AN ASSESSMENT OF SUSTAINABLE SOLID WASTE MANAGEMENT
IN ACCRA- GHANA

by

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Despite the vast research on options to improve solid waste management (SWM) in developing countries, little has been done to evaluate these possible improvements. This study assesses Ghana’s Community Participation and Public Awareness Program (CPPAP) for SWM through qualitative interviews comprising of 81 community members living in three different Communities - Kanda, Asylum Down, and Nima all in the Accra Metropolitan Area (AMA), Ghana. In addition, four officials were interviewed, and an activity worksheet for Strength, Weakness, Opportunity, & Threat (SWOT) analysis was developed based on responses from the study community members and officials. Participants were asked to identify implementation plans for SWM at different levels of government. Results indicated that community members and officials do not have expert knowledge of existing local and national laws for managing waste in Ghana. Study participants were also asked what targets are achieved with CPPAP; the study observed that community members have a good comprehension of SWM and are actively involved in managing waste. Notwithstanding that, enforcement of the listed guidelines to CPPAP has not been effective primarily due to lack of resources. Furthermore, to identify community members’ and policymakers’ viewpoints regarding SWM, the study found that the greater support of the local government and all stakeholders is needed in managing waste. The study identified significant threats and weaknesses of the CPPAP that include political
interference and a lack of resources that can be overcome by strengths and opportunities, including community mobilization, employment opportunities. The study contributes to the body of knowledge on assessing implementation programs and policies for solid waste management in developing countries. Stakeholders of solid waste management will also benefit from the challenges unveiled in the study regarding waste management implementation plans and policies from governments.
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CHAPTER 1
INTRODUCTION

1.1 Background and Purpose of the Study

Municipal solid waste management (MSWM) is a major national challenge in Ghana. Rapid urbanization in Ghana leads to increased waste generation, which exacerbates the challenge of SWM. According to Moh and Abd Manaf (2014), the volume of solid waste increases with urban population growth and material consumption rates. World cities generate about 1.3 billion tons of solid waste per year, and this volume is likely to increase to 2.2 billion tons by 2025 (Hoornweg and Bhada-Tata 2012). Increased waste production requires a rise in budgeting for solid waste management. Developed or high-income countries have invested in solid waste management (SWM) that includes collection and disposal. Developing or low-income countries struggle to find a solution to improper waste management. The bulk of SWM budgets in low income countries is spent on waste collection not disposal (Gopal et al. 2018, Hoornweg and Bhada-Tata 2012).

Poor MSWM, with its immediate and visible impacts, in Ghana is a major challenge to the Ministry of Local Government and Rural Development (MLGRD) and many Chief Executive of Metropolitan, Municipal and District Assemblies (MMDAs). According to a MLGRD (2010), 85% of household solid waste in Ghana is disposed of improperly at unspecified locations. Implementation plans documented in the National Environmental Sanitation Strategy and Action Plan and National Environmental Sanitation Policy (NESP) of Ghana (2010) are the Institutional Development and Capacity Enhancement program, Community Participation and Public Awareness, the Local Services Improvement Program, Research, and the Performance Monitoring and Governance Program. These plans are designed to achieve sustainable solid
waste management in Ghana. Notable studies on sustainable solid waste management have been carried out (Awortwi 2004, Asase et al. 2009, Cobbinah, Addaney, and Agyeman 2017), but the streets of Ghana are never free from the heaps of solid waste. Policy guidelines are essential to target goals. The guidelines for sustainable solid waste management in Ghana are rarely implemented (Awortwi 2004). Implementation programs must be assessed to improve their shortfalls, so policymakers and all stakeholders can adequately and efficiently play their respective roles in achieving sustainable solid waste management.

This study assesses the Ghana’s Community Participation and Public Awareness Program (CPPAP) to identify the strengths and opportunities that can be capitalized to overcome threats and weaknesses of the program. The CPPAP is based on awareness creation for behavioral change, education, and enforcement management to obtain environmental sanitation development in Ghana (MLGRD, 2010). Figure 1.1 illustrates the guidelines to successful CPPAP for sustainable SWM. The figure was designed based on the information about CPPAP provided in Ghana’s NESP and NESSAP.

![Figure 1.1: The guidelines to CPPAP](image-url)
The assessment of CPPAP could help provide options and promote the sustainability of solid waste management in Ghana in terms of restructuring management. The purpose of this study is consistent with findings by Oteng-Ababio et al. (2013), that is, in order to achieve sustainability of solid waste management, all measures in the accomplishment of a goal need to be adequately evaluated.

1.2 Problem Statement

The abrupt increase in Ghana’s population since its independence, 1957 and Ghana’s projected population growth of 30.7 million by the end of 2020 calls for a conscious effort by stakeholders to engage in sustainable solid waste management (World Population Prospects, 2017). Indeed, the government of Ghana has programs in place for sustainable waste management and these programs are supposed to be implemented in communities through metropolitan and municipal assemblies. However, trash still lingers on the street and communities in Accra, Ghana. The challenge of waste management has exacerbated flooding due to choked gutters. Figures 1.1 and 1.2 shows situations of improper handling of waste in Ghana. Community participation is posited by Srivastava (2005) and Asomani-Boateng (2007) to bring about sustainable solid waste management. Community participation evolves from a bottom-up decision-making approach, which boosts community ownership of projects to ensure continued success. Unquestionably, there is a need to assess the Ghanaian government's implementation plans, with a focus on the Community Participation and Public Awareness Program (CPPAP) regarding SWM to achieve sustainability. Assessing the CPPAP would raise government and public awareness of the program for Sustainable Solid Waste Management (SSWM). Furthermore, evaluating the program brings to understanding of issues to be faced, and alternative measures can be adopted to solve the issues and improve SWM.
1.3 Research Questions

In order to assess the Ghana’s Community Participation and Public Awareness Program (GCPPAP) for solid waste management, these main research questions were asked:

1. What are the implementation plans at different levels of government for managing solid waste in the Kanda, Asylum Down, and Nima neighborhoods of Accra, Ghana?
2. What goals have been achieved in the community participation and public awareness plan?
3. Do the viewpoints of policymakers’ vary from community members’ with regards to solid waste management?

Figure 1. 2: Community waste disposal site
1.4 Organization of the study

The study was organized into six chapters. The first chapter consists of the background to the study area. It also contains the problem statement, research objectives and questions. The second chapter consists of literature review which provides an insight to the already established school of thought on the subject matter. This was done with the aid of secondary information sources such as books and journals. The third chapter comprises the study profile. This is a holistic appraisal of the methodology employed in the execution of the research. The fourth chapter presents an outline of the data collected in the field. The fifth chapter provides assessment: Strength, Weakness, Opportunity, & Threat (SWOT) analysis and discussion of findings. The last chapter, being chapter six contains conclusion and recommendations for study findings as well as study limitations.
CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter examines existing literature that pertains to four aspects of municipal SWM: generation and composition, collection and transportation, treatment and disposal, and laws and regulations governing solid waste management. Sustainable solid waste management, its drivers, and assessment tools for evaluating SWM is also discussed. Analysis of these subjects provides an in-depth understanding of SWM by demonstrating the need to obtain sustainable waste management, how to evaluate municipal solid waste management, and most importantly, the effectiveness of sustainable solid waste management in achieving the United Nations Sustainable Development Goal (SDG 6) clean water, and sanitation. Undoubtedly, few studies have assessed implementation plans or laws for SWM. Therefore, the conceptual framework of previous research on solid waste management advances the main argument of this study.

2.2 Municipal Solid Waste Management

2.2.1 Solid Waste Generation and Composition

Solid waste is the non-liquid and non-gaseous products of human activities that are unwanted. For the sake of this study, solid waste is referred to as waste. Solid waste management (SWM) can be defined as the proper handling of unwanted waste in a manner that would not cause direct harm to human health and the environment. Successful municipal solid waste management depends on availability of accurate data on the generation and composition of waste, which is a guide for planning and deciding an appropriate waste management system. Waste generation, composition, collection, transportation, treatment, and disposal are vital functional elements in the process of waste management. Solid waste generation is associated with rapid rates of urbanization, economic growth and development, and public habits. The
increase of waste generation without any effective management is a threat to the environment and public health.

Generally, the higher the economic development and rate of urbanization, the greater the amount of solid waste produced (Levis et al., 2013). Global municipal solid waste (MSW) generation levels are approximately 1.3 billion tons per year. They are expected to increase to approximately 2.2 billion tons per year by 2025 (Hoornweg and Bhada-Tata 2012). Developed countries, reported by Griffin et al. (1999), generate waste of 85,000,000 tons per year with paper as the dominating component. Developing countries' waste generating rate is 158,000,000 tons per year, with organic waste being the primary component. Moreover, it is estimated that by 2025, the rate of waste generation in developing countries would escalate to 480,000,000 tons per year while that of developed countries would slightly increase to 86,000,000 tons per year. Waste generation drivers (urbanization, economic development, among others) differ from region to region and even within cities of the same region, which is the reason for variation in waste generation and composition.

A study by Asase et al. (2009) revealed that the city of London, Ontario- Canada has a higher per capita waste generation (1.2 kg) than that of Kumasi (0.6 kg), a city in Ghana. However, due to the large population in Kumasi (1,889,934), the overall waste generated is higher than that of the London, Ontario (352,395) with households recorded as the highest generator of waste in Kumasi. The composition of waste in London, Ontario is dominated mainly with paper waste, and Kumasi has organic waste as its primary waste component. Differences in waste composition are due to the variations in living standards and lifestyles of people in the two cities. Palanivel and Sulaiman (2014) discovered that the rate of waste generation in Muscat, Sultanate of Oman, was 0.70kg/day/person as at 2004 but it is now 0.97 kg/day/person by weight
with an average density of 311.73 kg/m$^3$. This new rate the authors mentioned is within the generation rate of developing countries. Economic growth and rapid population growth are correlated with a much higher new rate of waste generation (0.97 kg/day/person). The higher waste generation is due to increase in the number of consumers of final products and other human activities. Organic waste, especially mixed food waste, accounts for most MSW in Oman. Paper, plastic, and glass, respectively, in order of dominance, are other waste components discovered in Oman. These findings are consistent with earlier studies and the Gulf Cooperation Council that reported food waste as a large portion of solid waste in developing countries.

A related study in Malaysia discusses trends and the current waste management system (Agamuthu et al. 2007). This study revealed that the daily generation of waste increased from 13,000 tons in 1996 to 19,100 tons in 2006, with urban populations leading waste generation. Increases are attributed to changes in consumption habits and increased affordability of consumer goods. The study by Agamuthu et al. (2007) in Malaysia revealed that organic waste is dominant in the waste composition, followed by paper and plastic waste. These findings are consistent with findings in Bangalore city, India (Ramachandra and Bachamanda 2007). Households and commercial places are the primary sources of the generation with the increasing rate of generation credited to educational, cultural, and consumption patterns. Paper and plastic waste composition are higher in developed countries than in developing countries where organic waste is dominant.

Accra, the capital of Ghana, has a waste generation rate of 0.80 kg/capita/day (1,500 tons per day) as of 2014, organic waste is the primary component in the waste stream, and public places and households are the primary sources of waste production (MLDRD, 2010).

Overall, most studies indicate that rates of waste generation are increasing, especially in
developing countries. Households are the largest source of organic waste generation, which is the primary component of waste (Miezah et al. 2015). Organic waste generated by households is mostly food waste, largely due to impulse buying or unplanned meals and purchases.

2.2.2 Collection and Transportation

Collection and transportation of waste refers to managing waste from the point of generation to the point of treatment or disposal. Examples of means of the collection include, house to house, community bins, curbside pick-up, and contracted service. The means of service varies by geographical location. Collected waste could be mixed or separated based on local regulations. Unlike developed countries, waste separation is practically nonexistent in developing countries. However, recyclables are removed by waste pickers to earn a living. Their activities often leave gathered refuse scattered, making collection and disposal of waste even more challenging (Oteng-Ababio et al. 2013). Nonetheless, when their activities are appropriately organized, waste pickers could be effectively integrated into a waste recycling system to aid waste management. Collection services in developed countries are highly efficient despite a relatively small solid waste management (SWM) budget for collection. Developing countries, on the other hand, have the bulk of their SWM budget for collection services but have lower collection rates resulting from inefficient collection and transportation services (Hoornweg and Bhada-Tata 2012).

