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Solid Waste Management in Urban Areas of Ghana: Issues and Experiences from Wa

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Abstract Ineffective solid waste management remains a major challenge to many developing economies, Ghana inclusive. This study therefore chronicles issues relating to solid waste management, drawing experiences from Wa, the regional capital of the Upper West Region. Based on 150 administered questionnaires to purposively selected respondents and 10 in-depth interviews of core staff of the Municipal Waste Management Departmentand private waste collection company, the study interrogates issues regarding solid waste generation, collection and disposal practices that are employed by households and city authorities in the rapidly urbanizing city -Wa. Our findings revealed that 810 tonnes of solid waste is generated daily, out of which; 216 tonnes are collected leaving backlog of 594 tonnes uncollected posing serious environmental and public health hazards. This study identified two main forms of solid waste collection services; house-to-house (HtH) waste collection - implemented in middle and high income, low density suburbs and the communal container collection (CCC) - implemented in low-income, high density haphazard suburbs where infrastructural facilities are in bad state and in some cases none existent. We argue for a comprehensive approach that combines infrastructure improvement, health promotion, and community participation in solid waste management processes to improve the inefficiencies to ensure quality sanitation.

Keywords: *solid waste management, Urban, Wa, Ghana*

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1. Introduction

One daunting challenge of governments and city authorities in sub-Saharan Africa – seen as the last global macro-region to experience urbanization in the twenty first century is inefficient management of solid waste. The outcome of this rapid urbanization usually results in the capacity to provide what has come to be seen as necessary urban infrastructure lag behind. As aptly described by Tacoli, [1] and Yousif & Scott, [2], the waste produced by burgeoning cities is overwhelming city authorities and national governments in global south countries like Ghana; culminating in cities living in waste and squalor as opined by Worrell and Vesilind [3]. This situation has created distinctive urban spaces and forms which are emblematic of the unprecedented urban population growth [4]. Admittedly, this demographic trend of urban population growth rate has impacted on waste generation. Earlier studies have shown that, continuous economic development and increase in living standards culminate in the increasing demand for goods and services and the resultant commensurate increase in per capita waste generation [5,6]. This situation brings to the fore the urgent reality for African city authorities to adopt appropriate strategies towards the efficient management of solid waste in cities where the chunk of it are generated.

The trajectory of efficiently managing refuse generation has necessitated the demand for an efficient way of waste management services. Achieving this has been a puzzling task for most developing economies like Ghana due to the incongruity between rapid population growth, increased waste generation and management culminating in the inability of major stakeholders: city authorities and/or private sector to succeed [6]. The complexity in providing the required level of service commensurate with the increasing demand for good sanitation service is characteristically attributed to institutional, technical and financial constraints at the various levels of governance: national and local levels, as well as the private sector [6,7].

The efforts being made in Ghana have focused mainly on the collection and disposal of solid waste which does not cover the entire functional elements of solid waste management [8,9]. The elements encompass; generation, onsite storage, collection, transfer and transport, disposal, processing and recovery of solid waste [10]. Though practicing the entire functional elements of solid waste management is the ideal situation to ensure good sanitation, it remains a dream for most developing economies across the globe.

Ghana is bedevilled with inadequacy of efficient systems to manage solid waste particularly in cities and towns. Elsewhere, Fobil et al., [11] also argued that, the lack of well thought management plan for solid waste collection and disposal in most developing countries is a

major drawback for efficient management of solid waste in most developing countries. Although city authorities in such countries spend between 20% and 50% of their revenue on solid waste management, less than 30% of urban population have access to proper and regular solid waste collection services [12]. As reported in the baseline environmental sanitation survey in 2007/2008, close to 76% of households in Ghana depend on improper waste collection and disposal methods, with only less than 5% using house to house collection services [13]. This situation reinforces the need to increase coverage in terms of the provision of proper solid waste collection and disposal services to households.

Residents in poor urban communities usually have to cope with heaps of refuse over-flowing which are left laying uncollected for more than the stipulated frequency of once a day for CCC service and once a week for HtH [14] (Obirih-Opareh, 2002). In some cases, residents burn or dump it in streams and stagnant gutters, all of which creates breeding grounds for disease spreading insects and vermin [6]. Suffice to say that, lack of awareness of proper disposal habits on the part of residents in these poor urban suburbs and the inefficient monitoring mechanisms from the quarters of city authorities brings to the fore the complexity of the problem. This point resonate the critical role of public environmental education and the need to institute effective monitoring mechanisms in achieving efficient and proper management of solid waste. The efforts being made are primarily aimed at improving human health, promote environmental quality, and provide support for economic productivity [11,15]. To achieve this, successive governments in Ghana took the needed steps in the early 1990s to manage solid waste efficiently [16]. The effort led to a paradigm shift in policy from assemblies being solely responsible for waste collection and disposal to the involvement of private waste management companies.

