

# Perspectives on Solid Waste Management Practices in Urban Ghana: A Review

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## Abstract

The expansion of urban centres in Ghana has brought about the problem of waste management. The spiralling solid wastes in the metropolises go beyond the capacity of the metropolitan authorities to manage. The waste problem is not only bringing in environmental decay and health problems as well as loss of land for agricultural activities, it is denying the cities and the nation benefits from the waste resource such as compost for agriculture and energy through its recycling. The review examines solid waste practices in urban areas in Ghana drawing examples from the three most urbanized areas of Accra, Kumasi and Tamale. Literature on waste management practices in these areas has been reviewed and perspectives given. Weaknesses in the practices, as related to best practices in the world, have been identified. Issues that emanate from the review among others are that the level of urbanization, enlightenment and socio-economic status are determinants of the commitment and ability to pay for waste management services in urban areas in Ghana. Besides, indiscriminate dumping of waste and damaging waste management practices in urban Ghana are functions of socio-economic status. Moreover, in urban Ghana the need for government-private participation in waste management is a "sine-qua-non" in ensuring efficient waste management practices. The Ghana situation requires that the World Health Organization (WHO) model that low-middle income and developed countries tend to experience better waste management practices will require a second look. It is strongly recommended that the Swedish model of waste management where waste recycling is a major boost to economic development be embraced.

**Keywords:** Solid waste management; Urban; Ghana; Recycling; Disposal; Landfill; Perspectives

## Introduction

Rapid population growth, especially in developing countries, has led to accumulation of waste [1] which is a serious environmental threat with consequences on health and even space for development. The same source estimates that Municipal solid waste (MSW) generation will increase to 200 million tons per year in the foreseeable future. The global burden of urban waste management is enormous and, the urban waste burden could consume resources for development of education, health, energy and agriculture, especially in the developing countries where there is very little technological capacity to deal with the waste problem. Around the world, waste generation rates are rising. In 2012, the world's cities generated 1.3 billion tonnes of solid waste per year, amounting to a footprint of 1.2 kilograms per person per day. With rapid population growth and urbanization, municipal waste generation is expected to rise to 2.2 billion tonnes by 2025 [2].

Africa has a varied historical and political background of waste management. There have been allegations that some African countries serve as dumping grounds for toxic and hazardous waste produced mostly in the developed countries. The population growth trends which are focused on developing countries primarily are resulting in overt accumulation of waste especially in the cities. Some of the largest African countries like Nairobi, Dares Salaam, Lagos, Cairo and Johannesburg are experiencing population trends that are primarily fuelled by high levels of migration [3,4]. Interpreting the transformation of the city centres of South Africa through system dynamics: By 2020, it is estimated that more than 50% of the population in sub-Saharan Africa will be living cities [5]. This is likely to raise the daily rate of production of waste by as much as 1.0kg per capita. The African Environment Outlook (AEO) of the United Nations Environment Programme (UNEP) estimates that the per capita generation of solid waste is an average of 0.7 kg/day in Zimbabwe and 1.0kg/day in Tanzania [6,4].

Outside Africa, research on solid waste in urban areas has been done in several areas. One of such studies is “comparative study of municipal solid waste generation and composition in Shiraz City” of Iran [7]. In this study, the solid waste situation in Shiraz was compared with that of Iran in general and other developing countries. The study did not compare the situation in Shiraz with similar cities in Iran as being done in this study hence, making this study among the few in developing countries and Ghana. In Ghana, high population growth, like other developing countries, is resulting in a high rate of waste generation. There is in developing countries a strong positive correlation between population growth and waste generation. The rate of waste generation in Ghana is 0.47kg/per person/day, which translates to about 12,710 tons of waste per day and the average household waste generation among the metropolitan cities, except Tamale, is as high as 0.72kg/person/day [8]. The high rate of urbanization resulting from astronomical rural-urban migration, poor organization of waste collection practices, inadequate facilities for waste disposal, bad attitude of the public to waste management, increasing cost of waste collection which cannot be borne by the urban poor especially those in the slum and marginal areas are the factors responsible for the waste burden in urban areas.