According to Ramachandra and Bachamanda (2007), door to door and community bin collection are the most common methods of waste collection in Bangalore city, East Africa. The authors explained that waste is collected using pushcarts and then transferred to tipper trucks at a meeting point for disposal because no transfer station exists. Households deposit waste in community bins, which are then collected by an urban council or private operators and delivered
to disposal sites using trucks in Bangalore city, East Africa. Private operators usually collect waste from the source (door to door). The private operators negotiate the price of waste collection with individuals, while commercial places like the malls contract private operators to pick up the waste. Communities also rely on urban councils for waste collection. The urban poor receive very little to no waste collection services due to impassable roads, unplanned settlements, and neglect by urban councils. Waste collection in East African urban centers is based on the level of income of the service area. (Okot-Okumu 2012).

According to the Ghana Statistical Service (GTS), the 2010 Housing and Population Census revealed that about 2.5% of households in Ghana as at have house-to-house services or variations such as curbside collection. At the national level, 4.8% of households have their waste collected directly from their dwelling, and 7.9% burn their household refuse. More so, 57.6% use various household receptacles for storage and send it to designate public dumps, including communal-container stations or sanitary sites.

2.2.3 Disposal and Treatment

Landfilling and thermal treatment of waste are the most common methods of Municipal Solid Waste (MSW) disposal in developed countries. Most developing countries resort to open dumps and have poorly operated landfills—only a few places in developing countries like Bangalore, India compost waste as a means of waste treatment. Dumps are mostly located in environmentally sensitive areas and are hazardous to waste pickers. The trucks used in disposing of waste are generally open. They are kept uncovered, resulting in spillage of waste on streets while being transported, resulting in unhygienic conditions (Hoornweg and Bhada-Tata 2012, Okot-Okumu 2012, Ramachandra and Bachamanda 2007, Babayemi and Dauda K. 2009, Sharholy et al. 2008). Waste diversion through recycling in developing countries is done on an
informal basis and hence is not regarded as a means contributing to waste management (Asase et al., 2009).

Most communities in Ghana, close to 60% of households rely on a communal or public dump. They also rely on communal sanitary sites as secondary storage. The communal containers, or skips, that are used at the communal sanitary sites are not emptied frequently in many instances. It is reported by MLGRD (2010) that 25.9% of households dump their refuse at unspecified locations, including vacant lots, drains, and the embankment of watercourses, rivers, lakes, and wetlands. Crude open dumping is a practice in almost all communities in Ghana. In the few cases where controlled dumping is practiced, immediate and long-term environmental impacts are ignored. Kumasi and Tamale are the only two cities in Ghana with engineered landfills. Accra, the capital city, has no engineered disposal site and refuse is disposed of in abandoned quarries in adjoining districts (MLGRD, 2010).

The challenges of waste management in developing countries include: an inability to control waste generation, and problems with the collection of waste, transportation, disposal, and treatment. In contrast, developed countries have advanced in all means of waste management and budgeting towards efficient disposal. Thus, they have moved from worrying about human health-related and environmental impacts of waste management to resource recovery from waste.

### 2.3 Government Laws and Regulations

One primary driver of solid waste management is legislation (Agamuthu et al., 2009). Sustainable waste management must be grounded in local legislation that is geographically and culturally feasible, reasonable, and far-sighted. Co-operation by various stakeholders is required to achieve sustainable waste management. Laws and regulations for SWM in developing countries are mostly imbedded in larger environmental laws or acts. There are no specific laws
for solid waste collection and disposal processes to improve the way solid waste is managed. The few imbedded laws to improve SWM are poorly implemented as identified in a study of MSW in Lahore, Pakistan by Masood, Barlow, and Wilson (2014). According to the authors, Pakistan have Environmental Protection Act of 1997 and a national environmental policy which is used improve SWM in Pakistan, but these laws were poorly enforced by the city district government. Furthermore, a study by Ramachandra and Bachamanda (2007) in Bangalore, India disclosed that local authorities often see MSWM as a poor service because operating costs are barely recovered and most of the municipalities are unable to provide the appropriate level of services. The acts and rules in India for SWM are not practical due to inadequate finance in supporting waste management, untrained personnel at the local offices, political influences, lack of community involvement, inappropriate technology to suit conditions in developing countries, and unavailable data on waste and many others.

In addition, a research was conducted by Ibrahim et al., (2016) to improve solid waste management in Egypt. The authors identified that Egypt does not have a solid waste management law. The legal framework for solid waste management is scattered in many pieces of legislation. Ibrahim et al.’s (2016) finding is consistent with the study by Asase et al. (2009) in Ghana which revealed that Ghana has no national law for the management of solid waste but have sanitation policies that govern the management of waste. Furthermore, Metropolitan, Municipal, and District Assemblies (MMDAs) are to come up with bylaws, which must be passed by parliament and monitored by the Heads of MMDAs. Key national policy documents that capture solid waste management in Ghana include the National Environmental Sanitation Policy (NESP) 2010 and the National Environmental Sanitation Strategy and Action Plan (NESSAP) 2010. These documents were prepared by the Ministry of Local Government and
Rural Development to develop and sustain a clean, safe, and pleasant environment for human settlements. They are passed as the need to refocus the environmental sanitation sector in Ghana to meet Medium Term Development Policy Framework (MTDPF, 2010 – 2013) objectives to meet the objectives of the United Nations Millennium Development Goals (MDGs), and other recent international initiatives (Asase et al. 2009).

Looking back over time, the Revised Environmental Sanitation Policy of 1999 stated Information, Education and Communication, Legislation and Regulation, Levels of Service, Sustainable Financing and Cost Recovery, Research and Development and Monitoring and Evaluation as its general policy focus with several broad policy principles relevant to improving environmental sanitation. This revised environmental sanitation policy seeks to address the limitations of the old policy published in 1999. In addition, the policy emphasizes the need to ensure a systematic collection of data on wastes from all sectors of the economy and supports relevant research and development to meet the challenges of managing wastes in Ghana. This gave rise to the enactment of the implementation programs to ensure the successful accomplishment of the policy focuses. Unfortunately, these programs have not been up to the task. Among these programs is the Community Participation and Public Awareness Program (CPPAP), the focus of this study. The CPPAP is to enhance community participation in SWM in Ghana (MLGRD, 2010).

Formulation, and most importantly, enforcement of government laws and regulations are vital for the attainment of sustainable solid waste management. Developing countries have challenges with the implementation of laws and programs to attain proper solid waste management. Ghana has no unique law for solid waste management but has programs in place to promote environmental sanitation, the CPPAP is a program for sanitation which includes SWM.
Developed countries, on the other hand, have laid down rules and regulations that are strictly enforced. They also have recycling programs and engage higher education institutions in the recycling programs to reduce the amount of waste that go to landfills. Local governments also organize some sort of recycling drive to collect recyclable waste and send them to proper recycling facilities.

2.4 Sustainable Solid Waste Management

A solid waste system that does not compromise the needs of future generations is Sustainable Solid Waste Management (SSWM). According to Our Common Future, sustainability has three dimensions that are integrated: social, environmental, and economic sustainability. The word sustainability was polarized by Brundtland (1987). It was introduced on the basis that the environment is deteriorating at a faster pace and needs to be sustained for future generations. Sustainable solid waste management in developed countries is much more advanced than in developing countries (Gopal et al. 2018).

Social Sustainability is the capability of people to develop processes and structures. These structures will not only meet the needs of the current generation but also support the ability of future generations to maintain a healthy living (Mckenzie, 2004). Social sustainability is attained by the existence of strong cohesion between civil society and stakeholders. Social sustainability is regarded as necessary to support environmental sustainability (Colantonio, 2009). Concerning solid waste management, community participation, and inclusivity of all stakeholders in decision making is necessary to avoid social harm, such as poor human health. Environmental sustainability improves human welfare by protecting the sources (air, water, land) of raw materials used for human needs and ensures that waste does not exceed the assimilative capacity of the environment without impairing it. Environmental sustainability is necessary for
social sustainability (Goodland, 1995). In other words, in the quest for sustaining the environment (air, water, and land), obligations such as keeping water bodies clean and free from any form of waste call on society to manage waste by working in solidarity with all stakeholders. Economic sustainability in SWM contest is the ability of a system to be financially stable and be cost effective to support solid waste management indefinitely, and this could be achieved by recycling waste to recover resources from waste generated. It is vital to incorporate the three dimensions of sustainability to attain sustainability.

2.4.1 Drivers of Sustainable Solid Waste Management

Drivers are factors that influence the implementation and achievement of sustainable waste management. Identification of a unique driver associated with a country or local condition would help in the implementation of efficient, sustainable solid waste management. These drivers may be associated with any of the three aspects of sustainability: environment, economy and society. Institutional effectiveness, which includes capacity, decentralization of authorities, level of cohesion, and culture is one primary driver of sustainable solid waste management (Agamuthu et al., 2009). According to the World Bank (2000), planned administration and institutional structure are fundamental to effective waste management. Ineffective management decreases the performance of a waste system (Ogawa, 2008). Therefore, institutional effectiveness should be considered as a significant driver of sustainable solid waste management (SSWM).

Public participation is another important driver that has been identified by several studies as a significant step towards the success of solid waste collection programs (Chung and Poon, 2001; Folz, 1999; Lober, 1996). The involvement of the public can result in public awareness and change their perception of waste management. Their involvement will make communities
have a sense of ownership in any waste project or activity, thus boosting management effectiveness (Agamuthu, 2009). Public participation helps to improve community health and reduce the financial investment of institutions in solid waste management programs (Vidanaarachchi et al., 2006; Sujauddin et al., 2008; Khalil and Khan, 2009; Sandhu, 2014; Voronova et al., 2013; Yeboah-Assiamah et al., 2017).

Furthermore, government’s exploration and selection of appropriate technologies enhance the development of SSWM (Gopal et al. 2018). Efficient selection of cost-effective and innovative technologies must be based on suitability to deal with the prevailing local conditions and waste characteristics (Shekdar, 2009). Selection of cost-effective technologies with frequent upgrading and maintenance will provide long-term economic efficiency. Cost-effective and innovative technologies is a driver of SSWM.

Financial stability is an economic driver of SSWM (Agamuthu et al. 2009, Gopal et al. 2018). Continuous financial support for institutions handling solid waste management is necessary to achieve sustainable solid waste management. However, most waste management initiatives in developing countries are hindered by a lack of financial support. (Ferreira et al., 2017). Lack of financial support can be overcome by developing a new approach, such as restructuring waste management in a profitable way (Suocheng et al., 2001). Integrating waste pickers into the solid waste management system while encouraging sorting and recycling would help recover resources. A well-managed financial structure balances the costs required for solid waste management processes.

2.5 Assessment Methods/Tools

The methods/tools discussed in this study are Life Cycle Assessment (LCA), Multi-criteria Decision Making (MCDM), Cost-benefit analysis (CBA) and the SWOT (strengths,
Assessment models and methods are a means to discover the advantages and disadvantages of various sustainable waste management options and serve as a guide for decision-makers. Several studies have employed different assessment methods to evaluate waste management systems (Pires et al., 2011; Morrissey et al., 2004). Commonly used assessment methods that can be used by decision makers to assess waste management are were reviewed and categorized by Allesch and Brunner (2014).

Life cycle assessment (LCA), Multi-criteria decision making (MCDM) and cost-benefit analysis (CBA) are widely used assessment methods. LCA addresses the environmental aspects and potential environmental impacts (e.g., consumption of goods and environmental consequences of aftermath consumption) throughout a product's life cycle, from raw material acquisition through production, consumption, end-of-life, treatment, recycling, and final disposal (ISO 2006). LCA evaluates environmental burdens associated with a product or activity by identifying energy and materials used and waste and emissions released to the environment in order to assess their impact and to identify opportunities that would improve the environment (EEA, 2003). This tool, according to Allesch and Brunner (2014), has been widely used as a method to evaluate waste management systems. There has been a trend toward the use of life cycle approaches to compare waste management strategies (Berkhout and Howes, 1997). LCA is intended to be a guide and requires the input of several other considerations derived from site-specific impact studies and economic, social, and political aspects in order to propose the "best" system. LCA should not be used in isolation to decide which waste management treatment option is preferred. (European Organization for Packaging and the Environment (EUROPEN), 1996; Finnveden and Ekvall, 1998). In brief, LCA broadly assesses the impact of waste
treatment on the environment.