In spite of this major step, not much has been achieved in this respect due to the fact that in recent past, solid waste management services in Ghana have consistently failed to keep pace with the amount of solid waste generated in towns and cities. This is against the backdrop that rapid urbanization in Ghana has increased the pressure on urban infrastructure and environmental services which has resulted in the waste accumulation and unsanitary environmental conditions [17,18]. Other common drawbacks that militate against efficient solid waste management are: government's inability to streamline the responsible institutions to achieve their mandates, poor urban planning with regards to access routes for waste removal, inadequate sanitation facilities, lack of political will with respect to the awareness and dedication among national and local government to efficiently manage solid waste as well as the low technological know-how to manage the waste which is engulfing the cities and towns [7,11,19].

Despite the plethora of study on solid waste management, remarkably, little attention has been given to the spatial dimension with respect to the distribution of solid waste collection facilities especially in cities and towns in Ghana. That can explain why residents adopt environmentally unfriendly practices: dumping of wastes onto the streets, public areas, lowlands and into rivers or directly into the sea which can have dire public health consequences. This does not only cause environmental problems but also cause economic burden and leads to loss of valuable materials [11,19,20,21]. The problem is sometimes attributed to the lack of exhaustive collection of solid waste from roadsides and dustbins which cause severe contamination in the environment [22]. It is against this backdrop that this current paper seeks to explore the current state of solid waste management in Wa which doubles as the municipal and regional capital of the Wa Municipality and the Upper West Region respectively, taking cognisance of the challenges.

The paper proceeds as follows; the next section provides the geographical background of the study. We then present the methodology that guides our data collection and analysis. After that, the presentation of the findings and discussions follow and this illuminate and examine the functional elements of solid waste management as they pertain in the study area, which encompass: generation and storage at the household and communal level, collection, transport and disposal. Some recommendations are also presented for policy consideration.

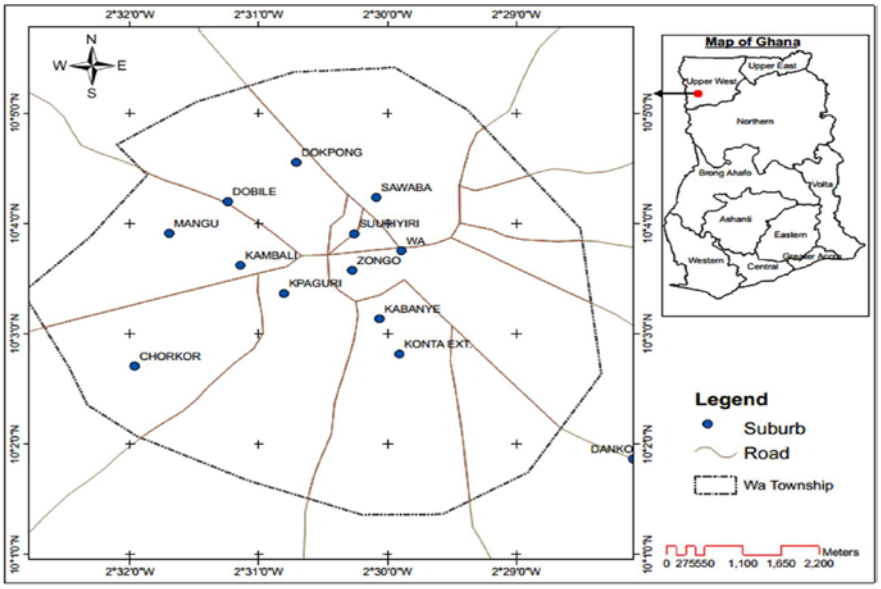

Figure 1. The study context (Source: Author's construct, 2014.)

