manufacturing	Housekeeping waste, packaging, food waste, demolition materials etc.
Commercial	Stores, hotels, restaurants, markets	Paper, cardboard, plastics, wood, food wastes, hazardous wastes etc.
Institutional	Schools, hospitals, prisons	Same as commercial government centers New construction sites, road repair, Wood, steel, concrete wastes etc.
Municipal services	Street cleaning etc.	Street sweepings; landscape and tree Trimmings, general wastes from parks, sludge water etc.
Process Wastes	Heavy and light manufacturing	Slag, mineral tailings etc.
Agriculture	Crops, orchards, vineyards, dairies	Spoiled food wastes, agricultural wastes etc.

4. Challenges of solid waste management in Kenema city

Municipal solid waste deposits, according to most research, pose a significant and long-term harm to persons and the environment (Laner et al., 2009). Solid waste management is a rising challenge in urban areas around the world, and Kenema is no different. As the world's population continues to expand and urbanization accelerates, efficient and sustainable solid waste management becomes increasingly difficult. Kenema, a thriving city in Sierra Leone, presents various challenges in successfully managing its solid waste, which poses substantial environmental, social, and health problems (Komba, 2021). Waste management typically accounts for 30-50% of municipal operations expenses in Third World towns. Despite these significant costs, many cities collect less than half of the waste generated. In India, for example, fewer than half of the waste created gets Waste disposal receives even less attention: up to 90% of MSW collected in Asian cities ends up in open dumps. Most Cities have issues in providing adequate municipal solid waste (MSW) services (Zurbrügg & Schertenleib, 1998). It is anticipated that about 80% of citizens in developing countries like Kenema engage in hazardous waste practice like Open-air burning, littering, and open dumping of household garbage in streets, rivers and mountains, affecting both human health and the natural environment (By-nc-sa, 2021). Tacking these problems means to throw light on the major obstacles that the City is faced with as an efforts to attain efficient solid waste management practices. Through comprehensive waste management strategies, including

improving waste collection and disposal systems, encouraging private sector participation, strengthening policies and regulations, promoting recycling and waste reduction initiatives, and raising awareness among the community about proper waste management practices(ADB, 2022). Among these are the following,

1. **Inadequate infrastructure and resources**: One of the major issues in Kenema city's solid waste management is a lack of proper infrastructure and limited resources. The city frequently issues with a lack of adequate waste collection vehicles, insufficient waste storage facilities, and insufficient financing for waste management projects. As a result, garbage collection is sporadic, waste segregation is inadequate, and capacity for proper solid waste treatment and disposal is restricted (Majale, 2011).

2. **The financial constrains**; financial burden connected with trash management can be a serious concern for cities such as Kenema. Waste management involves a wide range of tasks such as waste collection, transportation, treatment, and disposal (ADB, 2022). These processes necessitate large financial resources, which can put a pressure on municipal budgets, particularly in underdeveloped nations. In the case of Kenema city, Sierra Leone, the financial burden of waste management derives from a number of causes. For starters, insufficient infrastructure and equipment for garbage collection and transportation results in inefficiencies and increased expenses. The city may lack sufficient waste collection vans, bins, and other necessary equipment, resulting in delays and partial rubbish clearance. As a result, rubbish accumulates in public places, increasing the labor and costs involved with waste management (Medina, 2009).

3. **Lack of public awareness and participation**: Lack of public awareness and active participation in waste management practices is another key concern. Many residents are unaware of the significance of garbage segregation, recycling, and environmentally appropriate disposal options. As a result, improper garbage disposal, such as indiscriminate dumping and open burning, persists. It is impossible to achieve successful trash management without widespread education and community involvement (ADB, 2022).

4. **Informal waste sector and uncontrolled practices**: Kenema city also suffers informal waste sector difficulties due to scavengers, or informal waste collectors, these play an important role in waste management by collecting and recycling recyclable materials. Their actions, however, are frequently uncontrolled and can lead to unhealthy working conditions, pollution, and ineffective waste management practices. Integrating and controlling the informal trash sector is critical for enhancing the city's overall waste management (Ã et al., 2006).

5. **Inadequate legislation and enforcement**: A fundamental difficulty in solid waste management is the lack of adequate legislation and enforcement measures. Existing waste management regulations may be out of date or inadequately enforced, resulting in noncompliance and poor waste disposal practices (Castle, 2012). To ensure adherence to effective waste management practices, waste management policies must be strengthened, clear guidelines established, and robust enforcement mechanisms used.