MCDM (Multi-Criteria Decision Making) is a decision-making tool that facilitates choosing the best approach among several alternatives. This tool evaluates a problem by comparing and ranking different options (such as different waste management scenarios) and by evaluating their consequences according to the criteria established. The type of criteria chosen in these model types depends on the objectives of the model and, therefore, could include risk assessment or environmental impact assessment (Hermann et al., 2007; Hung et al., 2007; Karmperis et al., 2013). Commonly used MCDM software tools include the analytic hierarchy process, Elimination and Choice Translating Reality, multi-criteria method (ELECTRE), and Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) (Achillas et al., 2013). In the reviewed studies that were performed with MCDM, one-quarter were performed using ELECTRE (Allesch and Brunner 2014). Thus, MCDM ranks all the means of waste management (Collection, disposal, treatment) and its impacts on the society, environment, and economy.

Cost-Benefit Analysis (CBA) is a tool that enables decision-makers to assess the positive and negative effects of a set of scenarios. It is done by translating all impacts into standard measurement, usually monetary. The standard measurement means that environmental or social impacts must be estimated in monetary terms. The measurement can be done either by estimating the costs of evading a negative effect, such as the cost of pollution control on open dumping or by establishing how much individuals are prepared to pay for environmental improvement. After the analysis, the scenario with the most significant benefit, and the least cost is the preferred scenario (Morrissey et al., 2004). CBA can be used for specific decisions, e.g., evaluation of packaging recycling and reuse systems (RDC and PIRA, 2003). In brief, CBA assesses the effect
of different means of waste disposal on the environment, and the least cost less and most advantages is opted.

The analysis of the assessment methods LCA, MCDM, and CBA by Karmperis et al. (2013) and Morrissey et al. (2004) revealed the shortcomings of these methods. The main weaknesses of an LCA are the assumptions required by the researchers. The required number of assumptions within an LCA is large and leads to diverging results (Heijungs and Guinée, 2007). Moreover, a review regarding an LCA of sewage sludge by Yoshida et al. (2013) illustrates that the different assumptions made (e.g., energy and chemical consumption) vary significantly between the LCA studies. LCA’s are restricted to only environmental impacts which do not make it a suitable measure for a truly sustainable waste management model. The results of MCDM are challenging to interpret due to the choice of the criteria, and the weighting is highly subjective, and changing the weights could lead to a different result. Also, some of the multi-criteria techniques are very cumbersome. For CBA, there is uncertainty involved in estimating the monetary value of several environmental and social impacts in monetary terms. Further, the assumptions about prices may change during the lifetime of the waste program. Changes in price will change the desired outcome (e.g., changes in landfill costs may impact how much waste is recycled).

Srivastava et al. (2005) employed the use of SWOT (Strength, Weakness, Opportunities, Threats) analyses in the development of a strategic action plan of MSWM in Lucknow city, India. The analyses were based on an MSWM program in order to identify stakeholder involvement, which could overcome weaknesses and threats. A SWOT analysis can be undertaken for any idea, program, project, product, etc. (Johnson et al. 1989). It is a survey that aids in decision making and strategic management planning. SWOT analyses are conducted by
identifying possible threats, weaknesses, opportunities, and strengths of a program either from literature, survey, or by interview.

Furthermore, a systematic approach based on the outcome of the survey is taken to enhance the performance of the program. The systematic approach involves efforts to discover the ways of converting possible threats into opportunities and changing the weakness into strengths. A SWOT analysis includes economic, ecological (environmental), and social sustainability in analysis of external (opportunities and threats) and internal (strengths and weaknesses) factors of CPPAP for decision making. SWOT is not time-consuming and is useful and straightforward.

Standard waste management assessment tool described in academic literature are LCA, CBA, MCDM and SWOT. LCA, CBA, and MCDM tools assess the means of waste management (disposal, treatment, collection) and focus the assessment on the environmental and economic aspects of sustainability. These tool assessments often neglect social aspects, which are essential to ensure environmental sustainability. Examples of the social aspects are sustained laws, regulations, and community awareness and participation in managing waste. On the other hand, SWOT tool assesses social, environmental and economic aspects of sustainability. It is done by evaluating implementation programs, which are essential for effective sustainable waste management. Few studies have evaluated implementation programs and plans for SWM. For this study, SWOT analysis is used to discover the strengths and opportunities of Ghana’s Community Participation and Public Awareness Program that can be employed to overcome the programs’ threats and weakness for sustainable solid waste management.
CHAPTER 3

METHODOLOGY

This chapter describes the urban subdivisions within the Accra Metropolitan Area (AMA) in Ghana where field data was gathered for this study. The chapter also presents the methodology and processes used to evaluate the research questions. Figure 3.2 summarizes the methods and process of data collection, analysis and presentation.

3.1 Study Area

Accra, or Accra Metropolitan Area (AMA), is the regional capital for the Greater Accra Region and serves as the national capital of Ghana. It is in a coastal region bounded by the coast of Gulf of Guinea as shown in Figure 3.1 below. Accra has about 4 million inhabitants (World Population prospects, 2019), a population growth rate of 3.1% and covers a total land area of 225.67 km² (The World Factbook, 2013). The metropolitan area contains 29 Metropolitan, Municipal, and District Assemblies (MMDAs) which contain a total of 50 official neighborhoods, which are both planned and unplanned (Accra metropolitan 2019, Ghana districts 2019). These neighborhoods are legally referred to as subdivisions or “communities” in Ghana. For this thesis, the term “community” will be used to indicate these specific, legally and geographically defined neighborhoods. Three communities (Kanda, Asylum Down, and Nima) were identified for as study areas for this research (Figure 3.1). Kanda and Nima are communities within Ayawaso East MMDA and Asylum Down is within Korley Klottey MMDA.

Kanda is a residential area developed during the era of Dr. Kwame Nkrumah, Ghana’s first president, beginning in 1957. It has good road networks, potable water, and electricity (Meqasa, 2017). Asylum Down is a planned community that was developed in the colonial era, beginning in 1994, but due to population growth over the years, job-seeking migrants put
pressure on the community’s buildings and amenities resulting in their increasingly poor environmental conditions, such as defecation in the open, among other problems (Neighborhoods of Accra, 2018). Nima is an unplanned community and is characterized by poor road networks, inadequate drainage systems, and insufficient water services. Nima is noted for its rising population with abundant poor people, inadequate and poor social amenities and housing units (Owusu et al., 2008; the Database, 2019). Based on the description (population, amenities, and environmental condition) provided above, the study communities are classified as first (Kanda), second (Asylum Down), and third (Nima) class areas. Figure 3.1 shows the map of the study communities and the location in the country-Ghana.

Figure 3. 1: Map of Accra Metropolitan Area Showing Study subdivisions (Communities)

3.1 Research Design

The study made use of a mixed methods approach, employing both qualitative and quantitative methods in the research design. Mixed method according to Wisdom and Creswell (2013), gives a voice to study participants and ensured that the study findings are grounded in participants experience. Therefore, for this study,
data was collected using qualitative and quantitative methods that allowed for an elaboration on people’s views of community participation and awareness and aided in identifying and analyzing the solid waste management program. Thus, for this research, the researcher employed both structured and in-depth interviews to achieve the objectives of the study.

3.2 Sampling Design

Probability sampling was used for the study. This method is employed mostly by qualitative research (Davis and Lachlan, 2017). Purposive sampling (non-probability), was used to select the study areas. This enabled concentration on the study communities with specific characteristics, as discussed above. Thus, communities that are ranked first (high), second (middle), and third (low) class. Maximum variation sampling, a type of purposive sampling (Palinkas et al., 2015), was employed to identify study participants who are residents of the communities under study. Both male and female, aged and young, were interviewed to minimize skewed data according to age groups or gender. Convenience and volunteer sampling were used to recruit community members. Before the field survey, notices were sent to households in the study communities to determine the appropriate time to conduct the household interviews. Participants of the community interviews were male and female heads of households and household members who are 18 years and above.

Furthermore, three community officials and one official from the Ministry of Water and Sanitation were purposively selected. They were selected because these are Officials who work closely with the study communities. They are also much aware of the community involvement and the guidelines to achieve successful Community Participation and Public Awareness program for waste management in Ghana.
3.3 Data Collection Procedures

The data collection procedures included a literature review, participant observation, and interviews conducted in English with households and officials. Interviews with households were structured, semi structured and close ended. In addition, officials’ interviews were in-depth and open-ended. During the interview with households and officials, comprehensive notetaking, together with voice recording of the interviews, was made to facilitate efficient analysis.

Regarding the household interviews, twenty-seven households in each study community were interviewed, resulting in the total sample size of 81 households. The household sample size was determined based on the saturation of data collected from the field. The point of data saturation was when no new information was no longer observed (Faulkner et al., 2012). During data collection in each of the communities, responses from a fifth to tenth community member were repetitive of already collected data. However, to validate data saturation and to have a large sample size, twenty-seven community members were sampled in each community.

A total of four officials were also interviewed. Letters of intent were sent to the officials to schedule the interviews. Several follow-ups and office visits were made before dates were scheduled to hold the interviews. Each of the interviewed officials consented to the interview before it began. Table 3.1 gives a summary of the officials interviewed for the study. From Table 3.1, two officials were interviewed in Ayawaso East municipality because Kanda and Nima belong to this municipality.
Table 3. 1 Officials Interviewed

<table>
<thead>
<tr>
<th>Officials</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Korley klottey municipality- Asylum Down</td>
</tr>
<tr>
<td>2</td>
<td>Ayawaso East municipality (Nima &amp; Kanda)</td>
</tr>
<tr>
<td>3</td>
<td>Ayawaso East municipality (Nima &amp; Kanda)</td>
</tr>
<tr>
<td>4</td>
<td>Ministry of Water and Sanitation (Greater Accra Region)</td>
</tr>
</tbody>
</table>

Source: Authors Field Survey, 2019

3.4 Data Analysis and Presentation

Data analysis was conducted after all the data were collected. The analysis involved several steps, such as: listening to the audiotapes, studying the field notes and transcribing, reading and coding transcripts, grouping codes to identify overarching themes (Ritchie et al., 2013). For adequate data management and smooth transcription, the audio record tapes were listened to several times before transcribing. The transcribed notes and handwritten field notes were all cross-checked with the audio recorded tapes to ensure validity of gathered data. The thematic approach of analysis is based on inductive reasoning. Inductive reasoning was determined by original accounts and observations of the participants (Srivastava et al., 2009). This technique helped to analyze the data and develop a theoretical interpretation of what was attained through observation (Kolb 2012). It helped to derive themes through a posterior inductive reasoning approach (Agyemang-Duah et al., 2019).

Themes were compared with the responses to find common trends, similarities, and contrasts. All transcribed and coded data were proofread against the original audio recording to
obtain accurate and quality data for the study. Thus, transcribed and coded data were adequately verified. The study results are presented under the main research objectives and descriptive statistics are used in presenting data to reflect the mixed method approach. The key subjective views of the participants (Households-community members and officials) are presented in quotes, which depict a critical aspect of the study. Tables and graphs are also generated to show the quantitative aspects of community members' responses. An activity work sheet based on data gathered from interviews was developed to carry out the SWOT analysis (Table 3.2). The analysis includes the identification of the factors: strength, weakness, opportunities, and threats of Ghana’s Community Participation and Public Awareness Program (CPPAP).