2. Study Area

Wa is the regional capital and the most urbanized city of the Upper West Region located in the north western part of Ghana (see Figure 1). The city lies within latitude 1º40' and 2º45'N and longitude 9º32' to 10º20'W thus covering an area of approximately 1,180 square kilometres which is about 32% and 2.56% of the region and nation respectively [23]. The population of Wa is 135,638 (female 65,887 / Male 69,751) with a growth rate of 2.7% per annum [24]. Ghana's practice of decentralised system of governance initiated in 1988 [25] led to the establishment of Wa Municipal Assembly (with Wa as its capital city) in the year 2004. The city serves as a transportation hub forth north-western part of Ghana, with major roads leading south to Kumasi, North to Hamile and Burkina Faso, and north east to Tumu and the Upper East Region.

3. Methodology

To achieve the objective of this study, the paper employed social survey instrument to generate data. Mixed quantitative and qualitative (Q-Squared) methods [26] were used in the collection and analysis of data. Extensive literature was reviewed with regards to solid waste and its management. To complement the secondary data, field surveys werealso conducted to generate empirical data through interviews and questionnaire administration. The questionnaires were administered to one hundred and fifty (150) respondentswho were randomly selected from twelve of the suburbs in the city of Wa.

A second set of data collection, involved the conduct of tenin-depth interviews for core officials from the Municipal Assembly Waste Management Department and the private waste management company - Zoomlion Ghana Limitedto solicit their perspectives on their operations with respect to waste collection service they provide and the drawbacks that confront their efficiency and effectiveness.

A third stage involved the use of hand-held global positioning system (GPS) receivers to pick geographic coordinates of the communal container collection (CCC) points. The coordinates were taken in the Degree Minute Second (DMS) format. These were converted to Decimal Degree (DD) in Microsoft excel spreadsheet using the formulae $= D + \frac{M}{60} + \frac{S}{3600}$ where D = Degree, M = Minutes and S = Seconds. The coordinates were imported to ArcMap software and converted to a Shapefile. The projection parameters were changed from the default World Geographic System 1984 (WGS 84) to projected Universal Transverse Mercator zone 30 North, It was then overlaid with existing Administrative boundary and roads Shapefiles of Upper West Region. Layout map was produced and exported showing how the various refuse containers were spatially distributed within Wa Township.

4. Results and Discussion

The foremost purpose of solid waste management (SWM) strategies are to address the health, environmental, aesthetic, land-use, resource and economic concerns associated with the improper disposal of solid waste [29,30,31]. However, solid waste management services generally in most sub-Saharan African cities, Wa inclusive, can be referred to as inefficient, poor and disorganized fuelled by rapid urbanization and coupled with ill designed interventions fraught with lots of challenges. Imperatively, any useful planning for solid waste collection and disposal system needs to consider the quantity variation and generation [27]. This position has been reinforced by the fact that, solid waste generation, composition and management depends on myriad of factors such as the stage of development; socio-economic, climatic and geographical conditions as well as collection frequency [28]. The prevailing situation of solid waste management in Wa, its setbacks and recommendations for improvement of the existing system is the focus of this section.

4.1 Solid Waste Generation, Characteristics and Management

Wa is a fast growing and sprawling city. Data on the composition of solid waste generation in the city are shown in Table 1. The chunk of solid wastes collected are organic representing 55% mainly due to the high use of unprocessed foods in daily diets, echoing earlier studies [32,33,34]. The implication is reflective of the fact that households and markets generate more organic waste than the other types of waste.

Table 1. Composition of solid waste in Wa

S/N	WASTE COMPOSITION	AVERAGE WIGHT IN TONNES	PERCENTAGE (%)
1	Organic	9.99	54.76
2	Plastics	4.64	25.46
3	others	3.60	19.77
TOTAL		18.23	100

Source: Field Survey, 2014

Our findings revealed that the Municipal Assembly Waste Management Department (MAWMD) and Zoomlion Ghana Limited- private waste management company are responsible for the collection, transportation, and disposal of solid waste at a dumping site located in a near-by community – Siriyiri. It will be naive on our part to assume that the aforementioned responsibility is without flaws. So far however, services being provided are fraught with irregularity resulting in waste piling up in homes and CCC sites. Data on the total quantity of solid waste generation in Wa are unreliable due to the inability of key stakeholders (MAWMD and the Zoomlion Ghana Limited) to track and keep reliable records. It is estimated that, the amount of solid waste generated in the city is eight hundred and ten (810) tonnes daily, out of this, two hundred and sixteen (216) tonnes are collected daily. This leaves backlog of five hundred and ninety four (594) tonnes uncollected. Figure 2 depicts a consistent trend of increase of solid waste generated from 2009 and the figure almost doubled in 2013. As a consequence, it is a common sight to behold unsanitary urban landscape in Wa resonating Owusu-Sekyere et al., [18] claim that, most

