Journal of Studies in Social Sciences
ISSN 2201-4624
Volume 19, **2020**, 5

INFINITY PRESS
www.infinitypress.info

Municipal Solid Waste Management Performance

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Abstract

Sustainable municipal solid waste management (MSWM) is a major challenge in urban areas throughout the world, with the situation getting worse in most developing countries. This paper evaluates MSWM performance in Ghana, using the Wa Municipality as a case study. The policy and legal, institutional, and financial frameworks, as well as the technical capacity for waste management, were examined. The methodology and research design for the study was an exploratory and interpretive case study that was analysed through both qualitative and quantitative research methods. The study findings indicate that Ghana has a good institutional framework, sufficient and robust legislation, existing bylaws, policies and programmes regarding MSWM. However, the challenge is the non-enforcement of and non-compliance with the laws and regulations governing MSWM. Also, the emphasis on stakeholders' involvement in MSWM in the country is focused mainly on waste collection, and no attention paid to waste reduction, treatment and final disposal. Additionally, waste management

financing and the technical capacity for waste management are woefully inadequate. Thus, improving the enabling environment for sustainable MSWM with a focus on the examined indicators could scale up MSWM performance in Ghana for the attainment waste management goals.

Keywords: municipal waste; management performance; enabling environment; institutional arrangements; waste financing; technical capacity.

1.0 Introduction

Sustainability issues and sustainable development are terms of relevance in the waste management sector because of debates on environmental responsibility (Melissen *et al.*, 2018; Ghadimi, Wang and Lim, 2019). Accordingly, the sustainability issues in solid waste management (SWM) can be classified into economic, environmental, and social. The economic issues are generally related to either cost or profit, the environmental issues are usually expressed as the amount of pollutants released into the environment, and the social issues are about the social perceptions of various stakeholders (Olapiriyakul, 2017). Consequently, environmental performance (EP) assessment has been used to improve the overall performance, to assess the sustainability of management systems, and to improve the quality of the service provided to service beneficiaries in the waste sector (Buonocore *et al.*, 2018). EP assessment integrates environmental and human health risks in the assessment process, consequently ensuring that new policies are adopted by decision makers under the concept of continuous improvement of waste management systems. Thus, EP covers not only operational aspects, such as the handling, transfer, transport, separation, processing, and disposal of waste, but also aspects on public perception, environmental, economic, and social issues (Bing, Bloemhof and Ramos, 2016; Martinez-Martinez *et al.*, 2019). EP for SWM is divided into two components: management performance (MP) and operational performance (OP) (Feng *et al.*, 2018; Rodrigues *et al.*, 2018)

MP indicators are generally related to the sustainability aspects (social indicators), which are the governance features (institutional, political, and financial issues) and the various groups of stakeholders involved in waste management, whereas the OP indicators are usually concerned with the physical system and its technological components, with a focus on the environmental sustainability (environmental indicators) aspect of the system. MP, which is the focus of this study, is measured by chosen indicators defined to measure qualitatively and quantitatively the coherence of environmental policy with waste management objectives, the rate of compliance with a regulation framework, and the effective integration of stakeholders through an effective communication strategy for waste management (Turki, Medhioub and Kallel, 2017; Hirschhorn, Veeneman and van de Velde, 2018; Lo-Iacono-Ferreira, Capuz-Rizo and Torregrosa-López, 2018). Thus, MP requirements can be described as development drivers that create the enabling environment - a pillar of sustainability necessary to bring about a sustained change – for sustainable waste management (Zurbrügg *et al.*, 2012; Martinez-Martinez *et al.*, 2019).

To attain a good MSWM performance, there is a need for a synergy between the various actors involved in waste management, including the governments responsible for defining waste management policies, the companies that carry out waste collection and disposal, and the citizens whose behaviours' must comply with the governments' strategies (Bartolacci *et al.*, 2018). This would enable waste management authorities to determine opportunities for improvement and to implement the necessary actions needed to achieve intended outcomes of waste management. Thus, the objective of this paper is to examine MSW MP in Ghana, using Wa Municipality in Ghana as a case study. The policy and legal framework, institutional arrangement, financial framework, and technical capacity that create the enabling environment for sustainable MSWM were the chosen indicators for the MSWM performance evaluation. These indicators have also been identified as the drivers for effective waste management by many researchers (Kwabena, Clifford and Kwasi, 2018; Pongpimol *et al.*, 2019).