Table 3.2: Activity worksheet for Strength, Weakness, Opportunity, & Threat (SWOT) analysis.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengths</td>
<td>• What characteristics of community members will enhance the CPPAP?</td>
</tr>
<tr>
<td></td>
<td>• What activities are community members taking?</td>
</tr>
<tr>
<td></td>
<td>• What measures are in place to encourage enforcement?</td>
</tr>
<tr>
<td>Weaknesses</td>
<td>• What could be improved?</td>
</tr>
<tr>
<td></td>
<td>• What is not done properly?</td>
</tr>
<tr>
<td></td>
<td>• What should be avoided?</td>
</tr>
<tr>
<td></td>
<td>• What needs to be strengthened?</td>
</tr>
<tr>
<td></td>
<td>• What hurdle prevents progress?</td>
</tr>
<tr>
<td>Opportunities</td>
<td>• What are the good chances facing CPPAP?</td>
</tr>
<tr>
<td></td>
<td>• What benefits may occur?</td>
</tr>
<tr>
<td>Threats</td>
<td>• What hurdles does the CPPAP face?</td>
</tr>
<tr>
<td></td>
<td>• Do the stakeholders show their interest and willingness for supporting the program?</td>
</tr>
</tbody>
</table>

Source: Adapted from Srivastava et al., 2005
Figure 3.2: Methodological Framework

Research design
- Mixed method (Qualitative and Quantitative)
- Structured and closes ended (Community members)
- Indepth and open-ended (Officials)

Sampling design
- Purposive sampling (study communities and officials)
- Convenience and volunteer (recruits community members)

Data collection
- Interviewed four officials & 81 randomly selected community members
- Field notes
- Audio tapes
- Participant observation

Data analysis
- Data transcribed, coded, and themes generated
- Inductive approach
- Activity worksheet developed for SWOT analysis

Data presentation
- Findings: quotes, figures and tables
- Descriptive statistics
- Discussion
- Conclusion and recommendations
CHAPTER 4
RESULTS

4.1 Introduction

This chapter highlights the data collected from a survey instrument employed to gather data from 81 community members from Kanda, Asylum Down, and Nima communities in the Greater Accra region of Ghana. It also documents the responses gathered from interviews with three community officials and an official from the Ministry of Water and Sanitation. After careful initial analysis, this research determined that there are no observed unique differences in the three study communities. Therefore, findings/results or responses from the three study communities are combined and reported together in graphs and tables, which illustrate responses from all community members. Combining data for all three areas allows a comprehensive, more productive, and complete analysis of the overall situation regarding SWM in the areas. The results are presented according to the research questions which serve as themes. Under each theme, findings from community members are first reported, followed by responses from study officials.

4.2 Demographic Characteristics of Community Members

Table 4.1 below summarizes the demographics and social characteristics of the respondents in the study communities. Most community members 43 (53.09%) are within the age group 18-34 and 24 (29.63%) are within the ages 35-5. The study sample shows that more from the study sample, revealed that there are more males 42 (51.85%) in the three study communities than females 39 (48.15%). The study also showed that 25 (30.86%) respondents had been to senior high school and 6 (7.41%) of them had gained a junior high school education. Both Asylum Down and Kanda recorded the highest number of educational levels attained;
tertiary 10 (37.04%). In contrast, Nima's highest recorded level of education is senior high school, 10 (37.04%). Furthermore, the study also revealed that 36 (44.44%) community members have lived in the study communities for 11 years and more, while 21 (25.13%) have lived there between 4-10 years.
Table 4.1: Demographic characteristics of community members

<table>
<thead>
<tr>
<th>Variable</th>
<th>Community</th>
<th>Asylum down</th>
<th>Kanda</th>
<th>Nima</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>Age</td>
<td>18-34</td>
<td>15</td>
<td>55.56</td>
<td>12</td>
<td>44.44</td>
</tr>
<tr>
<td></td>
<td>35-50</td>
<td>7</td>
<td>25.93</td>
<td>8</td>
<td>29.63</td>
</tr>
<tr>
<td></td>
<td>51-65</td>
<td>4</td>
<td>14.81</td>
<td>6</td>
<td>22.22</td>
</tr>
<tr>
<td></td>
<td>66 and above</td>
<td>1</td>
<td>3.70</td>
<td>1</td>
<td>3.70</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100.00</td>
<td></td>
<td>27</td>
<td>100.00</td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
<td>13</td>
<td>48.15</td>
<td>12</td>
<td>44.44</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>14</td>
<td>51.85</td>
<td>15</td>
<td>55.56</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100.00</td>
<td></td>
<td>27</td>
<td>100.00</td>
</tr>
<tr>
<td>Highest level of education</td>
<td>Basic School</td>
<td>1</td>
<td>3.70</td>
<td>1</td>
<td>3.70</td>
</tr>
<tr>
<td></td>
<td>JHS</td>
<td>8</td>
<td>29.63</td>
<td>5</td>
<td>18.52</td>
</tr>
<tr>
<td></td>
<td>No formal education</td>
<td>0</td>
<td>0.00</td>
<td>3</td>
<td>11.11</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>0</td>
<td>0.00</td>
<td>1</td>
<td>3.70</td>
</tr>
<tr>
<td></td>
<td>SHS</td>
<td>8</td>
<td>29.63</td>
<td>7</td>
<td>25.93</td>
</tr>
<tr>
<td>Variable</td>
<td>Asylum down</td>
<td>Kanda</td>
<td>Nima</td>
<td>Grand Total</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>-------</td>
<td>------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
</tr>
<tr>
<td>Tertiary</td>
<td>10</td>
<td>37.04</td>
<td>10</td>
<td>37.04</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100.00</td>
<td>27</td>
<td>100.00</td>
<td>27</td>
</tr>
<tr>
<td>1 - 3 years</td>
<td>6</td>
<td>22.22</td>
<td>7</td>
<td>25.93</td>
<td>2</td>
</tr>
<tr>
<td>Length of stay in</td>
<td>10</td>
<td>37.04</td>
<td>8</td>
<td>29.63</td>
<td>18</td>
</tr>
<tr>
<td>4 - 10 years</td>
<td>8</td>
<td>29.63</td>
<td>8</td>
<td>29.63</td>
<td>5</td>
</tr>
<tr>
<td>community</td>
<td>3</td>
<td>11.11</td>
<td>4</td>
<td>14.81</td>
<td>2</td>
</tr>
<tr>
<td>Grand Total</td>
<td>27</td>
<td>100.00</td>
<td>27</td>
<td>100.00</td>
<td>27</td>
</tr>
</tbody>
</table>

Source: Author’s Field Survey, 2019
4.3 Research Question One: What are the Implementation Plans at Different Levels of Government for Managing Solid Waste?

Community members were asked whether they have any knowledge of local (bylaws) and national laws or plans for waste management in Ghana. Most of the community members had little or no knowledge of bylaws for SWM in their communities and national laws/plans for SWM in Ghana. Sixty-eight (84.0%) respondents were reported to have no knowledge of bylaws, while 13 (16.01%) respondents have a fair knowledge of bylaws. Regarding national laws for SWM in Ghana, 66 (81.48%) and 15 (18.2%) community members were respectively recorded to have little to no knowledge of these laws. Figures 4.1 and 4.2 show community members’ responses to their knowledge of local and national laws/plans for SWM. Most community members who said they know of bylaws and national laws for SWM provided similar examples of these laws. Some community members’ examples of bylaws and national laws are; “provision of dust bins, proper waste disposal, and cleaning of surroundings.”

Study officials 1, 2 and 3 could not explicitly mention any of the local laws (bylaws) for SWM in the communities. The officials said that,

We are a new municipality, so we are operating on national laws-Assemblies come up with their bylaw. (Official 1)

I wouldn't quote the law, but we have prosecutors that quote the law and do that. ...when you have a drain in front of you, you oversee cleaning that drain to the middle of the road. It is a law. (Official 2)

This is a new municipality. What we must do is to adopt the bylaws of the AMA. Because we are new, we are yet to stand on our feet to enact our bylaws…. I know one law which mandates every municipal Assembly to hold a clean-up exercise on the first day Saturday of a month. We are still doing it, but it is not effective. (Official 3)

Furthermore, officials 2 and 3 had no idea of national laws. Officials 1 and 4 mentioned Ghana’s National Environmental Sanitation Policy and National Environmental
Sanitation Strategy and Action Plan as guides for waste management. The officials acknowledged that bylaws are to be made by municipal assemblies from the Sanitation policy. One official remarked that,

When you come to the national laws, we have the environmental sanitation policy and the national environmental sanitation strategy and action plan... We also have specific bylaws for the metro, municipal, and district assemblies. So, all the regulations or all the enforcements or activities they must do are captured in their various bylaws. (Official 4)

Officials 1 and 3 respectively stated that 30% and 70% of citizens/community members do not know about the laws. Official 4 also said that the community members may or may not know of bylaws depending on whether the bylaws are communicated to them by community/assembly representatives. When officials were asked whether the study community members know about the laws for waste management. They said:

Like for instance, some know it, but I can tell you those who know it are about 30%. (Official 1)

I do not think the 70% know because they litter anyhow. (Official 3)

The general Assembly approves the bylaws, and Assembly representatives from the communities are supposed to communicate the bylaws to the municipality. However, having knowledge of about the law is one thing, and not doing the right thing with respect to the knowledge is another thing. So, the fact that they know does not mean they will do it. (Official 4)
In addition to identifying local and national laws for SWM, community members were asked what they understand by solid waste management (SWM). Thirty-three (41%)
respondents, defined SWM as proper waste disposal (PWD). Nineteen (23%) defined SWM as proper waste disposal (PWD) and proper waste storage (PWS). Community members were also asked about the effects of poor waste management. Most of the respondents 62 (77%) mentioned health issues - Malaria, Typhoid, Fever, and Cholera as the effect of poor waste management. Eighteen (22.2%) respondents also mentioned land pollution- flood, choked gutters, the release of toxic substances into the soil as another effect of poor waste management. Figures 4.3 and 4.4 show the definition of SWM by community members and their perception of the effects of poor waste management.

![What do you understand by SWM?](image)

Figure 4.3: Community members’ definition of SWM
4.4 Research Question Two: What targets have been Achieved in the CPPAP?

Community members were interviewed to assess the community awareness and participation in the SWM Program. They were asked a series of questions to identify their participation toward SWM. Furthermore, all study officials were asked about the guidelines put in place to create awareness, improve and enforce active engagement of communities for SSWM.

4.4.1 Community Participation in Waste Management

Community interviews revealed that 46 (56.79%) community members separate their waste; 40 (48.15%) separate plastics, and 6 (7.41%) separate food waste. Table 4.2 shows community members responses to waste separation.
Table 4.2: Community members’ response to waste separation

<table>
<thead>
<tr>
<th>Responses</th>
<th>Asylum Down</th>
<th>Kanda</th>
<th>Nima</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequen %</td>
<td>Frequen %</td>
<td>Frequen %</td>
<td>Frequen %</td>
</tr>
<tr>
<td>No</td>
<td>15 55.56</td>
<td>9 33.33</td>
<td>11 40.74</td>
<td>35 43.21</td>
</tr>
<tr>
<td>Yes, food waste</td>
<td>1 3.70</td>
<td>2 7.41</td>
<td>3 11.11</td>
<td>6 7.41</td>
</tr>
<tr>
<td>Yes, plastics</td>
<td>11 40.74</td>
<td>16 59.26</td>
<td>13 48.15</td>
<td>40 49.38</td>
</tr>
<tr>
<td>Grand Total</td>
<td>27 100.00</td>
<td>27 100.00</td>
<td>27 100.00</td>
<td>81 100.00</td>
</tr>
</tbody>
</table>

Source: Author’s Field Survey 2019

Regarding waste storage, 44 (54%) Community members use closed waste bins for garbage storage. Nineteen (23.5%) Community members use plastic or paper bags while 14 (17.3%) Community members said that they store their garbage in a pile on the floor but covered (see Figure 4.5).