urban space in Ghana are characterized by roadsides littered with refuse; drainage channels and gutters choked with waste; open reservoirs that appear to be little more than toxic pools of liquid waste; and beaches strewn with plastic solid waste. Admittedly, the pernicious social and health impact of these situations are greatest among the poor, particularly those living in the low-income settlements [7] where solid waste containers and dumping sites are usually located.

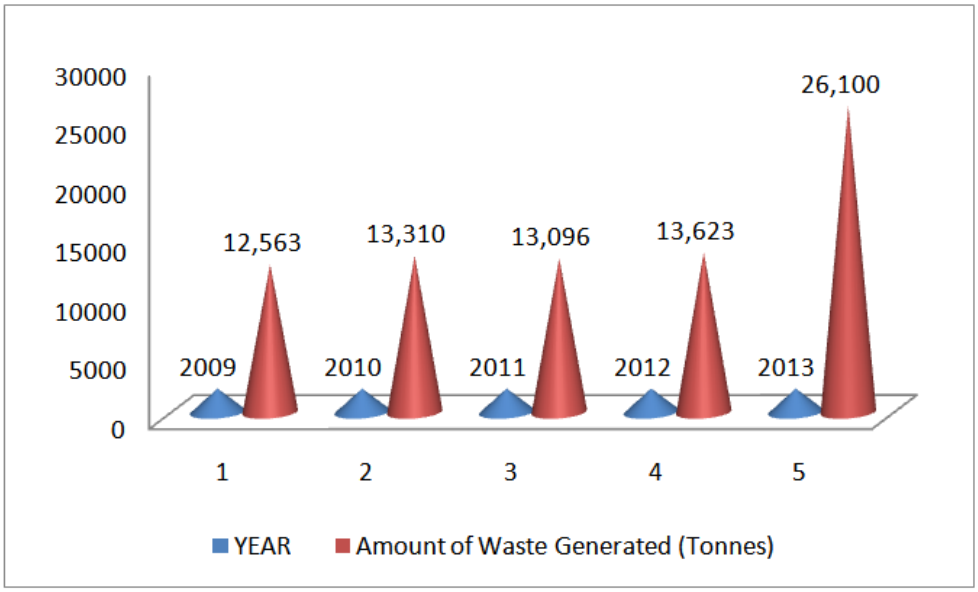

Figure 2. Trend of solid waste generated between 2009 – 2013 (Source: Zoomlion, (2013))

The exponential increase of solid waste generation is attributed to the rapid urban population concentration coupled with a sizeable group of transient student population that the city has witnessed over the past decennia. Our research findings revealed two main forms of solid waste collection options. This finding confirm earlier results by Oteng-Ababio et al. [6], Songsore et al. [35] and Fobil, Armah, Hogarh, & Carboo [36] that, solid waste collection is generally serviced under the House-to-House (HtH) and/or Communal Container Collection (CCC) systems.

The dumping of solid waste into communal containers (mostly placed near public toilet facilities - known as Kumasi Ventilated Improved Pits – KVIPs) remained the common option for domestic solid waste disposal in most low-income households in Wa. These communal containers are provided by both the Municipal Assembly and Zoomlion Ghana Limited. Collection of these communal containers is irregular, which leaves the urban space filled with heaps of uncollected solid wastes especially in the ill-served low income suburbs (see Figure 4). Suffice to say that this situation attract disease-carrying pests and creating grounds for serious public and environmental health hazards as opined by Oteng-Ababio et al.[6].

Currently, solid waste communal containers in the city are concentrated in the low income residential areas to serve a large coverage of residents. Residents living in these suburbs rarely patronise the house-to-house (also known as door-to-door service) solid waste collection services that Zoomlion Ghana Limited render to their customers due to financial difficulties as well as poor road access in these areas which makes the implementation of the HtH service difficult. It became evident that, communal solid waste containers are placed at strategic locations in these suburbs to serve the immediate inhabitants within a given coverage. The poor road access in these suburbs presents another critical challenge that city authorities have to contend with. In view of this, serious consideration is given to locations where the solid waste collection vehicles can have access to these containers to aid the collection and transportation of the CCC at the stipulated periods.