Recycling and composting facilities are very inadequate. Facilities for processing waste to convert to a resource for re-use are woefully inadequate. There is also the problem of inability for the regulatory institutions to enforce the regulations on waste management, resulting in the escalation of the waste crisis and consequent repercussions on health and clean space for development. The increasing rate of waste generation and attendant environmental and health implications are worrying. Health effects of waste pollution such as eye, respiratory tract, gastrointestinal, skin infections, among others, coupled with the conflicts that emerge from use of landfill sites and other environmental effects call for a critical review of solid waste management practices as well as the related policies as means of developing an appropriate framework for disposing waste in the urban areas in Ghana. The Ghana Environmental Sanitation Policy [9] is a laudable one; its effective implementation will ensure the war against solid waste in the urban areas.

The review aims at, firstly, conceptualizing waste and conventionalized waste management practices. Secondly, it reviews a few theories on waste management practices to provide a theoretical tone for reviewing the theoretical background of the studies. Thirdly, it examines waste management policies, especially as related to solid waste management in the urban areas. Fourthly, it examines waste management practices in the key urban centers in Ghana, relating to conventional and acceptable practices. Fifthly, the methodologies used for the study shall be critiqued, and, finally a framework for the effective and efficient management of solid waste in the urban areas shall be examined. This paper argues that the increasing waste burden in the urban areas shall be addressed through aggressive, pragmatic policies within the framework of a strong political will of government.

## Materials and Methods

This paper is a review which provides perspectives on solid waste management practices in urban Ghana. Works on waste management practices in the three key metropolitan areas, namely Accra the national capital, Kumasi the second largest city and Tamale the third largest city were randomly selected for review. The selection was from each of the ecological zones. Accra is in the coastal savannah zone; Kumasi from the forest zone and Tamale from the northern savannah zone. The selection from each of the ecological zones provides a geographical mosaic which ensures a balanced analysis. The data and methods used for the analysis as well as findings are discussed and limitations suggested.

## Waste, Types and Management

Waste is any substance which is discarded after primary use, or is worthless, defective and of no use. Zero Waste America [10] defines waste as “a resource that is not safely recycled back into the environment or the marketplace.” This definition takes into account the value of waste as a resource, as well as the threat unsafe recycling can present to the environment and public health. Generally, waste could be liquid or solid waste. Both of them could be hazardous. Liquid and solid waste type can also be grouped into organic, re-usable and recyclable wastes. Liquid waste includes point source and non-point source discharges such as storm water and wastewater. Examples of liquid waste include wash water from homes, liquids used for cleaning in industries and waste detergents. Solid waste predominantly, is any garbage, refuse or rubbish that we make in our homes and other places. These include old car tyres, old newspapers, broken furniture, food waste, etc. Hazardous or harmful wastes are those that potentially threaten public health or the environment. They could be inflammable, reactive (can easily explode), corrosive (can easily eat through metal) or toxic (poisonous to humans and animals).

Organic waste comes from plants or animal sources whilst recyclable wastes are used materials that could be processed into new, useful products. Waste could also be classified by their sources based upon which we have municipal, medical/ clinical, agricultural, automobile, industrial, construction/demolition and electronic sources. Waste management encompasses management of all processes and resources for proper handling of waste materials, from maintenance of waste transport and dumping facilities to compliance with health codes and environmental regulations. It simply means the collection, transport, processing or disposal, managing and monitoring of waste materials to minimise its consequences on humans and environment. There are several methods of managing waste some of which cause additional harm to the environment. The major methods of waste management are “recycling, composting, sewage treatment, incineration and landfill” [11].