2.0 Materials and Methods

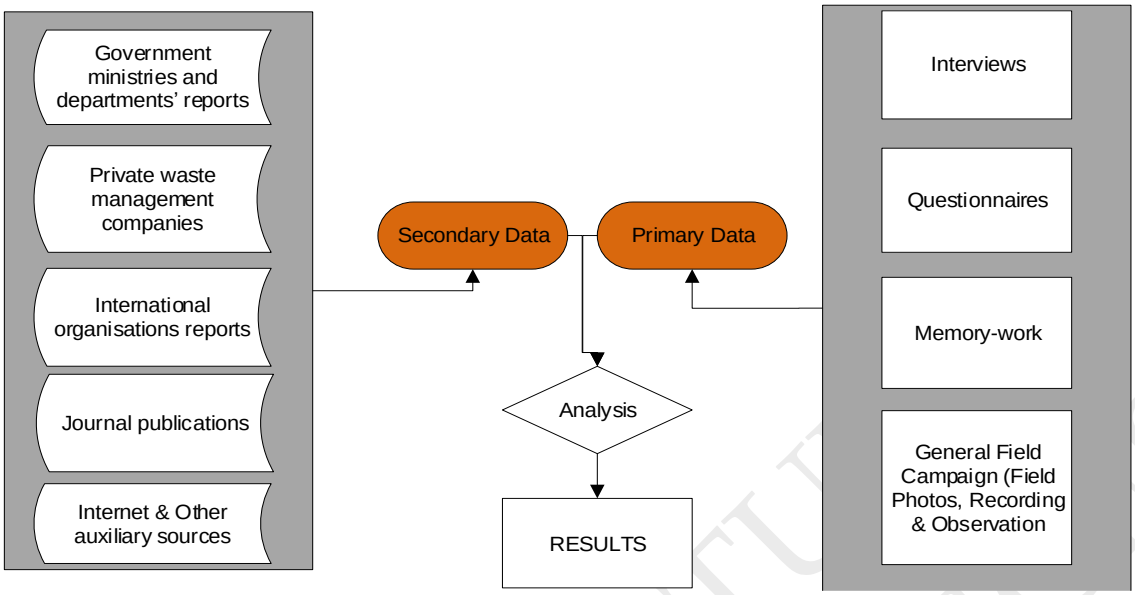
The study was an interpretive and exploratory case study, with a more qualitative than quantitative research design. A case study approach was considered appropriate for this study, as the study encompassed a holistic, in-depth study of waste management, with the use of a variety of data sources and procedures (Yin, 2013). Framework and category formation techniques were employed to analyse data collected through documentary analysis, questionnaires, memory work, passive observations and semi-structured face-to-face interviews from MSWM stakeholders in the case study area (the Wa Municipality) through purposive sampling technique.

An analytical review methodology was used to examine policies and laws governing waste management in Ghana. The researchers conducted a detailed search of existing policy documents on SWM in Ghana from the public domain. A total of 18 documents (policies and laws) that guide various aspects of SWM at national and district levels were retrieved and viewed.

The stakeholders sampled for the study were SWM service providers in the case study area (staff of the Wa Municipal Assembly and Zoomlion Ghana Limited, the only private waste collection company operating in the Wa Municipality) and waste management regulators in Ghana (staff of Ghana's Environmental Protection Agency and Judicial Service staff). Additionally, memory-work, a research method that was developed in Germany to bridge the gap between theory and experience (Onyx and Small, 2001; Grimwood and Johnson, 2019), was applied in this study. Memory is relevant in the improvement of waste management because without a memory of the past we cannot operate in the present or think about the future (Laird, Johnson and Johnson, 2018; Lubinski, 2018).

The research design for this study was an exploratory and interpretive case study that was analysed in themes. Figure 1 illustrates the summarised research design and primary and secondary data triangulation for the study.

Figure 1: Summarised research design and data triangulation for the study.



3.0 Results and Discussion

The results discussed under this section are based on the documents viewed, questionnaires administered, interviews held and written accounts from memory work of various waste management stakeholders (service providers and regulators) in the case study area. Policies and laws governing waste management in Ghana, official published reports and journal publications on the arrangements for waste management in Ghana were the documents viewed in the study.

3.1 Legal and Policy Framework for MSWM

Ghana has a long history of attempting to safeguard the environment from being abused by promulgating and incorporating environmental protection in appropriate legislation. The best result from these attempts is the establishment of an organisation solely responsible for the environment – the Environmental Protection Agency (EPA) in 1994, by an Act of Parliament (Act 490) with powers to regulate activities within the environment, including SWM.

Also, various other legislation specifically targeting some aspects of waste management have been enacted either before or after the EPA ACT 490. Additionally, due to the

changing problems posed by waste, and to compliment the legislation enacted to govern waste management, the Ministry of Environment, Science and Technology; Ministry of Local Government and Rural Development; and the Ministry of Health have prepared guidelines and standards for waste management in Ghana. The laws and policies governing waste management in Ghana accessed and reviewed in this study are presented in Table 1.