High class residential areas in the city patronise the HtH services that is provided by Zoomlion Ghana Limited at a monthly fee of Twenty Ghana Cedis (GH¢20) (Equivalent to US$ 6.6). Per the service contract, the company is required to collect, transport and disposed of the waste at a dumping site once every week. Evidence abound that the service that is being provided by Zoomlion Ghana Limited is fraught with challenges. Prominent among these challenges include the ill-timed collection of the waste containers whenever they are full. This inherent operational challenge hinders efficient service provision which act as a major disincentive for many households to patronise this service despite its benefits. Another challenge that militates against the efficient collection of waste has been the inability on the part of the Municipal Assembly to pay service providers on time for services rendered. This research finding supports earlier claim by Oteng-Ababio [6]. Elsewhere, the Earth Institute [37], also opined that, the private waste management company (Zoomlion Ghana Limited) is not paid regularly by the assembly for the collection services they provide. Owing to this, the company is usually adamant to render efficient services due to failure on the part of the assembly to fulfil their financial commitment per the contract signed with the private company. This situation further exacerbates the already unsanitary conditions in the city.

With the aid of GPS device, we mapped out all the CCC points in the suburbs of Wa to assess the spatial distribution of these containers. A total of 20 communal solid waste containers were identified(see Figure 3). It is

reasonable to surmise that, the wide coverage that these CCC sites have to serve leaves most households with no option than to walk long distances to dump their solid waste. This scenario encourages illegal dumping of waste in unauthorised places which according to Opare-Obireh and Post [14] supplant as a major source of environmental degradation and public health hazards. We therefore argue that, considering the unprecedented population growth rate coupled with a commensurate increase in per capita waste generation, the available communal waste containers are woefully inadequate creating detrimental impacts on environmental quality and public health. This research finding resonate the distance-decay in solid waste disposal as earlier claimed by Oteng-Ababio [39]. The resultant effect has been the littering and dumping of the waste along roads and in open drains as reported by Oteng-Ababio [3].

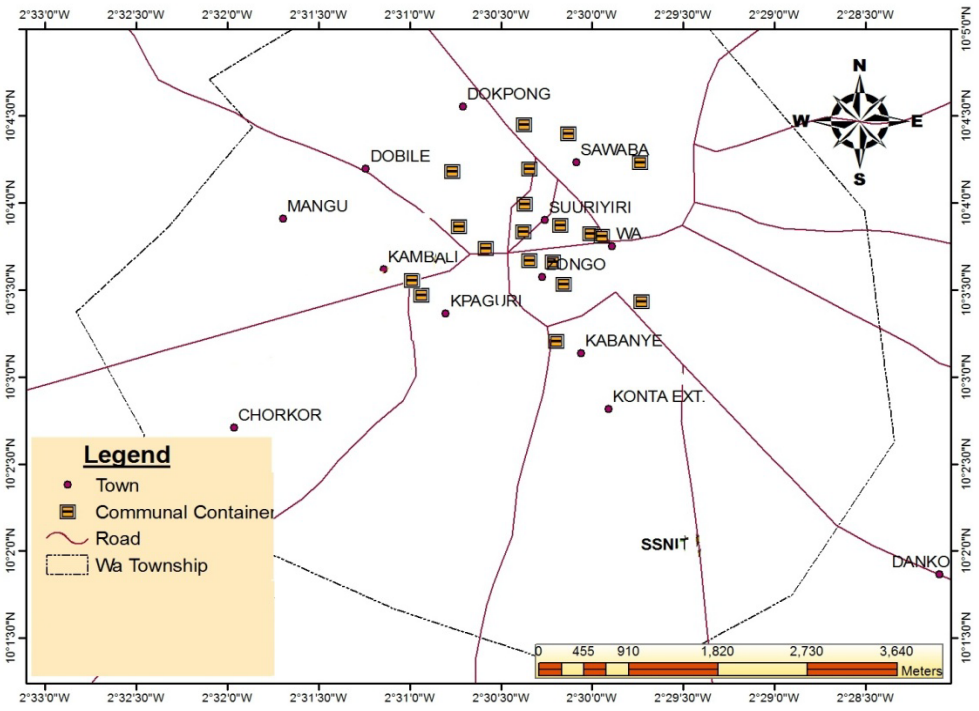

Figure 3. Spatial Distributions of Communal Solid waste Containers in Wa Township (Source: Authors Construct, 2014.)