## Solid Waste

As already defined, solid waste predominantly, is any garbage, refuse or rubbish that we make in our homes and other places. These include old car tyres, old newspapers, broken furniture, food waste, etc. Solid waste has several sources including municipal sources of waste, medical/clinical sources of waste, agricultural sources of waste, industrial sources of waste, construction/demolition sources of waste and electronic sources of waste and end-of-life automobiles [12-15]. Municipal sources of waste include trash or garbage from households, schools, offices, market places, restaurants and other public places. They include “everyday items like food debris used plastic bags, soda cans and plastic water bottles, broken furniture, grass and clippings, product packaging, broken home appliances and clothing.” Medical waste refers to “waste normally produced from health care facilities, such as hospitals, surgical theatres, veterinary hospitals and labs.”

Whereas agricultural sources of waste are generated by agricultural activities and include horticulture, fruit growing, seed growing, livestock breeding, market gardens and seedling nurseries, end-of-life automobile sources are rusted old cars. Industrial solid wastes are glass, leather, textile, food, electronics, plastics and metal products. Construction waste is that resulting from the construction of roads and buildings. Sometimes old buildings and structures are pulled down to make space for new ones. This is particularly common in old cities whilst electronic sources of waste are from electronic and electric devices. These include abandoned DVD and music players, TV, telephones, computers, vacuum cleaners, e-wastes, e-scrap, or waste and electronic equipment. The World Bank has designed a global typology of solid waste sources, typical waste generators and types of solid wastes [16]. The sources are residential, industrial, commercial, institutional, construction and demolition, municipal services, process, medical waste and agricultural waste.

## Solid Waste Management

Waste management simply means the “collection, transport, processing or disposal, managing and monitoring of waste materials to minimize its consequences on human and environment.” Tachobanoglou, *et al.* [17] define waste management as “.....that discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes.” It thus involves processes of waste collection, source separation, storage, transportation, transfer, processing, treatment, disposal and recycling of waste. The use of usable parts of waste makes a resource through recycling. Proper waste management is of essential importance in the effective utilization of resources and development of sustainable environmental planning [18]. Sustainable environmental management will create a waste free environment in which waste as a resource would be fully utilised. The processes include waste generation, storage, collection, transfer and transport, processing and recovery and disposal.

Waste generation encompasses those activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal [19]. In 2006, the total amount of municipal solid waste (MSW) generated globally reached 2.02 billion tonnes, which represented a 7 per cent annual increase since 2003 [20]. It is estimated that between 2007 and 2011, global generation of municipal waste will rise by 37.3 per cent, which was equivalent roughly to 8 per cent increase per year. Storage, a process which follows generation, means where solid waste is stored and is not thrown away indiscriminately. They are stored in dustbins or in a skip. Storage is primarily to ensure aesthetic consideration. The element of collection which follows after storage includes not only the gathering of solid waste, but also the hauling of waste after collection to the location where the collection vehicle is emptied [21]. After collection transfer or transport follows. This involves transfer of waste from the smaller collection vehicle to the larger transport equipment and, secondly, subsequent transport of the wastes over long distances to the final disposal site.

In the processing and recovery stage which follows separation operations have been devised to recover valuable resources from the mixed solid wastes delivered to transfer stations or solid waste processing plants. The disposal stage is the ultimate fate of all solid wastes. The methods used vary greatly with types of wastes and local conditions. Early practices of solid waste management were dumping on land, canyons and mining pits; dumping in water; ploughing into soil; feeding to hogs; and, reduction and incineration. A study at Ado-Kiti in Nigeria carried out by Momoh and Oladebeye [19] on solid waste disposal identified methods of solid waste disposal as dumping of wastes into gutters, drains, by roadside, unauthorised dumping sites and stream channels during raining season and burning of wastes on unapproved dumping sites and stream channels during the dry season. The burning of stumps was not uncommon in rural and peri-urban communities.

There are both early or traditional practices of solid wastes as well as contemporary practices. The most common methods for the final disposal of solid wastes were dumping on land, canyons and mining pits; dumping in water; ploughing into the soil; feeding to hogs and reduction and incineration [17]. The World Bank has categorised solid waste management practices by income level. For this work, practices in low-income countries shall be considered [22]. Even though Ghana has assumed low-middle income status, waste management problems are so alarming that it shall be absurd to place it under this category. It rather fits into the low-income category. The activities are source reduction, collection, recycling, composting, incineration, landfilling/dumping, and costs. In source reduction, there are no organised programmes of reducing the volume or toxicity of solid waste prior to its processing and disposal in incinerators or landfills [22] and reuse and low per capita waste generation rates are common.