Table 1: Waste management laws and policies in Ghana

Waste Management Laws	Waste Management Policies and Guidelines
• Land Planning and Soil Conservation Act, 1953 (No. 32) • Criminal Code, 1960 (Act 29) • Abandoned Property Disposal Act, 1974 (N.R.C.D.308) • Control and Prevention of Bushfires Act, 1990 (P.N.D.C.L. 229) • Local Government Act, 1990 (Act 462) • Environmental Assessment Regulations, 1999 (LI 1652) • EPA Act, 1998 (Act 490) • Water Resources Commission Act, 1996 (Act 522) • Pesticides Control and Management Act, 1996 (Act 528) • National Building Regulations, 1996 (LI 1630), and • Public Health Act, 2012 (Act 851).	• National Environmental Quality Guidelines (1998) • Environmental Sanitation Policy (1999) • Ghana Landfill Guidelines (2002) • Manual for the preparation of district waste management plans in Ghana (2002) • Guidelines for the management of healthcare and veterinary waste in Ghana (2002) • National Implementation Plan of the Stockholm Convention on Persistent Organic Pollutants (2007) • Handbook for the preparation of District Level Environmental Sanitation Strategies and Action Plans (DESSAPs).

Notwithstanding these policy and legal arrangements for waste management in Ghana, the fieldwork for this study revealed that enforcement of the laws in the Wa Municipality

and within other jurisdictions in Ghana was a major challenge. Three themes were identified during the analysis of the interviews and questionnaires administered to waste management stakeholders, namely: adequacy of SWM laws and policies, compliance with these laws and policies, and enforcement of SWM laws and policies. The stakeholders' assessment of the adequacy, compliance with, and enforcement of SWM laws and policies in the case study area is presented in Table 2.

Table 2: Stakeholders' thematic assessment of the legal and policy framework for MSWM

Stakeholder	Adequacy	Compliance	Enforcement
WMA	Very adequate	No	Not effective
EPA	Quite adequate	No	Not effective
ZGL	Adequate	No	Not effective
Informal waste collectors	Not sure	No	effective
Households	Not sure	No	Not effective

Whereas a majority of the waste management stakeholders agreed that the SWM policies and laws were adequate, all the stakeholders admitted that there was no compliance with these policies. On the enforcement of SWM policies and laws, only the informal waste collectors claimed that the enforcement was effective because their operations, usually at the main disposal site, was not allowed by the municipal authorities. However, the rest of the stakeholders agreed that the enforcement of SWM policies and laws was not effective. A senior official of the WMA affirmed this, stating that:

"*the authorities are relaxed in enforcing the laws, as the people also do not obey the laws*".

However, a retired director of the Wa MWD, through memory work, observed that:

> "*in the past laws governing waste management were properly enforced as waste management laws offenders were prosecuted and heavy fines imposed on them to serve as a deterrent to others, but presently offenders are not prosecuted or penalised in any way*".

Additionally, some environmental health officers in an interview recounted how they had been beaten and banned from visiting some parts of the Wa Municipality in their attempt to enforce waste management laws. An environmental officer narrated that:

> "*in an instance, when we were beaten and chased out of the community, we reported to the police and the offender was arrested but released on the same day without any charge proffered against the offender due to pressure from above*".

According to the environmental health officers interviewed, the 'pressure from above' is usually intervention by highly placed government officials, chiefs, and other community leaders for the release and termination of sanctions for SWM law offenders.

Similarly, a municipal engineer revealed that summons to individuals who disposed of their solid waste (SW) indiscreetly were not obeyed because chiefs, assembly members, and prominent politicians intervene and demanded the termination of sanctions. Nevertheless, a retired senior official of the WMD recounted how stringent enforcement of waste management laws in the past in the Wa municipality and most parts of Ghana led to compliance:

> "*in the past, there was no or little education to the general public on good sanitation including SWM practices. The law of force was the order of the day. Sanitary offenders feared the environmental health officer because of summons and prosecution in court. The moment a health inspector (called in the local parlance 'Tangas' or 'Samasama') was sited approaching a house, people screamed and run helter-skelter to remove all unwanted materials from their homes. The presence of the yesteryear inspector was felt always. Today the situation is not the same*".

The researchers' checks with the judicial service (a circuit court and a high court) in the case study area revealed that there have not been any successful prosecutions of SWM offences in the Wa Municipality for the past ten years. A court clerk revealed that:

> "*A number of waste management related cases have been brought here but none has been allowed to go through its full length since I started working in this court for the past 15 years; usually the individual or department that brings the case to court during prosecution will ask for out-of-court settlement*".

From the preceding, Ghana has sufficient and robust legislation, existing policies and programmes regarding SWM. However, the challenge is the non-enforcement of and non-compliance with the laws and regulations governing SWM. The poor enforcement of waste management policies and laws have significantly contributed to the inefficient MSWM in the case study area and the entire country.