![Place of waste storage](image)

Figure 4.5: Community members’ places of waste storage

Most community members, 67 (82.7%) resort to house to house waste collection as their means of initial waste disposal. Other means of disposal are the use of communal containers and burning of waste. Figure 4.6 illustrates the means of waste disposal.
Twenty-six (32.10%) respondents stated that they clean their immediate environment every day, and 17 (20.99%) said they cleaned once a week. Other respondents clean monthly 16 (19.75%), some biweekly 13 (16.05%), while 9 (11.11%), did not engage in cleaning their immediate environments at all. Some respondents who said they do not clean their immediate environment had these remarks; “... but I see people cleaning it,” “..., Zoomlion does it,” “...an eatery nearby does it, especially the gutter.” Zoomlion is a private organization in Ghana that is into waste management and sanitation business. Table 4.3 shows Community members’ responses about the cleaning of their immediate environment.
Table 4.3: Community members’ responses to cleaning their immediate environment

<table>
<thead>
<tr>
<th>Responses</th>
<th>Asylum Down</th>
<th>Kanda</th>
<th>Nima</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>14.81</td>
<td>1</td>
<td>3.70</td>
</tr>
<tr>
<td>Yes, biweekly</td>
<td>7</td>
<td>25.93</td>
<td>6</td>
<td>22.22</td>
</tr>
<tr>
<td>Yes, everyday</td>
<td>11</td>
<td>40.74</td>
<td>3</td>
<td>11.11</td>
</tr>
<tr>
<td>Yes, monthly</td>
<td>1</td>
<td>3.70</td>
<td>11</td>
<td>40.74</td>
</tr>
<tr>
<td>Yes, weekly</td>
<td>4</td>
<td>14.81</td>
<td>6</td>
<td>22.22</td>
</tr>
<tr>
<td>Grand Total</td>
<td>27</td>
<td>100.00</td>
<td>27</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Author’s Field Survey 2019

Officials further confirmed community members participation in SWM. They said community members engage in proper waste storage, disposal, cleaning of immediate environments, and the use of house to house waste collection as their initial disposal. The Officials mentioned that, house to house waste collection is mostly operated by informal service providers referred to as “Aboboya.” Aboboya is a local name for tricycles used in waste collection and disposal in Ghana. Below are some responses of officials;

Community members clean their immediate surroundings and make their waste available to their service provider. General clean up in their communities. That is how they participate. (Official 1)

You see people cleaning their environment and … (Official 2)

They have their rubbish in their houses. Every morning, they identify the central containers. They go there and pay something small, and they dump it... (Official 3)

4.4.2 Enforcement of Guidelines to Successful Community Participation and Awareness for SWM.

The guidelines stated in Ghana’s NESP and NESSAP to achieve successful CPPAP and
improvement in SWM are; environmental education, organization of community clean up exercises, prosecution of offenders, and establishing sanitation courts in each municipality. These guidelines were evaluated based on its implementation in the study communities and its effectiveness to make CPPAP a success.

4.4.2.1 Communal Environmental Educational Campaign

One goal of the community awareness and participation in SWM programs is to enforce and encourage community participation through educational campaigns. When community members were asked whether there were existing educational campaigns on waste management, 64 (79.0%) respondents said "No," and 17 (21.0%) said, “Yes” (Figure 4.7). Some respondents who said environmental educational campaign is not organized further stated that they obtain environmental education instead from their churches and the media. In their words; “No, but I know as humans we should clean our environment. I heard that on radio”, "No, just adverts on television, but I think those things do not work.” Few other community members who said educational campaigns are organized also had these to say; “Yes, church…”, “Yes, but it was a long time ago.”

On the other hand, the study officials emphatically stated that environmental education and awareness creation is being done to encourage community participation.

We organize the community to talk to them about waste management …we try to reach them at their gatherings. (Official 2)

We are educating them. We cannot take one or two days to do that. Its awareness... The vans have been going around the market to market, telling them not to put litter on the ground…. (Official 3)

When you go to the municipalities, they have an environmental health and sanitation unit. The environmental health officers go to the assemblies to check on waste disposal practices. (Official 4)
4.4.2.2 Organized Community Clean-up Exercises

Community members were asked whether community clean-up exercises are organized in the study communities. They were asked who the organizers are, and whether community members partake in these exercises. Thirty-nine (48.15%) community members said "Yes" to the existence of community environmental clean-up exercises. They further stated that the organizers of these community exercises are individuals and government. Individuals include; churches, household heads, market women, community groups, youth and private companies like Zoomlion. The government organizers are politicians and Assembly leaders. However, a majority, 42 (51.85%) of community members said “No” when they were asked whether community clean-up exercises are organized in the study communities. Out of these, 4 (4.94%) explained that no community clean-up is held except for election years.

Nevertheless, 30 (37.0%) community members said they participate in clean-up exercises organized in the study communities. Fifty-one (63.0%) said they do not partake in community
environmental clean-ups. Table 4.4 and Figure 4.8 illustrate community members' responses to the existence of organized community clean-up exercise and their participation in such activities.

Table 4.4: Community members’ response on communal environmental clean-up exercises organization

<table>
<thead>
<tr>
<th>Responses</th>
<th>Asylum Down</th>
<th>Kanda</th>
<th>Nima</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>40.74</td>
<td>11</td>
<td>40.74</td>
</tr>
<tr>
<td>No, but politicians during an election year</td>
<td>3</td>
<td>11.11</td>
<td>1</td>
<td>3.70</td>
</tr>
<tr>
<td>Yes, individuals</td>
<td>7</td>
<td>25.93</td>
<td>8</td>
<td>29.63</td>
</tr>
<tr>
<td>Yes, national sanitation day</td>
<td>2</td>
<td>7.41</td>
<td>3</td>
<td>11.11</td>
</tr>
<tr>
<td>Yes, politicians during an election year</td>
<td>4</td>
<td>14.81</td>
<td>4</td>
<td>14.81</td>
</tr>
<tr>
<td>Grand Total</td>
<td>27</td>
<td>100.00</td>
<td>27</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Author’s Field Survey, 2019
Figure 4. 8: Community members’ response to participation in organized communal cleaning

On the contrary, officials 3 and 4 made it clear that non-governmental organizations (NGOs) are the main organizers of community clean-ups. They also said some private companies in the study communities do organize clean-ups seldomly. NGOs are a nonprofit organization that operates independently of any government, typically one whose purpose is to address a social or political issue. The NGOs mentioned are WASH Ghana, Clean Ghana Army, Clean Ghana Ambassador and Jamo Foundation. The private company is Zoomlion, it is into waste management as well as environmental sanitation business in Ghana and Africa as a whole. However, official 4 could not identify in which community these organizations are operating. Some of the views expressed by these officials are captured below.

We have WASH Ghana. They organize clean-up exercises in collaboration with Zoomlion. In our Community, they help us to desilt gutters, go into the market, and other public places to clean up. They do it for Kanda Nima and Mamobi. (Official 3)

We have the Clean Ghana Army, Clean Ghana Ambassador, and Jamo
But I don't know the ones that are operating in these communities. But we have a lot of them currently doing sensitization. Even clean up exercises in some of these communities, and I know Nima has a lot of these civil societies and NGOs working there. (Official 4)

4.4.2.3 Prosecution of Offenders and Availability of Sanitation Courts

Community members were asked whether they know of any penalty meted to people who fail to participate in organized community clean-up exercises. Seventy-three (90.1%) community members said "No," 3 (3.7%) said "Yes," and 5 (6%) said they had no idea. Some of the respondents who said there are no penalties meted expressed their view that participation of the organized clean-up exercise was voluntary. Some of the community members who said penalties are meted expressed their view that those who opened their shops during the National Sanitation Day have them locked up and some and some are arrested. Figure 4.9 shows community members’ responses on penalties meted to people who fail to participate in organized community clean-up exercise.

Most of the community members, that is 80 (99%) mentioned that they do not know of an existing sanitation court designed for waste management in their communities. Only one individual stated he knows there exists a sanitation court, but he could not tell its location. In his words, "Yes, but I have not seen one in this community." Figure 4.10 illustrates community members’ responses to existing sanitation courts for SWM in their Communities.

Contrarily, the officials said people who do not participate in community clean up exercises, specifically National Sanitation Day (NSD), are prosecuted. NSD is every first Saturday of the month set aside for citizens to clean their surroundings. This activity is supposed to be supervised and supported by the Assemblies. Study community official 1 intimated that people who open their shops or try to make sales during the cleaning hours have their shops closed for the whole day.
Shops that are opened during the hours of cleaning (morning to noon) are closed for that entire day. This is punishment for individuals who own shops and do not want to partake in the cleaning. (Official 1)

Also, the study officials explained that penalty is served to anyone who go against the laws on sanitation. The officials said there are sanitation courts in Accra, Ghana for prosecuting offenders but not in the study communities. The study officials said that,

People are served with a cost of abatement, and it is to be paid to the assembly. Money meant to go into the sanitation fund to support and subsidize services in communities. However, if they do not pay, they go to court…I witnessed a court case…50% of the money paid by the offender should be given to the assembly by the court, but they failed to… (Official 1)

We have laws that say that if you are improperly storing your waste, they will come and take you to court. (Official 2)

Sanitation courts are all over, but the municipal does not have one. It was however captured in their proposal to the general assembly last month (May). (Official 3)

Maybe you dispose refuse in an inappropriate place, or you are not registered with a service provider. Based on these laws, you are fined by the court. (Official 4)
Figure 4.9: Community members’ response to a meted penalty

Figure 4.10: Community members’ response to available sanitation courts
4.5 Research Question 3- Do Viewpoints of Policymakers’ Vary from Community Members’ with Regards to SWM?

Community members and officials were asked to share their views on SWM. Both parties focused on the responsibility for SWM. Forty (49.38%) community members were of the view that Assemblies should be responsible for SWM. Twenty-seven (33.33%) said individuals, while 14 (17.28%) said they have no idea about who should be responsible. Table 4.5 shows community members' responses on who should be responsible for solid waste management.

Similarly, study officials; 1, 2, and 3 mentioned that the government is responsible for waste management. Official 4, however mentioned that waste generators; people who make the waste, are responsible for managing their waste. In the words of the officials,

The government is responsible for waste management. The waste stream in urban areas is complex. The system should be made known to the community. (Official 1)

Waste, the moment you create waste, it belongs to the government. It is government property. Of course, along the way, we realized that the Ghana government alone could not manage waste for everybody. So, let us have by-laws that an assembly uses. We also came up with a polluter pay principle, so people pay for the waste they generate. (Official 2)

It comes to the municipal. We are in charge now. Every Assembly must make sure waste management is under control. The government has established the Assembly to work. Nobody can stop you…the government? You can't leave waste management to private hands, unless the government. They can't do it. (Official 3)

It's the generator. Because, like in our policy, we say polluter pay principle so whoever generates waste, you are responsible for your waste. You must take up the responsibility; you should have the bin to keep it safe, you should subscribe to somebody to take your waste and manage it on your behalf. We do not reduce, reuse, and recycle, so we always get a high volume of waste. We can reduce waste at the generation level. (Official 4)
Table 4.5: Community members’ responses on who should be responsible for SWM in communities

<table>
<thead>
<tr>
<th>Responses</th>
<th>Asylum Down</th>
<th>Kanda</th>
<th>Nima</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>Individuals</td>
<td>11</td>
<td>40.74</td>
<td>9</td>
<td>33.33</td>
</tr>
<tr>
<td>Municipal</td>
<td>11</td>
<td>40.74</td>
<td>14</td>
<td>51.85</td>
</tr>
<tr>
<td>Assembly</td>
<td>No idea</td>
<td>5</td>
<td>18.52</td>
<td>14.81</td>
</tr>
<tr>
<td>Grand Total</td>
<td>27</td>
<td>100.00</td>
<td>27</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Source:* Author’s Field Survey, 2019

4.6 Conclusion

The findings revealed that most of the community members have little or no knowledge of laws or implementation plans at different levels of government for managing solid waste in Ghana. Furthermore, most of the study officials did not show expert knowledge of national and local laws for waste management in Ghana. Only two officials had knowledge and could state Ghana’s national sanitation laws. Community members are knowledgeable about the effects of poor waste management. They are as well taking initiatives, such as proper storing and disposing of waste, cleaning of their immediate environment, and much more. The guidelines for CPPAP to improve SWM have not been practical, as seen from the inconsistency in responses provided by study community members and the study officials. Most of the study community members and the study officials are of the view that local and national governments should be exclusively responsible for waste management in Ghana.
CHAPTER 5

ASSESSMENT: STRENGTH, WEAKNESS, OPPORTUNITY, & THREAT

(SWOT) ANALYSIS

5.1 Introduction

The purpose of this study is to assess Ghana’s Community Participation and Public Awareness Program (CPPAP) for Solid Waste Management (SWM). Specifically, the survey identified implementation plans for managing solid waste, targets achieved in the CPPAP, and policymakers’ and Community members’ viewpoints about SWM. Field findings show that there is a lack of expert knowledge of SWM at the local and national level. Based on participant observation and available literature, variability in the building structure, planning, and environmental state exits in the study communities. These variabilities depict differences in social class regarding wealth, which influence people’s choice of housing location and their willingness and availability to partake in community activities. Irrespective of the variations observed, it is surprising to identify that community members are actively involved in SWM. There is however inconsistency in responses provided by community members and study officials about the guidelines (see Table 2.1) to CPPAP. This inconsistency in responses tells that the guidelines have not been effective.