4.2. Solid Waste Storage and Handling at the Household Level

Households and communal solid waste storage and handling approaches in Wa are myriad. Historically, small communities managed to bury solid waste just outside their settlements or dispose of it in near-by rivers or water bodies [38]. In recent times, though these practices have not changed entirely because waste is collected and stored in temporary refuse containers which do not prevent the spread of pungent odours and diseases before it is buried, burned or carried to the CCC sites. The common characteristics of all the containers used in households for solid waste storage are materials such as plastic bags and containers, metal basket and paper cartons. In certain instances, households keep their solid waste in hand-dug pits behind their houses. Households who patronise the services of Zoomlion Ghana Limited upon registration are given refuse bin with sizes ranging between 12 – 240 litres. Contrary to the observation by Oteng-Ababio [39] in a study conducted in Accra, which revealed that both the Municipal Waste Collection Department and the Private contractors provide waste bins for their customers upon registration, the waste bins for individual households and corporate entities in Wa are provided only by the private company upon registration with them. Nonetheless, both the Municipal Assembly and Zoomlion Ghana Limited provide the CCC.

The fee charged by Zoomlion Ghana Limited deters some households from patronizing this service making these households resort to the use of sub-standard waste containers (uncovered containers) for temporary storage and the disposal of their solid waste in environmentally unfriendly manner (see Table 2).

Table 2. Methods of Household solid waste disposal

Method of solid waste disposal	Frequency	Percentage
Burn it in the open	40	26.7
Dispose of in communal containers/dump site	82	54.7
Bury it at the backyard	28	18.6
Total	150	100

Source: Field Survey, (2014).

As observed in Table 2, the approaches identified as modes of disposing solid waste usually have serious public health hazards - respiratory diseases from polluted air as reported by Owusu-Sekyere (2013) [18]. Households that adopt these modes usually complain that the CCC sites are too far away from their houses as reported by [39] and in some cases they do not have at all, hence they adopting these alternative modes of disposal.

4.3. Institutional Arrangement in Solid Waste Collection, Transportation and Disposal

As stipulated in Ghana's Local Government Act (Act 462), the metropolitan, municipal and district assemblies

are mandated with oversight responsibilities of Solid Waste Management in their jurisdiction. Nonetheless, due to the deficiencies in recent times, there has been a paradigm shift in this approach culminating in the assemblies losing that full responsibility. The pressures from international organizations (such as the World Bank; IMF) and globalization forces, has also made waste management decision-making process more market-based. Again, under the Act, the assembly's Waste Management Department (WMD) and Metro Public Health Department (MPHD) provide collection and disposal services. However, due to poor quality of service - including collection of only 60 - 65% of waste generated in the city [40] it eventually led to a transition to public-private partnerships (PPP), mostly in the form of contracting services out to private operators [3].

As a response to the foregoing, the major stakeholders that are responsible for street sweeping, collection and transportation of solid waste in the city are the Environmental Department of the Municipal Assembly and Zoomlion Ghana Limited. The emergence of this partnership between the public and the private sector in the area of Solid Waste Management (SWM) has preoccupiedthe attention of waste practitioners and researchers in recent times [6,42]. Over the years, there has been an on-going debate regarding the origin as well as the tents of these networks. Some scholarships trace the origins of these partnerships to the advent of neo-liberal doctrine, which saw the resurgence of market forces and a reduction of state control as way of cutting down on public expenditure [6,41,42,43,44,45,46]. Other studies are also of the view that such reforms were inspired by the quest for sustainable development after the 1992 Earth Summit, which highlighted environmental issues as key in international policy [47,48]. By inference, it can be observed that both arguments are relevant in the discourse of Solid Waste Management (SWM). We argue that despite the enormous benefits that these partnerships bring to the fore in SWM, inefficient supervision on the part of city managers remains a serious threat to the efficient and sustainable management of SWM.

The primary role of theWaste Management Department of the Wa Municipal Assembly is the collection of the solid waste containers which are situated at strategic locations within the suburbs (see Figure 3) to serve as communal solid waste collection point for the inhabitants living within that suburb to dispose their solid waste without any fee. On the other hand, street sweeping, house-to-house solid waste collection and transportation of communal solid waste containers remain the prime responsibility of Zoomlion Ghana Limited.