The process of collection is sporadic and inefficient. Service is limited to high visibility areas, the wealthy, and businesses willing to pay, and overall collection is below 50%. In recycling, although most recycling is through the informal sector and waste picking, recycling rates tend to be high both for local markets and for international markets. Recycling markets are unregulated and include a number of middlemen and there are large price fluctuations. Composting is rarely undertaken formally even though the waste stream has a high percentage of organic material. Incineration is not common and generally not successful due to high capital, technical, and operation costs, high moisture content in the waste and high percentage of inerts. There are low technology sites and there is usually open dumping of wastes. Nearby aquifers, water bodies and settlements are highly polluted.

## **Waste Management in Ghana**

The review begins with an analysis of the issues of municipal waste management in Ghana. This will establish the framework for the review of waste management practices in the urban areas. Adanney and Anarfiwaah Oppong examine critical issues of municipal waste management in Ghana [23]. The authors collected data through structured questionnaires and interviews with key informants as well as relevant resource persons including private waste collectors. The study was conducted in the Awutu Senya East Municipality of Ghana which municipal capital, is Kasoa located at the south-eastern part of Accra the national capital. A sample size of 100 households and another sample size of 30 non-domestic generators (institutions) were used. This study is supposed to be a representation of the national picture of waste management in Ghana. Although the national representation of the geographic space of the study is an understatement, there is some semblance of the national character especially when the area shares boundary with the national capital which is the epicentre of waste management in the country. Apart from this work several others including Songsore, et al. [24], Mensah and Larbi [25], Oteng Ababio, et al. [26], Owusu Sekyere, et al. [27] and Douti, et al. [28] have done works on waste management practices in Ghana. Their views are captured in the summary of waste management practices in Ghana.

### **Results are as indicated below:**

- a. In Ghana the rate of waste management is 0.47 kg/person/day which translates to about 12,710 tons of waste per day, given the current population of about 27,043, 093 [28].
- b. Between 30 and 50 per cent of the solid waste generated are never collected for disposal but are scattered on the streets, streams and drains [29].
- c. Rapid urbanisation in Ghana has resulted in the accumulation of waste in urban areas which puts pressure on urban infrastructure [24,27].
- d. Poor financing by local authorities, low technical staff capable of effective planning services and management are other factors operating against effective waste management in the urban areas [30].
- e. The key management practices and in the work of Addaney and Anarfiwaah, [23] are summarised below:
  - i. Practices adopted concentrate on waste collection with little emphasis on reduction, recycling and re-use and there is the trend of increasing waste generated with increasing urbanisation.
  - ii. There is indiscriminate dumping and littering of waste and the main method of collection is by house-to-house which constitutes 53% of waste collected. The second major disposal method is dumping which, in some instances, is paid for.
  - iii. Greater proportion of waste is collected by private collectors. 43% patronise private formal collection whilst 10% patronise private informal collection.
  - iv. Burning is used by 20% of households and littering and improper dumping creates environmental and health hazards.
  - v. Public awareness of solid waste management and implications for abuse is high yet it does not reflect in appropriate behaviour.
  - vi. The financial burden of financing solid waste has traditionally been the responsibility of government. At the municipal level solid waste management financing consumes about 35% of its budget.
  - vii. The Municipal Assembly (public institutions) does not have the capacity to manage solid waste in the municipality. Although the Assembly needs 60 technicians and 120 non-technicians to manage solid waste in the municipality, 34 technicians and 75 non-technicians are available.
  - viii. The private sector plays a significant role in waste management in the municipality and households and commercial institutions prefer services by private institutions in waste collection.