Moreover, all survey participants are of the view that stakeholders including governments and individuals, should be responsible for managing waste in Ghana. In reference to the findings, an activity worksheet for SWOT analysis was employed in assessing CPPAP. SWOT analysis was conducted by identifying possible strengths, weaknesses, opportunities, and threats of the program from literature and interview. The summary of findings illustrates that CPPAP has strengths and opportunities that can be utilized in overcoming its threats and weaknesses. For
instance, integrating informal SWM service providers into the SWM formal system in Ghana would reduce financial investment in private organizations to manage waste. Also, educating the public about other means of waste management, preferably waste reduction and recycling, would yield more Sustainable Solid Waste Management (SSWM) in the long run.

Analysis of collected data indicates the key themes and SWOT of CPPAP (Table 5.1). Under each key theme, SWOT findings listed in Table 5.1. are discussed. The identified and listed strengths and opportunities are factors that can be utilized to overcome the weakness and threats of CPPAP. If these factors are actively taken into consideration, CPPAP would be a success, and that would further trickle down to improve waste management and SSWM in Ghana. Table 5.1 illustrates SWOT findings that are responses to the activity worksheet for the SWOT analysis listed in Table 3.2.
Table 5.1: Key Strength, Weakness, Opportunity, & Threat (SWOT) of the Solid Waste Community Participation and Public Awareness Program (CPPAP)

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Community mobilization for SSWM ✓ Community clean-ups organized by individuals ✓ Deliberate actions for proper waste storage and disposal • Acknowledgment of who should be responsible for SWM (Local government and waste generator).</td>
<td>• No knowledge of implementations plans at different levels of government ✓ Community members ✓ Officials • Untrained and unskilled community officials • Lack of resources • The focus of SWM education only on storage and disposal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Job for the youth ✓ Informal service providers- Aboboya (House to house waste collection) ✓ Waste pickers • Reduce financial investment in waste management • Serene environment- revenue generation from tourist sites • Improved community health • Establishing sanitation courts in municipalities where study communities are located • Prosecution of offenders</td>
<td>• Indiscriminate dumping ✓ The high cost of Aboboya service • Incoherence between Community and leaders • Community lackadaisical attitude ✓ Not participating in clean-up exercises ✓ Junkers • Political interference</td>
</tr>
</tbody>
</table>

5.2 Research Question One: Local and National Implementation Plans for SWM

Ghana has two national sanitation laws that govern SWM. These laws were identified by two surveyed Officials, just as stated in MLGRD (2010). They are the National Environmental Sanitation Policy (NESP) and National Environmental Sanitation Strategy and Action Plan.
NESSAP). These policy and action plans constitute and guide all forms of waste management in Ghana. Within the NESSAP are other implementation plans, which are programs to enhance sanitation issues in Ghana. Among these programs is the Community Participation and Public awareness Program (CPPAP) which is assessed in this study. It is mandatory for every municipal assembly to enact local laws (bylaws) for waste management. The bylaws are formed based on the NESP and NESSAP. These laws are then communicated to municipalities for adherence.

Community members need to be aware of implementation plans at different levels of government to be actively engaged in SWM. Most importantly, they need to know the immediate local laws or plans for waste management in their communities, which is directed towards a common goal, SSWM in Ghana. According to this study, most community members have no idea of implementation plans for waste management at different levels of government. The few community members who claimed that they know of bylaws and national laws or plans for SWM provided some examples of these laws (refer to section 4.3 and Figures 4.1 and 4.2). The examples given show basic knowledge of what they think should be the right means of waste management. It is good to identify that community members understand how to handle waste because their expertise will contribute to their participation. However, respondents lack of knowledge of the laws that will guide and ensure participation to SWM will only weaken study respondents’ commitment and might delay Ghana's attempt to cause a significant improvement in waste management. Community members' ignorance also reveals government failure of the guideline, “communicating policies” (Figure 1.1) to the public and could constitute the reason why waste is still a challenge in Ghana.

Furthermore, not only has the government failed to communicate policies to the general public but lacks trained personnel at the local government and has also failed in planning and
organization, which constitute a weakness of CPPAP (Table 5.1). The community officials are representatives of the municipal assemblies, and they are to communicate policies and bylaws to community members after they are formulated. However, only two study officials acknowledged that there is no specific national law for SWM in Ghana and mentioned the two national sanitation laws that encapsulate waste management (see section 4.3). More so, the community officials could not explicitly mention bylaws for SWM in the study communities. Their reason for the inability to provide examples of bylaws is that the communities are now part of new municipal assemblies, thus are yet to come up with bylaws for SWM. The reason given probably account for the inability of community officials to communicate bylaws to the municipalities and enforce the implementation of guidelines to CPPAP. Moreover, not instilling bylaws only shows the government has failed concerning planning and organization which could cause a delay in the improvements of SWM in the study communities and Ghana. Some of the views expressed by community officials 1 and 3 are captured below.

We are a newly created municipality carved out of Accra Metropolitan Assembly, so we are yet to make bylaws.” (Official 1)

We became municipal assemblies in August 2018. (Official 3)

Laws are a primary institutional driver for waste management (Agamuthu et al., 2009). This survey however shows that the study officials and community members lack expert knowledge of local and national laws that is needed to guide and drive SWM in Ghana. Their lack of knowledge would slow down progress in Ghana’s effort in dealing with SWM and its challenges. Therefore, until these laws are acknowledged, communicated, and effectively enacted, improving waste management will remain a puzzle in Ghana. The government of Ghana needs to maintain skilled and well-trained personnel at the local government. The personnel need to have knowledge of SWM policies and plans at different levels of government and should be
able to effectively administer the solid waste management system. If possible, qualified individuals like scientists and engineers should be employed by the Ghana government. These individuals, according to the Kansas State Solid Waste Management Plan (2010), are essential in waste management. Further,

5.2.1 Comprehension of Solid Waste Management

Undeniably, interviewed community members' understanding of SWM is a strength identified in the SWOT analysis (Table 5.1) for a successful CPPAP. Most community members interviewed understood SWM and explained it in diverse ways but with a similar perspective and dimension. SWM was understood as the practice of keeping, storing, and disposing of solid wastes as well as recycling the waste. However, most of their definition of SWM were skewed towards proper waste disposal (PWD) (Figure 4.3). Defining SWM as PWD could be because environmental education given to the general public in Ghana is focused on appropriate waste disposal due to indiscriminate dumping in Accra-Ghana, as discussed in section 2.2.3. All the same, community members have some understanding of what SWM involves and their knowledge would influence their efforts towards sustainable SWM.

Furthermore, most respondents surveyed are aware of the human health and environmental impacts of improper waste management (Figure 4.4). Community members' consciousness of their health and the environmental impact of poor SWM, is essential and an opportunity (Table 5.1) to achieve CPPAP. Some effects of improper waste management are harmful to sea and plant life, pollution of water bodies, and the air. These impacts communicate that human and environmental health is the main objective of waste (Brunner and Fellner, 2007). Community members’ mindfulness of the human health and environmental impact of waste is good to sensitize and make them committed to waste management activities. More so, their
engagement in SWM can be heightened by promoting pro-environmental behavior in the community members. Pro-environmental behavior is an action that a person consciously chooses to take to minimize their negative impact on the environment (Bain et al., 2012). Therefore, pro-environmental behavior can be achieved by educating community members on the outcomes of proper waste management on the environments and health of their loved ones. Pro-environmental practice in this study communities would develop a better society and encourage full participation in waste management.

5.3 Research Question Two: Goals Achieved in CPPAP

This section focuses on study community members actions towards waste management and study officials’ roles in ensuring community engagement in waste management. That is the enforcement of the guidelines of CPPAP: organization of community educational campaigns, organization of community clean-up exercises, prosecution of offenders, and establishment of sanitation courts.

Community members’ participation in waste management according to findings have improved. Community members engage in proper waste storage, disposal, informal recycling, and cleaning of their immediate environment. These actions exhibited by community members are needed in managing waste sustainably. Community members are deliberately demonstrating these actions; hence their efforts are valued as strengths (Table 5.1) of CPPAP that can cause an improvement in waste management in Ghana. Therefore, the government needs to provide support for sustained practices. The guidelines (Figure 1.1) for successful CPPAP have not been practical based on responses given by community members and the study officials. The inconsistencies in responses provided and the lack of resources have made it challenging to enact CPPAP guidelines for SSWM effectively.
5.3.1 Community Participation in Waste Management

Most community members' and officials' responses on community participation in waste management are aligned (refer to section 4.4.1). Community participation in SWM is demonstrated in the study areas because the majority, 46 (56.79) of Community members use closed bin in storing waste. Sixty-seven (82.72%) of community members use house to house waste collection as their initial disposal, and a total of 72 (88.89%) community members cleaned their immediate environment. These measures, according to study community officials surveyed, is an improvement in community participation that has been realized. Below are the expressed views of study Officials 2 and 3;

There is an improvement in waste storage within communities. (Official 2)

Community members are doing better than before with waste storage disposal even though some of them still give their waste to Junkers. (Official 3)

Community members, as shown by the survey, are undoubtedly participating in waste management. Officials further confirmed their contributions, and this reveal Community members enthusiasm and indicates that the goal of CPPAP, community participation for SWM, is being realized. The achievement of this goal represents the strength of CPPAP because, as discussed in section 2.4.1, community participation is needed to improve waste management and its challenges. The Achievement of this goal represents the strength of CPPAP because, as discussed in section 2.4.1, community participation is needed to improve waste management and its challenge. Enhanced Community participation, as seen in the study, will improve SWM in Ghana, the environment, and human health. Improvement in the environment and human health would further directly and indirectly create more revenue for the government (Table 5.1). Community members continuous participation could also lessen the government of Ghana's financial investment in private institutions to manage waste (Table 5.1). According to a study
by Yeboah-Assiamah et al. (2017), community involvement in SWM reduces government’s financial investment in institutions for waste management programs. So, for this study, funds that would be invested in institutions to manage waste in Ghana could be used to finance other developmental projects in the local neighborhoods. The funds could also be channeled to ensure sustained community involvement in waste management by providing necessary support and resources to the study communities and other communities in Ghana. Government realization of these opportunities (Table 5.1) would help overcome the weakness and threats of CPPAP and trigger calculated means to achieve improvement in SWM.

Some community members are explicitly engaged in the separation of plastic, but officials surveyed did not identify this as an action taken by community members to manage waste because it is an activity that is not regarded as nonexistent in most developing countries (Oteng-Ababio et al., 2013). Separation of waste should be the first step in SWM once trash has been generated because it helps reduce the amount and type of waste that ends up at the landfill (Al-Khatib et al., 2010). It also makes it easy to identify which waste can be recycled, rediscovered, composted, or be disposed. In this study, informal waste separation is practiced by 46 (56.79%) community members (Table 4.2). Findings revealed that community members sell their plastic waste to earn a living, others give it to market women, and others separate food waste to feed their animals. This measure taken by study community members illustrates their zeal in engaging in recycling should it be prioritized in Ghana. During data collection for this study, I observed people of both sexes picking up plastics and other recyclables disposed of indiscriminately on the ground outdoors. These individuals are referred to as waste pickers by Oteng-Ababio et al. (2013). Waste pickers and community members practice informal waste (plastic) separation/recycling, but their action is not regarded as a means of waste management in
Ghana. According to Gupta et al., (1998), in the absence of waste segregation, recycling is an informal sector activity. Therefore, if the actions of waste pickers and community members in this study are recognized and integrated into the waste management system in Ghana, recycling will become a formal sector activity. This will advance SWM in Ghana and generate revenue from resource recovery.