As a common practice in many cities, both mechanical and manual methods are used to collect solid waste in Wa [49]. With respect to the mechanical approach, whenever the communal solid waste containers are full, the following vehicles; skip loader, or roll-off-trucks which has a special lifting device for collecting the solid waste containers comes to lift the container and transport it to the disposal site. The collection crew usually consists of two or three workers plus a driver.

Each vehicle is assigned to collect the solid waste from suburbs where the containers are located. On the other hand, the manual method employs tri-cycles which are driven by one person. This method is usually used to collect the waste from houses-to-house as well as the waste that are gathered by the street sweepers. As evident in other cities such as Khoram Abad, wastes are collected by small vehicles (e.g.vans) and then discharged into an open top trailer for transfer to the disposal site [49]. It is important to reiterate that, the locations of the containers are determined among other things by the area's access to road to aid the collection and transport of the waste containers.

One major challenge that bedevils waste collection and transportation in Wa has been the untimely collection of the communal waste containers whenever they are full and this has serious public health implications. This owes to the fact that, residents living in areas where these waste containers are located are left to cope with the stench that emanate from the heaps refuse laying uncollected for a long period of time (see Figure 4).

Figure 4. Uncollected solid waste in communal container Source: Field survey, (2014)

Authorities in Wa employ land filling as the final site for the disposal of solid wastes [34]. This is a widely used approach in most developing cities across the globe. Wa's solid wastes are transported to the disposal site –Siriyiri, located in the north- western part of the city (5 km distance from the centre of the city). The Siriyiri community has been used as the solid waste dumping site since 2004. The transported wastes are deposited at this site without any on-site treatment posing serious public health hazards to residents in Siriyiri and its surrounding communities through polluted air and disease carrying pests and insects as pointed out by Oteng-Ababio et al., [6] and Owusu-Sekyere et al., [18]. By inference from the afore discussion, it is evidently clear that the SWM system in the case of Wa ends at the disposal stage which we are calling for urgent attention to manage this site well without it we envisage a 'looming danger' which can trigger serious epidemic in the near foreseeable future.

As a common practice in most solid waste sites in many developing economies, scavengers informally collect components of the solid waste –including;papers, plastics, glass and metalswhich they consider valuable due to their economic benefits. These components are sold to individuals who act as middlemen for small recycling units. In the view of Jafari et al., [34], even though scavenging activities reduce the volume of waste, the activities of the scavengers make waste collection much more difficult due to the manner in which they do the sorting which illuminates the need to streamline and/or regulate and monitor the activities of the scavengers remedy this challenge.

5. Conclusion

This paper has demonstrated essential findings that have implications for solid waste management. First, collection services that are provided are in two forms: house-to-house (HtH) waste collection which is implemented in middle and high income, low density suburbs of the city with well-planned settlements and infrastructure and the communal container collection (CCC) which is also implemented in low-income, high density haphazard suburbs where infrastructural facilities are in bad state and in some cases none existent. Second, the current trend of rapid population growth and its commensurate waste generation patterns are critical and present urgent need for city authorities to provide the needed infrastructure necessary to keep pace with the increasing volumes of waste and the changing waste types. Although the private sector is involved in the collection and disposal of the solid that is generated, the current situation still needs much to be desired. This assertion takes into cognisance backlog of tonnes of uncollected solid waste which undoubtedly pose serious environmental hazards. Admittedly, the inefficiencies in dealing with the waste is attributed to myriad of factors: government's inability to mobilize the needed funds to finance solid waste management, institutional weakness, poor urban planning that militate against waste collection and the lack policies and regulations that sanctions officials and residents who are found couple of environmentally unfriendly practices.

One crucial finding that is left unattended to that we are calling upon city authorities to be careful not to romanticize is the mere dumping of solid waste without any form of treatment and/or management on site. We argue that this condition is a recipe for serious out-break of diseases in Siriyiri and its adjoining communities through polluted air and disease carrying pests and insects. We further urge city authorities to put in place measures to curtail any avoidable environmental hazards. We further advocate for innovate ways of collecting wastes from households that reside in inaccessible suburbs since this scenario is by no means inevitable especially against the backdrop of congested urban space. Our principal argument is that, the unsanitary conditions in the city of Wa stemming from the identified deficiencies can be remedied by designing comprehensive approach that combines infrastructure improvement, health promotion, and community participation to the entire solid waste management process to ensure improved sanitation.

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