Consequently, Starovoytova (2018) observes that a country's inability to implement existing bylaws on waste disposal results in a 'throw-it-where-you-like' attitude and general disregard of waste management regulations (Starovoytova, 2018). Therefore, many waste generators have resorted to indiscriminate waste dumping in open spaces, streams, drains and drainage channels in the case study area and most other parts of Ghana. This creates unsanitary living conditions, blocks existing drainage channels and creates a breeding ground for mosquitos and rodents (Ejaz *et al.*, 2010; Alam and Ahmade, 2013; Srivastava *et al.*, 2015; Sebastian, Kumar and Alappat, 2019).

3.2 Institutional Arrangement for MSWM

Ghana is currently divided into sixteen administrative regions, with each region, in turn, divided into district assemblies. The assemblies are second-level administrative subdivisions of Ghana (there are currently 254 districts). However, depending on their population size, the assemblies are classified as metropolitan (more than 250,000 people), municipal assembly (population of over 95,000 people) or district assembly (population 75,000 people and over). These Metropolitan, Municipal and District Assemblies

(MMDAs) under the decentralised local government system are supervised by the Ministry of Local Government and Rural Development (MLGRD). The MLGRD has the mission:

> "*to promote the establishment and development of a vibrant and well-resourced decentralized system of local government for the people of Ghana to ensure good governance and balanced rural based development*".

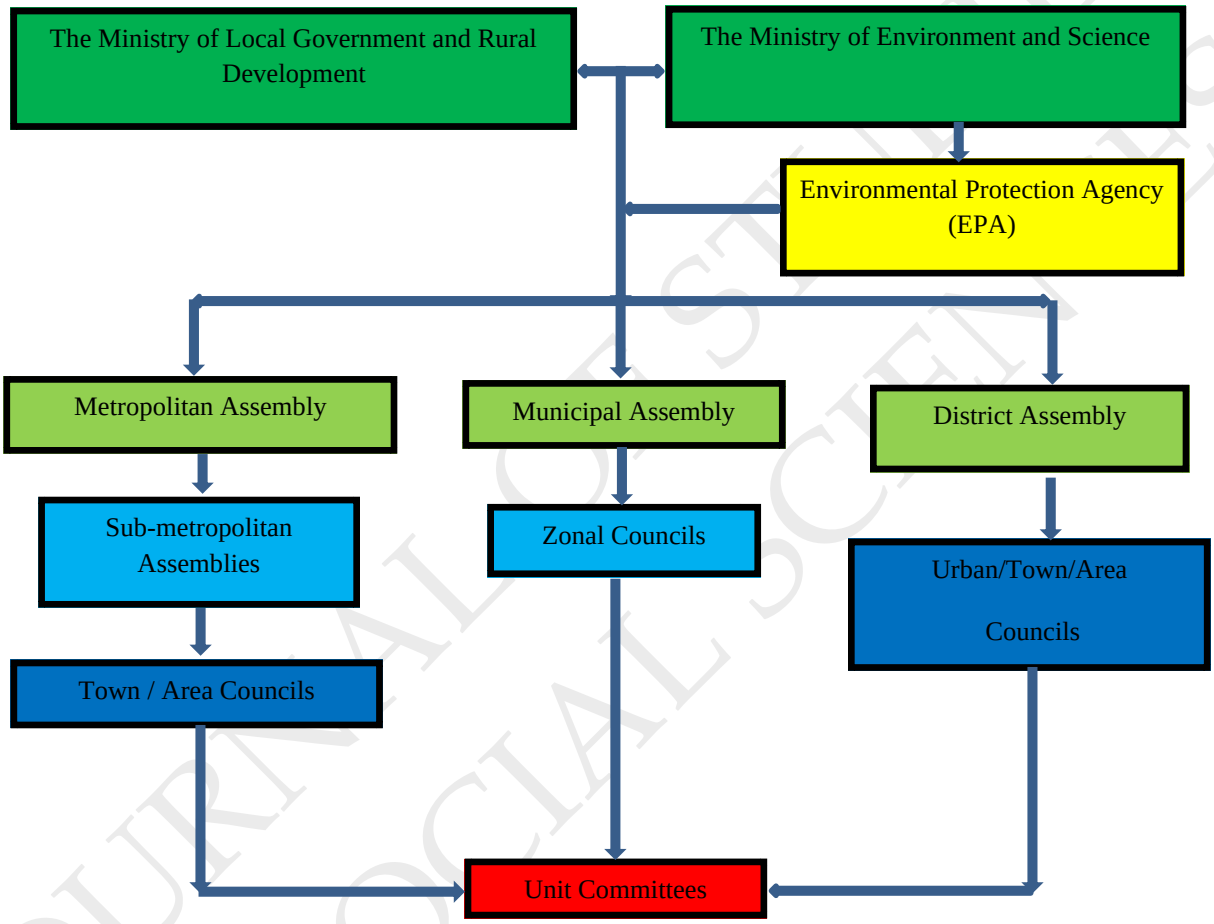
According to the Ministry, this will be achieved by:

- Formulating, implementing, monitoring, evaluating and coordinating reform policies and programmes to democratise governance and decentralise the machinery of government
- Reforming and energising local governments to serve effectively as institutions for mobilizing and harnessing local resources for local national administration and development.
- Facilitating the development of all human settlements through community and popular participation
- Facilitating the promotion of a clean and healthy environment.
- Facilitating horticultural development
- Improving the demographic database for development planning and management, and
- Promoting orderly human settlement development

Consequently, the Local Government Act (Act 462 of 1993, which was repealed and re-enacted as Act 936 of 2016) mandates various decentralised MMDAs, through the MLGRD with the responsibility of SWM, however, the regulation of the environment including SWM is vested in the EPA, which is under the Ministry of Environment and Science. The Assemblies are supposed to enact by-laws to govern the environment based on their local conditions and to form local unit committees in their communities to effectively protect and manage their respective environments.

Additionally, the Waste Management Department (WMD) was established in 1985 in the assemblies to specifically manage environmental sanitation services, including SWM. Figure 2 illustrates the decentralised government system and SWM arrangements in Ghana.

Figure 2: Decentralised local government system and SWM arrangements in Ghana



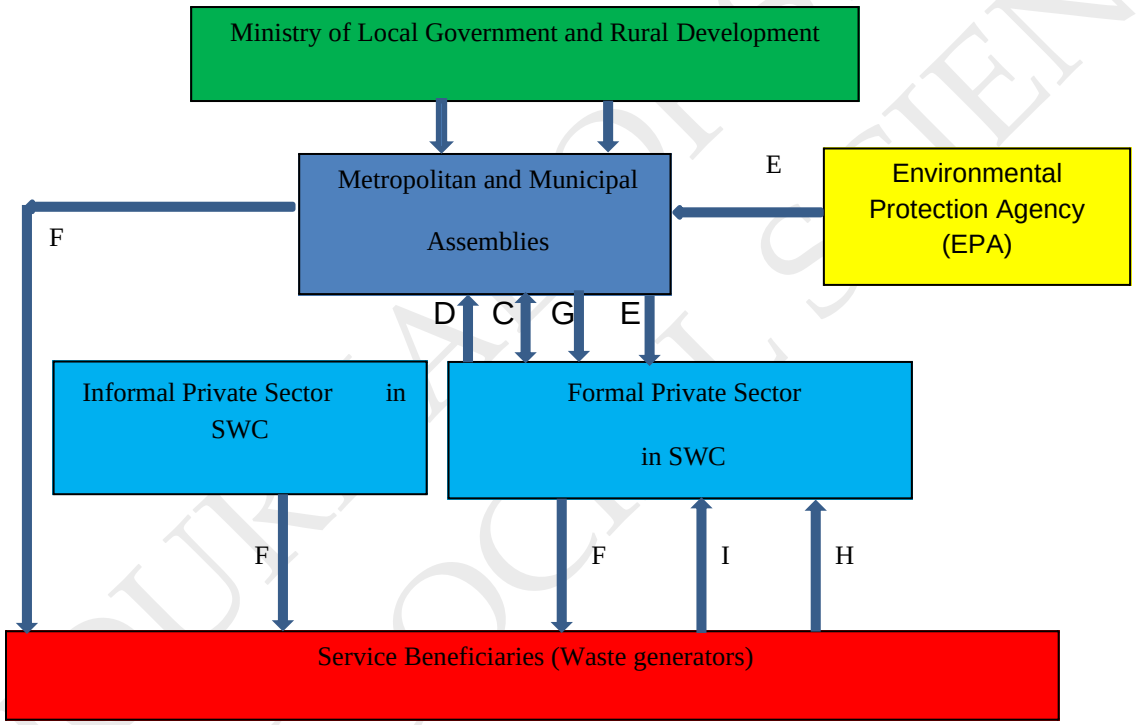
Source: adapted from (Oteng-Ababio, 2012)

3.2.1 Stakeholders in MSWM

There are several stakeholders and interest groups in SWM, which include waste generators, regulators, service providers, recyclers/waste pickers and the community (Santos, Mendes and Ribau T. M., 2019; Spoann *et al.*, 2019). The ability to locate

stakeholders is crucial to identify and incorporate social impacts into waste management system planning (Olapiriyakul, 2017; Porter and Kramer, 2019), as every stakeholder needs to be involved in the attainment of waste management goals. For instance, the public (waste generators) must be made aware of the relationship between managing SW and protection of human health, and the environment (Adipah and Kwame, 2019; Trivedi *et al.*, 2020). The Relationship between stakeholders in MSWM in Ghana is shown in Figure 3. The thematic assessment of the effectiveness of the relationship between stakeholders in SWM and their satisfaction with the role is presented in Table 3.