In this study, the means of waste collection and initial disposal (house to house collection) are consistent with findings in Ramachandra and Bachamanda's (2007) and Oteng-Ababio et., al (2013) studies. As discussed in (section 2.2.2), the means of waste collection service is undeniably dependent on geographical location. However, from this study, the means of waste collection is not only dependent on geographic location but also reliable service. The survey revealed that most households receive services from informal service providers referred to as Aboboya. (Aboboya is a locally branded name for tricycles that are used in collection and waste disposal in Ghana). Figure 5.1 illustrate the local transport for solid waste disposal. The informal service providers, according to study officials 3 and 4, are to be registered with municipal assemblies to be able to operate in communities that belong in the municipalities. However, I observed and questioned four (4) of these informal service providers during my field survey. They all have not been registered in any of the study communities or municipalities but have been operating. According to them, they are in business because people who are registered with formal service providers have their bins overflowing due to delays in picking of waste. The Aboboya operators said the delay in picking waste also applies to people who use government-provided communal containers. This finding supports the MLGRD report (2010) that communal sanitary sites with communal containers are not emptied frequently in Ghana. Aboboya provides services to households located in remote areas or locations that are not accessible. In the
words of study Officials 2 and 4,

Because of the planning nature of the communities, accessibility is challenging. So, Communities like Nima depend on central container system and informal service providers-Aboboya for the house to house waste collection and initial disposal. (Official 2)

Choked area where trash cars can’t access, these small tricycles go there. People pay for their services... they send the waste to a transfer station, where a bigger truck will move it to the final disposal. (Official 4)

However, due to the unreliable service provided by formal private operators, even planned communities with functional road networks like Kanda and Asylum Down still require the service of Aboboya operators. The informal service providers, as stated by two Officials, have been of help in keeping the study community clean and are known to also engage in waste separation. In their words;

So now apart from the central container, that the municipal is providing, there are private people involving in the lifting of rubbish, helping to keep the Community clean. (Official 3)

…. they do more of recycling. They usually do not dump all the waste. They take the plastics out, metals... so, kind of resource recovery and the rest, like organic waste, they send it to the disposal site. (Official 4)

The survey findings indicate that informal service providers, like the waste pickers need to be integrated into the waste management system in Ghana to improve the pace of achieving SSWM. Their integration is an opportunity that will benefit the general public and Ghana. Assimilating the Aboboya service providers will result in job creation for the youth and other benefits (Table 5.1).

Community involvement underlies the primary purpose of CPPAP. Therefore, realizing the efforts of community members gives hope and communicates that CPPAP can result in the improvement of SWM in Ghana. Advancement in SWM is guaranteed should the opportunities and strengths (Table 5.1) mentioned and discussed above be
sternly taken into consideration.

![Figure 5.1: Local transport for solid waste disposal (Aboboyaa)](image)

5.3.2 Enforcement of Guidelines to Successful Community Participation and Awareness for SWM

To adequately assess the CPPAP, study community members and study officials were questioned. These individuals were interviewed to identify whether the guidelines to attain successful CPPAP have been effective in its implementation. The guidelines are organized communal educational campaigns, community clean-up exercises, prosecuting offenders, and the establishment of sanitation courts.

5.3.2.1 Communal Environmental Educational Campaign

As seen in Figure 1.1, education on the need for proper waste management is one means of environmental education put in place to impact the public with knowledge on proper SWM. Nevertheless, as stated in the results, 64 (79.09%) community members said “No” when they were asked whether communal environmental education is being organized. Few study community members acknowledge that they hear and see from radio and TV commercials about
the need for proper waste management and how to handle their waste (Figure 4.7).

In contrast, study officials mentioned communal environmental education and awareness as activities carried out to induce community participation in SWM (refer to section 4.4.2.1). There is inconsistency in the responses provided by study community members and study Officials. Sixty-four (79.09%) community members responded that communal environmental education is not organized. Seventeen (21.0%) said that it had been organized but has been done for a long time (see section 4.4.2.1). Most of the community members have lived in the study communities over a decade; therefore, it means that environmental education has not been active or not done consistently. The inactiveness or inconsistency of communal environmental education could be attributed to a lack of resources, a weakness of CPPAP (Table 5.1). This weakness was confirmed by study Officials 2 and 3. They said that:

…. but it’s not being done and done well because the resources are just not there for us to do that… we try to reach them in their gatherings. (Official 2)

What I have also realized is that we need to do more. ... Mobility for officers to be able to get to the communities is not available. (Official 3)

The survey communicates that communal environmental education has not been active. Also, from the responses provided by the study Officials, environmental education, and awareness are focused on waste storage and disposal (see section 4.4.2.1). The focus on waste storage and disposal show that other means of waste management such as waste reduction, recycling, or diversion of waste are not prioritized in Ghana. This finding indicates that communal environmental education and awareness provide limited information on all forms of waste management. Therefore, there is a need for expanding on the depth of knowledge on waste management to community members. Developing and providing education on other means of SWM, starting from waste reduction, would be an opportunity for more awareness and
community engagement regarding their consumption habit. According to Tal (2004), people with knowledge and skills in environmental education are motivated to take part in environmental protection activities and plans. Therefore, this study community members might generate ideas for managing waste sustainably in their communities and receive enough tutoring from community officials.

5.3.2.2 Organized Community Clean-Up Exercise

There are no efficient community clean-up exercises organized or supervised by the study officials and government in Ghana. The Ghanaian government-initiated National Sanitation Day (NSD) in 2014 through the Ministry of Local Government and Rural Development. It is a day set aside for public clean-ups, that is, the first Saturday of every month (Basiru et al., 2019). NSD, which is a government initiative to promote community clean-up exercises, is not active (Table 4.4). This was confirmed by study official 3, who further explained that NSD created an erroneous impression. That is, the responsibility towards social and environmental cleanliness in local communities can be deferred to a later date. In the words of study Official 3, “…. Every municipality must hold a clean-up. We are still doing it, but it is not enough. I do not see why we should wait a month before doing general cleaning…… the same volume of rubbish every month it is not useful. “

The only government organized clean-up exercise has failed. Nonetheless, individuals, as identified by community members, are key organizers of community clean-up exercises (Table 4.4). These individuals include churches, household heads, market women, community groups, youths, and Zoomlion. Zoomlion is a private company, explicitly engaged in community clean-up with locals in Ghana and Africa at large. Contrarily, study officials mentioned that community clean-up exercises are organized in the communities by non-governmental
organizations (NGOs) and private companies (see section 4.4.2.2). These responses show that study officials do not hold or supervise clean-ups, and it explains why NSD has failed. It also explains why individuals are taking initiatives in organizing clean-ups. All the same, it is encouraging to know that individuals are playing key roles, and the tasks are undoubtedly a strength of the CPPAP (Table 5.1). Community clean-up is one of the guidelines to CPPAP that needs to be enforced by the government through officials. However, individuals are the organizers, and this conveys that when officials organize efficient clean-ups or supervise community members, the study communities would always be clean. Also, community members would tend to police each other to ensure cleanliness.

Furthermore, sanitation in Ghana seems to be politicized. When study community members were asked whether communal clean-up exercises are organized, the majority said "No," and others said "Yes." Further, both those who said "No" and "Yes" mentioned that politicians organize clean-ups but only during election years (Table 4.4). The community members clarified that this is purposely done to gain the vote of people. The study also revealed that some community members do not participate in community clean-up exercises (Table 4.4). Lack of participation could be attributed to the fact that individuals organize community clean-up exercises, so Community members do not see the urgency to participate. An official, bitterly stated that people who belong to political opposition parties ignore taking part in clean-ups. These people also give their waste to Junkers, who dispose of them indiscriminately. This, the official explained, is a political challenge to get study communities involved in organized communal cleaning. In his words,

... Because the person knows his party is not in power, they will not engage in communal cleaning and still give their waste to Junkers. They know very well that giving waste to the Junker, he will throw it away anywhere. However, they still do it because they also do not want to pay the right amount for
their waste to be disposed of properly. Also, when the environment is filthy, the government in power will be blamed, so they throw waste around and into drains when it is raining. People do a whole lot of things because of political polarization. (Official 2)

Identifying the political challenge, which is also a threat to CPPAP (Table 5.1), gives room to take calculated measures to combat the play of politics among government and citizens-community members. SWM, sanitation issues and, clean-ups are a national concern and should not be made political. Illnesses as a result of unclean surroundings do not know or care about political affiliation. Therefore, political leaders must demonstrate genuine devotion in leading or organizing community clean-ups all the time. In so doing, there would be a trickle-down effect on the youth and the community members to involve themselves in waste management activities.

5.3.2.3 Prosecution of Offenders and the Availability of Sanitation Courts.

Most community members, 73 (90.12%), said there are no penalties meted to people who do not partake in organized communal cleaning (Figure 4.9). Community members failure in participation is not surprising because individuals are key organizers of community clean-up exercises (Table 4.4). Therefore, there are no established punishments for those who do not participate in clean-ups, making participation voluntary. Moreover, voluntary participation would only make certain community members ride on the back of others and never partake in clean-up. So, the organization of community clean-ups by individuals could be supported by the government to guarantee participation by all and sundry.

A few community members, 3 (3.70%), remarked that people who do not partake in organized communal cleaning are arrested and get their shops closed (Figure 4.9). These penalties are meted only to people who fail to participate in NSD, because that is the only government-initiated clean-up exercise that, without a doubt, would come with a penalty. Besides, the study officials stated that prosecution is offered for all sanitation-related
misdemeanors, such as inappropriately disposing waste, and not taking part in NSD. Only a few community members knew that people who do not partake in NSD are prosecuted. This could deter community members' participation in governmental organized communal clean-ups and could be a reason why NSD has outlived its practicality.

Prosecuting offenders, an enforcement guideline (Figure 1.1), is an opportunity of CPPAP (Table 5.1). This is because it would undeniably urge community members to uphold their duties and activities in managing waste, and offenders would serve as deterrence to others. Moreover, most community members do not know of penalties meted to prosecutors which proves failure of the prosecution guideline.

Furthermore, most, 80 (99%) study community members are unaware of sanitation courts in their community. Only one individual said “Yes” when he was asked whether he knew of any sanitation courts in his community. This individual, however, mentioned a magistrate court in Ghana. The study officials also said that there are sanitation courts in Ghana but not in the municipalities where the study communities belong. This finding reveals that the enforcement guideline, establishment of sanitation court in each municipality to regulate issues of sanitation, and community members' behavior has failed.

In the words of the study officials,

People are served with a cost of abatement...... However, if they do not pay, they go to court… (Official 1)

...If you are improperly storing your waste, they will come and take you to court. (Official 2)

…Either you litter, you throw rubbish or toilet at places you are not supposed to throw it, they can arrest you… courts are all over. Municipal does not have one, but it is in their proposal to the general assembly last month (May). (Official 3)

When you offend or are caught with any nuisance, you are served notice. If you do not abate, they will serve you prosecution, to take you to court against any fine
that is in the by law. Maybe you throw refuse, or you are not registered with a service provider. Based on these laws, you are charged at the court. (Official 4)

The existence of sanitation courts in Accra-Ghana is essential in dealing with sanitation issues, but community members are not aware of these sanitation courts in Accra, Ghana. Even though there are no sanitation courts for the study communities yet, community members need to be aware of the available ones in Accra, Ghana. Establishing of sanitation courts is an excellent opportunity (Table 5.1) in advancing SSWM in Ghana. Therefore, instituting sanitation courts for the study communities would improve community members' responsibilities. More so, sanitation fees will be channeled appropriately to support waste management services in the communities. One official lamented,

…Sanitation fees are to be paid to the assembly; money meant to go into the sanitation fund to support and subsidize services in communities…. I witnessed a court case…50% of the money paid by the offender should be given to the assembly by the judiciary. However, they failed to…giving difficulty in assembly to collect waste. (Official 1)

5.4 Research Question Three: Viewpoints of Policymakers’ and Community Members’ with Regards to SWM

Forty (49.38%) community members stated that local government- municipal assembly should be responsible for managing waste (see Table 4.5). Twenty-seven (33.33%) community members (Table 4.5) are of the view that individuals or waste generators should be responsible for the waste they create. The reason behind their responses could be because the government mobilizes and collect tax from every Ghanaian. However, these findings imply that community members look up to the local government- study officials to provide guidance and avenues to manage waste sustainably. As a result, study officials need to implement the guidelines for CPPAP (Table 2.1) effectively. The practical implementation would encourage all stakeholders; Community members, government, and private individuals to cooperatively manage waste in
Ghana.