6. **Lack of financial and technical resources**: Kenema City like other cities has financial and technical challenges in adopting comprehensive waste management programs causes municipalities in developing countries have difficulty allocating adequate finances for waste management infrastructure, equipment, and training programs (ADB, 2014). Furthermore, qualified waste management personnel and technological skills may be in short supply. Building local authorities' financial and technical capacities, as well as investing in waste management infrastructure, are critical for solving these issues.

7. **Rapid population growth and urbanization**: Kenema's rapid population expansion and urbanization worsen solid waste management concerns. As the population grows, so does the amount of waste produced, putting extra strain on the already overburdened waste management system (Vinet & Zhedanov, 2011). Changes in consumption patterns and waste composition are brought about by urbanization, necessitating adaptive waste management systems. To handle increasing trash creation and assure proper waste management in a fast growing metropolitan environment, proactive planning and infrastructure development are required (Liu et al., 2019).

8. **Limited landfill capacity and unsustainable waste disposal techniques**: The city of Kenema is confronted with the dilemma of limited landfill capacity and unsustainable waste disposal methods. While the normal

operation of landfills and the accompanying emissions are thoroughly studied, the behavior of garbage deposits in the event of floods is less understood. During a flood occurrence, it must be expected that the landfill body becomes water saturated, resulting in a significant mobilization of pollutants, because the presence of water accelerates decomposition and transport processes. Existing landfill sites may be at capacity, necessitating the need for alternate garbage disposal alternatives. Furthermore, dependence on traditional landfilling without effective waste treatment and management practices can result in pollution, groundwater contamination, and greenhouse gas emissions (Siddiqua et al., 2022). Finding sustainable waste disposal alternatives, such as waste-to-energy technology, composting, or recycling facilities, is critical for reducing the strain on landfills and promoting a circular economy approach to waste management. However, implementing these alternative ways necessitates major infrastructure and technological investments, as well as extensive planning and coordination among parties.

5. Environmental and health impact of MSW in Kenema

Mismanagement of solid waste in Kenema, has serious environmental and health consequences (Ferronato & Torretta, 2019). Since Municipal solid waste (MSW), which includes a variety of waste categories such as household garbage, institutional wastes, street sweepings, business wastes and building and demolition debris, accounts for the majority of solid waste created in the city it reckless disposal can cause flooding one of the most serious environmental consequences of MSW mismanagement. Improper garbage disposal practices, such as depositing rubbish in vacant lots, public places, landfills, or rivers, aggravate the situation. During heavy rains, uncollected waste collects on the streets, clogs drainage systems, and contributes to the incidence of floods. Furthermore, runoff water can transport waste and contaminate rivers, lakes, and oceans, altering ecosystems and endangering aquatic life. Uncontrolled disposal causes serious heavy metal pollution in water, soil, and plants open burning causes CO, CO2, SO, NO, PM10, and other pollutant emissions that affect the atmosphere (Ferronato & Torretta, 2019). Open dumping of solid trash creates a variety of environmental and health risks. The decomposition of organic materials releases methane, which can cause fires and explosions and contributes to global warming. The biological and chemical processes that occur at open dumps produce powerful leachates, which damage surface and groundwater. Fires erupt on a regular basis in open dumps, causing smoke and contributing to air pollution (Babayemi & Dauda, 2010). More so waste picking within open dump sites poses a serious health risk to people working in these areas and the release of SW in water bodies improves marine litter globally, enhancing environmental contamination (PNUMA, 2009). As a result, SW mismanagement is the cause of severe and diverse environmental and social consequences, which prevent advancements in sustainable development in the city.

Mismanagement of solid waste in Kenema has both environmental and health impacts. Open dumping sites, which are ubiquitous in cities, also serve as breeding grounds for rats and insects, raising the danger of disease transmission. These pests can cause or transmit severe illnesses to humans, raising public health issues. Furthermore, the decomposition of organic materials at open dumps releases methane gas, a powerful greenhouse gas that contributes to global warming (Omang et al., 2021). The accumulation of methane not only exacerbates climate change, but also raises the likelihood of fires and explosions at these dumpsites, providing additional risks to both human health and the environment.