## **Evaluating Waste Management in Selected Cities**

The objective of this paper is to express perspectives on waste management practices, implying an assessment of how waste is collected, transported, processed and disposed and recommendations to improve efficiency in solid waste management in the urban centres. In effect, it is to evaluate waste management practices. Evaluation will thus take these factors into consideration and appropriate recommendations made to ensure sanity in the waste management practices in the cities in Ghana.

**Waste Management in Accra Metropolis:** Solid waste generation has been increasing with increase in economic activity, which increases consumption levels. Increase in economic activity also increases income levels and the quantum of consumption and consequent increase in wastes generated [31]. Wastes generated in the metropolis have been increasing as the years roll by and with increasing population. In 1994 waste generated was estimated at 1200 tons per day [32] with an annual increase of 6 per cent [33].

In April 2017, the daily solid waste generated in the Accra Metropolis in a day increased to an estimated 3000 tonnes [34]. The problem with the quantity of waste is that it is mere estimates. There has not been waste audit for over 25 years. Researchers thus rely on estimates. Going by these estimates however, the quantity of solid waste generated in a day has increased by over 250% in about 25 years. The amount of waste generated relates to the income levels with low-income areas generating less waste per capita than middle and high-income areas but low-income areas generating waste with high organic matter.

On the other hand, high-income areas generate waste from packaged products and empty cans. Waste from low-income areas has a high density of 0.50kg/l due to the high share of inert matter (sand and dust) and organic matter of the waste composition [31]. The bulk of the waste is generated in low-income areas, which make up over 80% of the population of the metropolis. Generally in the metropolis there is a shifting towards the consumption of plastic and paper packaging therefore plastic and paper wastes are becoming phenomenal as in most cities of developing countries [35]. In low-income households, solid waste is stored in baskets, and cans and any receptacles, which defy hygienic standards. Due to the high organic contents of the wastes, and with high temperatures and moisture contents, they decay fast so attract flies and insect vectors and sometimes rodents, posing health threats to residents. A good number of residents in wealthy and medium households store their wastes in containers. Most residents practice indoor storage of wastes. This is irrespective of wealth status. Indoor storage of wastes has health implications. Petrification of the wastes indoor, with delays in collection by collecting agents, creates health risks.

Waste collection in Accra is largely by private contractors. Just over 10% of residents have home collection services. The amount of waste generated exceeds the volume collected. The amount of waste collected represents 60% of wastes generated [36]. The problem of collection is worst in poor quarters and neighborhoods that are difficult to reach. In high income settlements the Waste Management Department and private formal enterprises collect directly from households whereas in low and some middle-income areas residents carry wastes to public waste containers provided by the Waste Management Department collection points. Indeed, substantial amounts of wastes are dumped into water bodies, canals, surface drains and even scattered openly in neighborhoods. Some wastes in open containers are not covered. Some wastes also drop on the streets when being transported to dumping grounds in trucks.

Waste in Accra is disposed of in open dumps. Accra generates nearly 900,000 metric tons of waste a year of which 67% is organic matter (biodegradables) [37,38]. There is no waste disposal site in Accra. Waste is transported from Accra to a landfill at Tema. Other types of waste including paint, products, batteries, discarded motor parts, etc. release chemical contaminants into open dumpsites which creates land pollution during rainy season in low lying areas. Lack of adequate disposal vehicles by the waste management department and irregularity of operation of the vehicles create accumulation of waste and resulting pollution of air and land. The inadequate landfills and resulting spill overs of wastes have serious health implications. The metropolis has a small-scale composting and recycling plant which receives about 500 tons of municipal solid waste per day. The plant is owned and operated by a private company on a public-private partnership arrangement [39]. The cost implications of solid waste management in the metropolis are great. Financial constraints reduce the rate of collection thus causing accumulation of wastes and concomitant health hazards.