Figure 3: Relationship between stakeholders in SWM in Ghana



Source: adapted from (Oduro-Kwarteng and Shaw, 2009)

A – Sanitation and SW policies formulated for the Assembly to implement

B – Provision of funds for solid waste collection (SWC) activities

C – Submission of reports by private companies and access to data from Assembly

D – Payment of charges to the Assembly by private companies

E – Supervision and monitoring of activities of service providers

F – Rendering of services to beneficiaries by the Assembly or private companies

G – Release of funds to private companies for services rendered

H – Payment of user charges to private companies by service beneficiaries

I – Complaints about service quality by beneficiaries

Table 3: Stakeholders thematic assessment of the effectiveness of the relationship between stakeholders in SWM and their satisfaction with the role

Stakeholder	Effectiveness	Satisfaction
Wa Municipal Assembly (WMA)	Not effective because of inadequate resources and inability to supervise private sector	Not satisfied
Environmental Protection Agency (EPA)	Not effective because of inadequate resources	Not satisfied because of inability to regulate SWM
Zoomlion Ghana Limited (ZGL)	Very effective	Very satisfied
Informal waste collectors	Effective	Not satisfied because their operations at dumping site is not permitted
Households	Not effective because of inadequate waste collection bins and lack of education on their role	Not satisfied

The MLGRD is by legislation responsible for SWM in Ghana. Therefore, the MLGRD formulate sanitation, including SWM policies and provide oversight responsibility for the Assemblies (A), and disburses funds (B) for SWC services in the Assemblies. The EPA is mandated by Act 490 to regulate the environment. Therefore, EPA is supposed to monitor the activities of the Assemblies to ensure that SW is properly collected and

disposed of. However, currently, the EPA is under resourced and is not able to effectively supervise SW disposal in the Assembles.

An official of EPA in an interview lamented about the inability of EPA to monitor waste management in the Assemblies:

> "*EPA per the act of parliament (ACT 490) is supposed to have operational offices in all MMDAs, but this is not the case. EPA only has operational offices in all the regional capitals and a few offices in some MMDAs. Even where EPA has operational offices, it is so preoccupied with other environmental problems, such as illegal gold mining and siting of petroleum products filling stations to the neglect of SWM*".

Currently, in case study area (the Wa municipality), the EPA does not regulate MSW disposal, as communal containers and open dumps are sited without the notice or permission of EPA.

The Assemblies also contract private companies to collect waste in certain locations within their jurisdictions (E). The Assemblies pay the private companies for their services (G); however, the private companies recover some of the cost through payment of user charges (H) by some service beneficiaries, mostly house-to-house collection service beneficiaries.

During the field work for this study, an official of the WMA confirmed that the private sector involvement has drastically improved waste collection, although, in the opinion of the official, the private sector lacks the technical expertise required for effective waste management and thus attributed the improvement of waste collection to the resourcefulness of the private sector. The official further that ZGL (the only private waste collection company operating in the Wa Municipality):

> "*has the requisite equipment for SWM but lacks the technical expertise*".

Additionally, the Wa Municipal Authorities bemoaned their inability to monitor and supervise the operations of ZGL. In an answer on the arrangements for the supervision of the private sector's operations, a municipal engineer revealed that:

> "*the MWD is supposed to monitor and supervise the operations of the private sector but, it is not happening* because p*ayment for the private sector's operations is made by central government, through the MLGRD without recourse to the Municipal Assembly. Most often, the company is ineffective in waste collection and yet is fully paid for waste collection services*".

Presently, ZGL is the only private company engaged to collect waste in all 254 MMDAs by the MLGRD. The condition(s) of the contract between the MLGRD and ZGL since 2006 has been shredded in secrecy. This lacks the elements of private sector involvement in waste management - competition, transparency, and accountability (Hettiarachchi *et al*., 2018; Omran and Gebril, 2018; Pinz, Roudyani and Thaler, 2018).

However, ZGL indicated that the contractual agreement between them and the local assemblies was through a "*public-private-partnership*" (PPP), nevertheless, the content of the agreement or partnership is unknown to the municipal authorities. Meanwhile, in 2013 the World Bank debarred Zoomlion Ghana and Zoomlion Liberia (subsidiaries of Zoomlion Company Limited) for two years because Zoomlion Company Limited was accused of fraud and paying bribes to secure waste management contracts sponsored by the World Bank in Liberia (The World Bank, 2013).