Further, waste management, as acknowledged by study officials, is the sole responsibility of the government. One official stated that waste generators (people or individuals) are exclusively responsible for the waste they create. Moreover, the government is only responsible for its final disposal. Both study communities and officials are of the view that government and waste generators have a role to play in SWM in Ghana. It is essential and considered a strength (Table 5.1) because, according to Okot-Okumu (2012), local authorities are responsible for waste management in most developing countries. Nevertheless, as seen in this study, they are mostly either technically or administratively not capable of dealing with SWM challenges. Therefore, to achieve SSWM, collective efforts and cooperation of individuals—public or private and every citizen is needed.
CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

This study aids in filling a gap within SWM, policies, and guidelines for CPPAP to improve SWM in Ghana. While this was a comprehensive research study, several limitations are noted.

6.1 Limitations

Limitations are common in most research, and this study is no exception. Over the course of this project, it became obvious that the research questions were too broad to fully assess the CPPAP for SWM in Ghana. However, this limitation was mediated using study findings to develop an activity worksheet for SWOT analysis and the worksheet helped to evaluate the CPPAP. In addition, the study’s sample did not represent the population in Accra, Ghana because the study’s female to male ratio (48.15:51.85) does not represent the population’s female to male ratio (51.2:48.8). All the same, the findings illustrated general community participation in SWM in the communities. Future studies could focus on the role of gender in making CPPAP a success.

6.2 Key Points

The first research objective was to identify implementation plans at different levels of government. It was discovered that study community members and officials do not have expert knowledge of implementation plans at varying levels of government for managing waste in Ghana. There is, therefore, the need to advance the depth of information and education given to the public. Environmental education and awareness should be integrated into the school curriculum in Ghana, starting from primary school. Integrating environmental education into the school curriculum would serve as early awareness and be assimilated into people's way of living
rather than perceived as a separate educational concern. Officials should be trained to gain the necessary skills and capacity to communicate and engage the public appropriately.

The second research objective was to identify targets of the Community Participation and Public Awareness Plan for SWM in Ghana. That is the achievement of community involvement and the efficiency of the guidelines for achieving CPPAP. The study revealed that households are actively engaged in waste management. Thus, they practice proper waste storage, disposal, and informal recycling. They as well play a key role in organizing community clean-up exercises. These are strengths of CPPAP, as shown in Table 5.1, that need to be capitalized on to overcome threats and weaknesses like politicization of SWM and lack of resources. Community participation is an essential driver for solid waste management. Hence, the government's environmental education and awareness creation should go beyond waste disposal and storage to include waste reduction, waste separation, diversion, recycling, and treatment, among others. Waste disposal and storage are measures for only dealing with the already generated waste. It is recommended that emphasis should be placed on waste reduction because it would undoubtedly reduce pressure on other waste management systems.

Waste separation should also be championed and enacted in every study community; this initiates the process of waste diversion and other means of waste management. Besides, waste pickers, informal service providers- Aboboya, and households who engage in informal recycling, can be formally recognized and integrated into the formal waste management system. Their integration would result in an improvement in SWM and provide opportunities such as, provide employment for the youth, reduction in government investment in private companies to manage waste (Table 5.1), and restructuring of waste management to yield profits. Financial resources obtained from recycling could also be reinvested in other waste management systems. According
to Agamuthu et al., (2009) and Gopal et al., (2018), financial stability is an economic driver for SSSWM. It is needed to support private organizations like Zoomlion and other community groups that organize community clean-up exercises in this study. Community groups need to be supported and managed to be able to continue their excellent work to promote SWM.

The guidelines for a successful implementation of CPPAP are community environmental educational campaigns, organized community clean-ups exercises, prosecution of offenders, and establishment of sanitation courts. There was inconsistency in the responses provided by study community members and officials regarding the guidelines. The variance in response tells that it has loopholes in its implementation. The difference in responses also shows there exists a gap between public practice and policy design. Therefore, there is a need for clearer partnership between communities and government. Also, government need to provide consistent support in terms of resources like dustbins, good transportation system among others to community members to make community effort towards SWM sustained. The identified strengths, and opportunities of CPPAP (Table 5.1) should be an inspiration to effectively make the guidelines workable to eliminate the weaknesses and threats of CPPAP for success in improving SWM in Ghana. Other implementation programs for SWM should be evaluated by government because the assessment of the programs will help to restructure the programs and aid to eliminate threats, weaknesses, and identify strengths and opportunities that can be enhanced to make SWM programs a success.

Finally, the third and last research objective was to identify the viewpoints of community members and policymakers' on SWM. Both study community members and officials are of the view that SWM is the responsibility of the government. They both, however, consider the collective efforts of all stakeholders to make SWM a success and sustainable. Community
members are the largest stakeholder in SWM; their sense of responsibility to SWM communicates that there is a need for collaboration between all stakeholders to implement SWM policy and programs to efficiently enhance sustainable waste management in Ghana.
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APPENDIX A

COMMUNITY MEMBERS RECRUITMENT LETTER

Hello,

My name is Pearl Sika Deku and I am a Graduate student at Southern Illinois University in the United States. I am conducting a research that seeks to assess sustainable solid waste management in Ghana. Specifically assessing the community participation and awareness plan for sustainable solid waste management. You are being contacted because you are a resident of the community where the study will take place. An interview will be held within the vicinity, your home or outside your compound. The discussion will last for 5-10 minutes depending on individual’s responses.

Participatory is voluntary and information that you provide is kept confidential unless you wish otherwise. Numbers will be used in place of participant’s names and interview will be audio tapped. You must be at least 18 years old to take part in the discussion. I would be grateful to engage you because the information you provide may help discover the way forward for sustainable solid waste management in Ghana.

Should you consent to take part, your telephone number will be collected, and you will be contacted a day before the discussion to be reminded.

You are also welcome to call me or my advisor should you have any concerns. Below is the contact information;

Pearl Sika Deku  
MSc Geography and Environmental Resources  
(6183031651)  
Pearl.deku@siu.edu

Dr Leslie Duram  
Professor, Full Bright Scholar. Director of the Environmental Studies Program  
(618) 453-6084)  
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If you have questions about your rights as a research participant, you may contact the Southern Illinois University, Carbondale Committee Chairperson at Human Subject Committee at Office of sponsored Projects Administration, Southern Illinois University, Carbondale, IL 62901-4709.
Phone (618)453-4533. Email siuhsc@siu.edu. They have reviewed and approved this research study.
I hope that you will be able to joins us for the important discussion.
Thank you.
PERMISSION FOR SCHEDULED INTERVIEW
My name is Pearl Sika Deku and I am a Graduate student at Southern Illinois University in the United States. I am conducting a research that seeks to assess sustainable solid waste management in Ghana. Asylum down, Kanda and Nima within Korley Klottey and Ayawaso east municipal Assemblies are my study areas. As a body that governs activities carried out within the municipalities, I thought it is wise to engage you on the progress of the community participation and awareness program listed in the National Environmental Sanitation and Action Plan. Furthermore, identify the assistance provided by government and other stakeholder institutions to make community participation effective to promote sustainable waste management in Ghana. The meeting would last 40-50 minutes. The information that you provide may help discover the way forward for sustainable solid waste management, probably help discover the strength and opportunities of the plan that can be capitalized to overcome weakness and threats.

Kindly, reach me via pearl.deku@siu.edu on your availability for the interview. Please be assured that anything you say during interview will be kept strictly confidential. Numbers will be used in place of names should I need to use a name during data analysis unless you permit me to use your name.
Please do not hesitate to contact me or my advisor should you have any questions. Below is the contact information.

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If you have questions about your rights as a research participant, you may contact the Southern Illinois University, Carbondale Committee Chairperson at Human Subject Committee at Office of sponsored Projects Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone (618)453-4533. Email siuhsc@siu.edu. They have reviewed and approved this research study.

Thank you
APPENDIX C

STUDY OFFICIALS INTERVIEW QUESTIONS

1. Please give a brief biography of yourself. What is your highest education attained? How long have you been working in the assembly?
2. What national legislation or policy and bylaws exist to regulate solid waste management in this municipal area?
3. Do you know how these laws are made? Top down/bottom up/top bottom.
4. Does the average citizen know about the laws of waste management or follow them? Why?
5. Are offenders of these laws prosecuted? If yes, how are they prosecuted?
6. Do you know of the community participation and awareness program for environmental sanitation? What are the goals of this plan for solid waste management?
7. Are the goals for the community participation and awareness program being realized? If so, what are some achievements/challenges?
8. How are individuals, households, communities engaged or involved in waste management?
9. Are there community-based organizations or NGOs that provide any source of assistance towards solid waste collection, transport or disposal?
10. Are there any annual, quarterly or monthly review on waste management implementation and enforcement data available for Kanda, Asylum - Down and Nima?
11. Why is waste still a big problem within Ghana despite having implementation plans like the community participation and awareness program?
12. What can be done to make the community participation and public awareness program effective to promote sustainable solid waste management?
13. Overall, how is waste management program “community participation and awareness” funded?
14. In your opinion as a government official, who is most responsible for waste management?
15. Is there any comment you will want to give with respect to managing waste in your area and the country as a whole?
APPENDIX D

COMMUNITY MEMBERS INTERVIEW QUESTIONS

Bio Data

1. How long have you lived here?
2. What is your highest level of education?

Identify Implementation Plans

3. What do you think is the highest source of municipal solid waste? Household, markets/commercial areas/ institutions/industries, others.
4. What do you understand by solid waste management?
5. In your opinion, what are some effects of poor waste management?
6. Do you know of any bylaws for waste management in your community, what are they?
7. Do you know of any implementation plan for waste management in Ghana? If so, what are they?

Assess the Community Participation and Public Awareness Program

8. How much refuse do you collect or make a day?
   (Quarter container, Half, container, Full Container, three- quarter container, other)
9. Do you separate your waste? If so, which ones and what do you do with them? (paper, Plastic, Glass, food waste, metals, cloth)
10. Who do you think is primary responsible for solid waste management in your community?
11. Which of these places do you store your garbage? (In a pile on the floor, paper or plastic bag, a closed waste bin, other)
12. How do you dispose your refuse?
   (Bury, Burn, Communal containers, House to House collection, other)
13. How often do you dispose refuse?
   (once a day, once in two days, once in three days, once in four days, once in a week, others)
14. What do you think happens to the dumped refuse? (Stays there, removed by municipality, burnt, searched by scavengers)
15. Do you clean your immediate environment (drains and roads)? If so, how often
16. Do you know if there are educational campaigns organized to educate you on waste collection and disposal? If so, how often?

17. Which of these will you say you personally do to manage waste? (waste reduction, re-use, recycling, proper waste disposal)

18. Are community environmental clean-up exercises organized in your community? If so, who organizes it?

19. Do you partake in such exercise?

20. Do you know of any penalty meted to people who fail to participate?

21. Do you give inputs or ideas towards the planning of community clean-up exercise? If so, are your inputs taken into action?

22. Do you know of any organization in this community that provide waste bins, brooms or other means to aid community cleaning?

23. How will you describe the state of cleanliness of your community with regards to waste reduction, re-use, and recycling, proper waste disposal? (very good, good, neutral very bad, bad)

24. Do you know of any sanitation court available in your community or district for prosecuting offenders of bylaws?

25. Do you know of any community that have clean environment and manage waste well that you will want to live there?

26. What do you think can be done to achieve sustainable solid waste management in your community and Ghana as a whole?
To: Pearl Deku  
From: Kimberly K. Asner-Self  
Chair, Human Subjects Committee  
Date: April 19, 2019  
Title: Assessment of Sustainable Solid Waste Management in Ghana  
Protocol Number: 19082

The revisions to the above referenced study have been approved by the SIUC Human Subjects Committee. This approval includes all aspects of the project. The study is determined to be exempt according to 45 CFR. 46.101(b) 2. This approval does not have an expiration date; however, any future modifications to your protocol must be submitted to the Committee for review and approval prior to their implementation. 
Best wishes for a successful study.

This institution has an Assurance on file with the USDHHS Office of Human Research Protection. The Assurance number is 00005334.

KAS:kr  
Cc: Leslie Duram
VITA

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- Golden Key International Honor Society
- Priscilla Anne Moulton Award
- Graduate and Professional Student Council Research Award
- Environmental Ambassador Award

Thesis Paper Title:
An Assessment of Sustainable Solid Waste Management in Accra-Ghana

Major Professor: Dr. Leslie Duram