The average waste collection cost is about US\$320,000.000 per month [40] and disposal is provided by government subsidies through the local government and metropolitan revenue. A greater part of the waste management budget goes to the collection and transporting services. An average monthly user fee of US\$1.10 per household in Accra is enough to remove the financial burden of collection of solid waste from municipalities in Ghana [40]. A study has established that residents are willing to participate and have the ability to pay for user charges and that, a combination of house-to-house collection by private operators in high to middle income areas in addition to collection at sanitary sites in inaccessible low-income areas will be a more feasible alternative. There is a problem of recycling. There is the absence of source separation of solid waste as part of the solid waste management system. Dumping sites are getting difficult to procure and conflicts have ensued between landowners and the Accra Municipal Assembly over use of sites as dumping grounds. Incineration and open burning of waste in communities are practices that are used in waste management in the metropolis.

**Waste Management in the Kumasi Metropolis:** KMA estimated waste generation at between 1000-1500 tonnes a day [41]. Wastes generated in major urban centres are similar. The wastes generated are agricultural wastes such as cassava and plantain peels and food leftovers [42]. Others include polythene bags and other plastic materials, old car tyres, old newspapers, broken furniture, discarded automobile parts, radio and television parts, etc. Most features in the Accra Metropolis are replicated in the other cities. There is concentration of efforts at collection in high-class residential areas with the poorer areas receiving very little attention [42]. The house-to-house collection system operates. A bulk of household waste is found to be organic waste which includes food waste and putrescible waste. Dustbins are provided by the collecting companies most of whom are private. The wastes are put in the dustbins and placed in front of the homes for collection. Several other residents carry their wastes to big containers (communal sites) provided by the Metropolitan Assembly at vantage points and pay fees upon submission of the wastes. Those who deal with the formal operators put them in dustbins which are collected at irregular periods for specific fees.

The metropolis is facing serious financial challenges in waste collection. The Metropolitan Assembly is currently saddled with a GhC63,800,000.00 debt owed waste management service providers [43]. In order to recover some funds spent on waste collection and compel residents to reduce the quantity of waste disposed of, the Metropolitan authorities introduced Pay-as-you-throw

(PAYT) policy [44] which was met with opposition from the residents resulting in indiscriminate disposal of waste. Some waste management practices were abused and there was seemingly environmental decay. The community's preparedness to pay for the services of waste disposal is not desirable, a situation that poses a serious problem for waste management since financial capacity plays a major role in ensuring effective and efficient disposal.

**Waste Management in the Tamale Metropolis :** In the Tamale Metropolitan Area (TAMA) it is estimated that 810 tonnes of waste is generated a day out of which 210 tonnes are hauled daily [45], which represents 25.9% of total waste generated. Waste management services are provided by the Metropolitan Waste Management Department and Zoomlion Ghana Limited. Besides, there is the tricycle waste collector concept which ensures effective and efficient collection. They are assigned to collect waste from both commercial and residential areas including street sweepings, waste from bins along streets, etc. The introduction of the latter has brought improvement in waste management practices with more equipment introduced into the collection system. The company cleans principal streets, lorry parks, dredging of gutters, door-to-door services, etc. There are three modes of waste collection at TAMA. These are door-to-door, curb (primary waste collection) and communal dumpsites. There is variation in the type of waste storage system based on residential classes.

Majority of the residents in the high and middle class residential areas use covered plastic waste bins to store their solid waste whilst those in the low-class residential areas use uncovered metal waste bins. The same applied to income levels. Majority of those in the high-income group use covered plastic waste bins whilst those in the low-income group use uncovered metal waste bins. Females constitute greater proportion of those who dispose of waste than males. Majority of the residents prefer the use of the community container system. This confirms the belief among the indigenes that those chores are the responsibility of females. The waste collected is finally disposed of in a landfill at Gbalahi, a suburb of Tamale metropolis. Waste was collected regularly twice a week, especially in the low class residential areas, and in some cases no collection at all was done in weeks. In low class residential areas, residents were not made to pay for the collection even though a significant number was prepared to pay. Indeed, there is a general willingness by households to pay for waste collection. In the middle class residential areas, collection was once a week.