Due to the lack of a competent refuse collection system, many Kenema residents resort to improper garbage disposal practices, such as dumping waste in inappropriate locations or burning it in their backyards causes pollution because burning waste emits hazardous pollutants into the air and dumping rubbish in unsuitable regions contaminates the land and groundwater. As a result, the costs of environmental remediation and healthcare rise as efforts are made to clean up polluted areas and treat persons affected by the negative health effects of improper waste management.

Another significant environmental and health impact of Kenema's solid waste mismanagement is air pollution. Improper garbage disposal practices, such as open burning of rubbish, discharge a number of dangerous chemicals into the air. The combustion of plastics, rubber, and other materials included in solid waste emits hazardous gases and particulate particles, contributing to poor air quality(Kumar & Prakash, 2020). This can cause respiratory issues, allergies, and other respiratory disorders in the general population, particularly in sensitive groups such as children and the elderly. Prolonged exposure to dirty air can have long-term health consequences, including an increased risk of cardiovascular disease and lung cancer. Implementing good waste management practices, such as encouraging garbage segregation and recycling and avoiding open burning, is critical to reducing air pollution and protecting public health.

6. Socio-Economic Implications

In Kenema, solid waste management has important socioeconomic ramifications. For starters, improper solid waste management endangers the population's health. Improper waste disposal can result in the spread of diseases such as cholera, typhoid, and other watery ailments. These health difficulties not only have an impact on individuals' well-being, but they also place a strain on the healthcare system, diverting resources away from other critical services. Furthermore, the presence of uncontrolled garbage can attract vermin and bugs, worsening health risks and lowering overall community quality of life. The socioeconomic impact is especially important for low-income people, who frequently reside near trash disposal sites and are most vulnerable to health problems. Inadequate waste management practices in the city might have a negative impact on public health. Improper solid waste disposal causes garbage to accumulate in residential areas, producing breeding grounds for disease-carrying vectors such as mosquitoes and rodents. This increases the danger of diseases including malaria, dengue fever, and leptospirosis, impacting the community's overall health and well-being. Individuals and the local economy bear the cost of following healthcare costs and lost production as a result of illness.

Inefficient waste management methods can have a harmful impact on the environment. Improperly dumped garbage frequently ends up in open dumps or uncontrolled landfills, contaminating the soil, water, and air. Toxins and hazardous substances from solid waste can leak into groundwater, poisoning water supplies and endangering human health and ecosystems. Furthermore, in the absence of suitable waste disposal procedures, garbage burning emits hazardous greenhouse gases and particulate matter, leading to air pollution and climate change. These environmental effects can have a negative impact on agricultural output, biodiversity, and the overall quality of life in Kenema.

Finally, improper solid waste management has socioeconomic consequences for economic output and tourism. Potential investors and businesses may be put off by a city with garbage-filled streets and ineffective waste management systems (Iqbal et al., 2022). The accumulation of rubbish not only degrades the city's appearance but also provides the impression of an unhygienic and badly controlled place. This may result in fewer economic prospects, lower property values, and slower tourism growth. Kenema, which is recognized for its dynamic markets and cultural heritage, may lose its allure if solid waste management is not prioritized, threatening the livelihoods of locals who rely on these economic activities.

7. Conclusions

The financial burden associated with waste management in Kenema City stems from inadequate infrastructure, lack of treatment and disposal facilities, and limited recycling and resource recovery systems. The strain on financial resources hampers the city's ability to effectively manage waste, leading to environmental and public health concerns. Addressing this challenge requires a comprehensive approach involving improved funding mechanisms, infrastructure development, and sustainable waste management practices.

To overcome these difficulties, Kenema City may find it advantageous to encourage private sector participation in solid waste management. This can be accomplished by providing incentives for enterprises to invest in waste management infrastructure, promoting partnerships with private organizations, and enacting rules that promote responsible waste management practices. By incorporating the private sector, Kenema City may be able to improve the overall effectiveness and sustainability of its solid waste management initiatives.

Kenema may become a more sustainable and livable city by tackling the environmental and health consequences of solid waste mismanagement. This necessitates a multifaceted approach that includes raising public awareness about the importance of responsible waste management, implementing stringent regulations and enforcement mechanisms, and providing the necessary infrastructure and resources for effective waste collection, treatment, and disposal. Collaboration between the government, local governments, community organizations, and people is critical to creating meaningful and long-term changes in solid waste management. Kenema can improve its quality of life, maintain its natural resources, and promote a cleaner and healthier environment for its present and future generations by prioritizing environmental protection and public health.

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