Nevertheless, the evidence on the ground showed that ZGL has improved SWC in the Wa Municipality. A municipal public health engineer in the MWD admitted this in an interview, but observed that:

> "*if the MWD was given half of the money paid for the services of ZGL, the MWD would have performed far better, because the MWD has the technical expertise but lacks the resources, whereas ZGL has the resources, but lacks the technical expertise*".

However, research shows that the private sector performs better, especially in the waste collection because it can overcome bureaucracies and source funds to purchase the requisite equipment for SWM activities through loans (Benito, Guillamón and Ríos, 2018; Fernando, 2019).

The relationship between stakeholders in MSWM in Ghana shows that the emphasis on stakeholders' involvement in SWM is focused mainly on waste collection and no attention paid to waste reduction, treatment and final disposal. However, for sustainable waste management, the stakeholder's involvement is often focused on promoting waste reduction/avoidance and resource recovery (Mondal and Palit, 2019).

3.3 MSWM Financing

Poor national economic policies coupled with extreme poverty and high infrastructure deficits make financial considerations one of the most obvious constraints to developing appropriate waste management systems for Ghana and other developing countries (Pieterse, Parnell and Haysom, 2018). Accordingly in most developing countries, there are four ways of financing local public goods including SWM: local taxes such as the property tax, user charges which are levied on various urban services, grants from higher levels of government, and loans from the capital market from governments/financial institutions or international agencies like the World Bank (Kaganova and Telgarsky, 2018; Mullin, Smith and McNamara, 2019).

In Ghana, urban spiralling has exhausted the capacity of existing traditional disposal sites to the extent that wastes must be transported greater distances to sites outside many urban areas. The WMA's (the case study area) disposal site is located at *Siiriyiri* in the Wa West District, about 5km away from the Wa. This leads to the irregular collection of waste in poor residential areas who mostly rely on communal containers for their waste collection. A municipal engineer admitted that there was no schedule for the lifting, transporting and emptying of communal containers under the management of the MWD by saying that:

> "*it depends on the availability of fuel, it can be one week, two weeks, three weeks, one month and sometimes two months for the Assembly to lift communal containers in various parts of the municipality*".

As a result, most middle and low-income household dwellers often complain of unsatisfactory or unreliable waste management services. For this reason, they often resist paying any charges for waste management and instead resort to illegal dumping and burning of their waste. Only high-income households who mostly reside in the beautiful parts of the municipality pay for waste collection through the house-to-house collection service operated by ZGL.

MSWM in Ghana is solely financed by the central government. Initially, the various district assemblies were mainly responsible for waste management within their jurisdictions, however, since the early 1990s, the private sector has been involved in waste collection, especially in the bigger cities such as Accra, Kumasi, and Takoradi.

The government pays the private company for the collection services from monies deducted from the various Assemblies Common Fund. However, the bigger metropolitan assemblies (Accra, Kumasi, and Takoradi), who generate high volumes of waste above the collection capacity of a single private SWC company, engage additional private companies for waste collection and pays for the collection from funds internally generated from sources such as property rates and market user levies, among others.

In the Wa Municipality, there was no alternative or funding structure for SWM, except the funding from central government. A budget officer at the WMA in an interview confirmed that there was no allocation or budgeting for the recurrent cost for MSWM but acknowledged that,

> "*for the first time, we were asked to make provisions for solid and liquid waste management in the 2019 budget, however, without a specific budget source. So, I'm wandering where the money will come from for waste management*".

Similarly, a municipal engineer in an answer to how recurrent MSW disposal is financed in the assembly said that:

> "*There is no proper financing arrangement for MSW disposal in the Assembly. Funds are provided when the need arises, for instance, when there is a cholera outbreak*".

Thus, the current and future projected cost for MSWM is unknown to the municipal authorities. Meanwhile, the provision of SW services is an expensive undertaking, and resources are required to purchase the appropriate equipment and infrastructure, fund the maintenance and daily operation of vehicles and equipment and train or upskill personnel. The scarcity of resources (financial and logistical) is a major hindrance to effective MSWM practices in the Wa Municipality and Ghana in general.

In most developed countries, the polluter pay principle, whereby the polluter bears the expenses of carrying out the measures decided by public authorities to ensure that the environment is in an acceptable state, has provided a secure funding source for SWM (Adshead, 2018; Musch and De Ville, 2019). Thus, the polluter pay principle is worth considering in Ghana and other developing countries to provide a secure and a clear source of funding for SWM.

Also, MSW has become a resource and should not be a mere trash, as is the case in most developing countries. There have been reports of Sweden running out of waste for processing in her waste-to-energy plants and have resorted to the importation of SW to keep the plants in operation. The management of MSW is not just a public service but also an important economic sector which can provide business and job opportunities (Saadeh, Al-Khatib and Kontogianni, 2019). Therefore, the recognition of MSW as a resource and not just a mere trash in Ghana can create business and employment opportunities and provide avenues for alternative sources of funding for MSWM.