This resulted in the accumulation of waste in such areas with resulting pollution and health implications. In some cases it resulted in the burning of waste which also resulted in the pollution of the environment. The final disposal of solid waste in the metropolis is the landfill site at Gbalahi, about 13 kilometres away from the centre. The landfill has the following elements which are currently not functioning: weighbridge, internal access, treatment plant, leachate collection system, gas recovery. There is a mountain of waste at the site due to the non-functioning of the landfill facilities. A significant amount of the revenue of the Assembly goes into waste management. In 2009 for instance, over 44% of revenue generated went into waste management. There are inadequate capacities of the waste management department of the metropolis. Of the 230 skips required by Zoomlion Ghana Ltd. and the waste management department of the metropolis, 186 were available.

Besides, of the about 4000 extra dustbins needed in the middle and high class residential areas, 1,597 dustbins are available. This will result in dumping of waste at unapproved sites, resulting in communicable diseases. Literature on waste management in TAMA indicates waste collection processes as exist in the other metropolises: Accra and Kumasi. The volume of waste collected is less than the two major metropolitan areas in Ghana whose populations exceed that of TAMA. It goes to suggest that the volume of waste is related to the population, with greater population corresponding with greater volume of waste.

## Discussion

Some issues emerge from the review that requires attention for policy implications. Firstly, the WHO observation that middle and lower-middle income countries tend to engage in better waste management practices is not applicable to Ghana which currently enjoys a lower middle-income status. This situation may be due to prioritization of waste management in state budgeting. Although the metropolitan assemblies devote a large proportion of their budget to waste management, receipts from central government on waste management is inadequate. Central government expects the local authorities to generate income to address the waste management problem but this goes beyond their financial capacity. The WHO must thus take a second look at their model on a nexus between waste management, which is more an urban problem, and level of development.

The second issue is willingness and ability to pay for waste collection. The review shows that even though the three urban centers report willingness to pay but Accra shows greater commitment to pay for the services than the other urban centers. The reasons may be that Accra is more urbanized than the other urban centers with better opportunities for income generation. It could thus be hypothesized that the level of income opportunities and elitism is a determinant of ability to pay for waste management services.

Thirdly, there has not been waste audit for over two decades. Planners thus use estimates rather than current data on waste. There is thus no realistic data for effective planning for waste management. Fourthly, the problem of recycling basically emanates from the culture of not separating wastes collected from the homes and industrial establishments and institutions. This practice goes on in most collection centres. Therefore, from the cradle of management of waste the need for non-recycling is established. Fifthly, with the capacity by the city authorizes to manage waste being low, the involvement of private organisations in waste management cannot be overestimated [46-48]. Besides, the indiscriminate dumping of waste is more a practice in the low-income residential areas of the urban centres. Finally, there appears to be some sanity in management of solid waste in high class and some middle class residential areas than in the low class residential areas which are deprived. Finally, the problem of inadequate staff and lack of sanctions on defaulters of solid waste practices are bottlenecks to be addressed if solid waste management will see the light of day.

## Conclusion

Waste management in the urban areas in Ghana faces challenges. They face the problems of collection, transporting, disposal, composting and recycling. To address the problems and ensure sanity in sanitation and effective waste management to rid the urban centers of filth and concomitant health problems, there is the need for a strong political will, attitudinal change, capitalization of the sector through imposing realistic fees for collection and committing financial resources to recycling processes to ensure multiple benefits from wastes. The Ghana Environment and Sanitation Policy (1999) is a realistic document but its effective operation will make it achieve its lofty goals [9]. There must be more emphasis on recycling to reduce landfilling process. Sweden has set a benchmark in waste management recycling. About 99% of the waste in Sweden is recycled and only 1% goes to landfill [49]. In 2016, nearly 2.3 million tons of household waste was turned into energy. They are in the process of importing waste. Proper waste management practices will thus give multiple advantages to the country. The economic potentials of solid waste must be exploited as done in the work by Abbas on Shiraz, Iran where solid waste was found to possess a huge potential for economic development [50]. The WHO model on the nexus between the level of development and waste management practices does not apply to the Ghana situation.

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