3.4 Technical capacity for Waste management

Technical skills (human resource) and the requisite equipment disposition are essential for effective waste management, especially the daily operations of waste management. In this regard, the capacities of the WMA and ZGL were examined. The results indicate that both WMA and ZGL did not have the requisite expertise and equipment disposition for effective SWM. However, there was a wide variance in the human resource base and equipment disposition between the WMA and ZGL. Whiles ZGL had some minimal

waste management equipment such as compactor tracks, skip trucks, tipper trucks, tractors, motorised tricycles, and manual tricycles; the WMA only had a compactor track and a skip truck. The technical skills and equipment disposition of the WMA and ZGL are presented in Tables 4 and 5 respectively.

Table 4: A comparison of the technical skills between the WMA and ZGL

Technical Skill	**Qualification**		**Number**	
	WMA	**ZGL**	**WMA**	**ZGL**
Public Health Engineer	BSc., Public health engineering	BSc., Environmental science	3	1
Environmental Health officer	Certificate in environmental health and hygiene	-	10	-
Civil Engineer	BSc., Civil Engineering	-	1	-
Account officer	BSc., Accounting	BSc., Accounting	3	1
Administrative Assistant	BSc. Administration	Higher National Diploma	2	1

Table 5: A comparison of the equipment disposition between the WMA and ZGL

Equipment	**Number operational**		**Number Ideal**		**Number broken down**	
	WMA	**ZGL**	**WMA**	**ZGL**	**WMA**	**ZGL**
Compactor truck	1	4	1	3	-	1
Skip truck	1	4	1	4	-	-
Tipper truck	-	1	-	1	-	-
Tractor	-	2	-	1	-	1
Motorised tricycle	-	12	-	5	-	-
Manual tricycle	-	10	-	15	-	-
Communal containers	15	22	-	-	10	5

Essential waste management personnel such as landfill and plant managers were absent in both the WMA and ZGL. Also, the researchers during the fieldwork observed wastes spillage around the communal containers because of overflowing due to irregular emptying of the communal containers, as shown in Figure 4. The spilt wastes were usually not collected because of the lack of requisite waste management equipment such as front-end loaders, bull dozers, and landfill compactors. However, the use of motorised tricycles and manual tricycles in SWC by ZGL, enable access for SW collection in poorly planned and crowded parts of the municipality, where there were no good or access roads.

Figure 4: Container overflowing with waste in Wa

The findings on the technical capacity for SWM in this study supports other researchers who observed that, the private sector is usually properly resource and equipped than the public sector, because the private sector is able to overcome bureaucracies and source for funds to purchase the appropriate waste management equipment through loans (Fernando 2019), whereas, the failure of the municipal authorities to consider important parameters such as waste generation rates and characteristics in the purchase of waste management equipment may lead to the breakdown of the equipment and the wastage of huge sums of money (Wiesmeth and Häckl, 2017; Tyagi *et al.*, 2018).

On the other hand, the WMA had a greater skilled workforce than ZGL. The WMA had experts in SWM such as civil engineers, public health engineers, and environmental health officers, whereas, ZGL only had a public health engineer and other support staff who were not experts in SWM. This made the municipal authorities feel that they were better placed to effectively manage waste in the municipality than ZGL. However, the evidence on the ground proved that ZGL, even without the requite expertise in MSWM, has drastically improved waste collection in the Wa municipality and other MMDAs in Ghana.

4.0 Conclusion

The study examined MSWM performance in Ghana using the Wa Municipality as a case study. The findings indicate that Ghana has a good institutional framework for MSWM, the laws and regulations governing waste management are adequate and the involvement of the private sector in waste collection has drastically improved waste collection in the country. However, there is non-enforcement of, and non-compliance with laws governing waste management. Also, there is dissatisfaction with the private sector engagement in waste collection due to the lack of the elements of private sector involvement in waste management (competition, transparency, and accountability). Waste management financing is equally woefully inadequate because of the over-reliance on central government to provide the needed funding for SWM; and the technical capacity of both the local assembly and the private sector is not adequate for sustainable MSWM. Therefore, the current scenario of MSWM performance in the Wa Municipality and Ghana in general does not present an enabling environment for sustainable MSWM. Strengthening the enabling environment for sustainable MSWM could scale up MSWM performance in Ghana for the attainment SWM goals such as protection of public health and the environment, conservation of resources, and creation of employment.

Acknowledgement

We are grateful to Ghana Education Trust Fund (GETFund) for partly sponsoring this research and all our research participants in Ghana.

Funding

Authors received funding from GETFund for fieldwork

Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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