UNIVERSITY OF EDUCATION, WINNEBA

EXAMINING THE INTEGRATED COMMUNITY-BASED WASTE MANAGEMENT SYSTEM IN BECHEM IN THE TANO SOUTH MUNICIPALITY

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DECLARATION

STUDENT'S DECLARATION

I, ATTA KWAME GEORGE hereby declare that except for references made to other people's work which have been duly acknowledged, this report is the result of my own research and that it has neither in whole or in part been presented elsewhere.

Signature ……

Date……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Supervisor's Name……

Signature ……

Date……

ACKNOWLEDGMENTS

This work would not have been possible without the contribution of certain key personalities. I will therefore take this opportunity to proffer my profound gratitude to them.

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To all my friends and family who in diverse ways helped to make this work a success, I am eternally grateful.

DEDICATION

This work is dedicated to my lovely wife, Mrs. Naomi Twum who sacrificed her comfort to support me through my education. The work is also dedicated to my siblings whose plight has spurred me on this academic path.

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ABSTRACT

Domestic solid waste, also known as municipal solid waste (MSW), refers to the non-hazardous waste generated by households, including items such as food scraps, paper, plastic, glass, and other materials discarded in the normal course of daily life. The purpose of the study was to examine the domestic solid waste management problem in the Bechem township and suggest possible ways of solving the problem. The research approach used for this study was qualitative. The case study design was considered appropriate for this study. Out of the total population of 625 households, a sample size of 12 households were selected through purposive selection. In addition to the household, three other respondents including an Assembly member, Municipal Finance Officer and an officer from the Waste Management Department were also purposively selected and interviewed. The data collection method which the researcher used for the study was face-to-face interview. The study revealed that communal skip containers were woefully inadequate in Bechem culminating in indiscriminate disposal of refuse. Indeed, most of the households resorted to indiscriminate disposal of waste. These included dumping refuse in open depressions, open spaces in front of their houses and their backyards. The study recommended that there should be adequate provision of skips, education of residents, regular collection, financing of waste management and provision of more waste management resources.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Wastes are an unavoidable part of human activity. They either come from man's production activities or as a by-product of the materials consumed by man. Man appears not able to deal sufficiently with this waste (Maulidya, Mora, Matondang, 2022). Even though the natural environment is the recipient of these waste it is more capable of dealing with it within acceptable limits than man. The inability of man to deal decisively with these wastes has created both environmental and health problems (Robin., Kaur., Jagdeep, Kaur., Sartaj, Ahmad, and Bhat, 2023). Solid waste is any material which comes from domestic, commercial, and industrial sources arising from human activities which is of no use to the people who possess it and not intended to be discharged through a pipe. Solid waste is classified into domestic, commercial due to construction and demolition, agricultural, institutional and miscellaneous ways (Mehdi, Ghanbarzadeh, Lak., Milad, Ghaffariraad., HamidReza, Jahangirzadeh, and Soureh, 2024). Many times, domestic and commercial wastes are considered together as urban waste. Sometime ago, waste management did not pose many problems because of the lesser number of inhabitants in the communities (McAllister, 2015). It has however become problematic due to the large masses of people in the towns and cities where the problem is serious. Rapid urbanization, poor financing capacity of local authorities, low technical capacity for planning and management of solid waste, weak enforcement of environmental regulations which allow local authorities to flout environmental regulations without any sanctions have all contributed in compounding the problem (Mensah, Amoah, Mattah and Mensah, 2023). There have been several strategies in the past to tackle this menace but these have sometimes succeeded in moving the

problem around. Solid waste management has therefore emerged as a suitable alternative to keep towns and cities clean and healthy (Guerrero, Maas, & Hogland, 2013). Solid Waste Management refers to the collection, storage, transportation and final disposal of waste in an environmentally friendly manner (Muthuraman, & Ramaswamy, 2019). Solid waste management includes all activities that seek to minimise the health, environmental and aesthetic impacts of solid wastes. Solid waste management has become an essential aspect of health delivery. Effective waste management is a very important element of the health of a people, thus managing it in an environmentally sustainable way is of paramount importance. Another issue closely related to health which results from unsustainable waste management practices is pollution of the environment, which consist essentially of solid waste, diseases such as cholera, typhoid, dysentery and malaria are all related to the practice of poor waste management (Al-Dailami, Ahmad, Kamyab, Abdullah, Koji, Ashokkumar and Zabara, 2022). This can result in the loss of human resources needed in the development of the country. Solid waste management has received particular attention in the the various metropolitan, municipal and district assemblies expending large sums of money to collect, transport and dispose solid waste properly. As mentioned by Owusu, Nketiah-Amponsah, Codjoe and Afutu-Kotey (2014), they opine that the key problems with solid waste disposal in Ghana principally relate to issues with indiscriminate dumping, increasing difficulties with acquiring suitable disposal sites, difficulties with conveyance of solid waste by road due to worsening traffic problems and the lack of alternative transport options and weak demand for composting as an option for waste treatment and disposal. Similarly, the Kumasi Metropolitan Assembly (2006) asserts that the problems with solid waste management are; inadequate funding for capital investment for effective delivery of waste management services, inadequate equipment

holding culminating in limited coverage of service delivery, inadequate byelaws and lack of enforcement of available ones, Inadequate revenue mobilization to finance Waste Management Service costs, bad attitude of residents such as indiscriminate disposal of household waste and littering due to lack of effective environmental health education and service promotion strategy, poor infrastructural condition particularly road networks and waste collection points, mostly in new settlements, which impacts negatively on service delivery and inappropriate design of communal containers.

The high reach of containers results in waste being thrown on the ground particularly by children. These can be broadly categorized into financial, technical and institutional. Also, the amount of solid waste generated in Ghana has been increasing with the rapid increase in population. It was estimated; based on the population of 22 million, that Ghana generates 3.0 million tonnes of solid annually and average per capita daily generation of 0.45kg (Mensah and Larbi, 2005). This is expected to increase as the population increases. The collection of domestic solid waste is delivered by the private sector under various contractual arrangements (Vicknesh, Kumar, Yogamadhavan., Giriraj, Mannayee, 2024). The major collection types are house-to-house collection in rich neighbourhoods and communal collection points in less affluent neighbourhoods. The disposal of the generated waste is however problematic. Some towns and cities do not have well engineered sanitary landfill sites. These towns and cities therefore resort to open dumps putting the lives of near-by communities at great risk (Tasantab, 2012). Recycling and composting of domestic solid waste are currently at a very small scale, even though greater proportions of the domestic solid waste are putrescible and therefore compostable. The above represents the overview of issues relating to domestic solid waste management in Ghana. Bechem is not an exception to this rule as the town

has experienced and continuous to experience serious solid waste management challenges.

1.2 Statement of the Problem

In recent times domestic solid waste management has become a major problem in Bechem. Indiscriminate dumping, irregular collection, poor storage and inadequate resources are the main problems facing the management of domestic solid waste in the town. A familiar scene in the town is littering, choked gutters, heaps of household waste in the town. Refuse dumps are seen almost at the back of every house, especially in the outskirts. The recent proliferation of polythene bags for packaging has compounded the situation in the study area. If the situation is left unchecked it can result in the outbreak of communicable diseases such as cholera, typhoid and other sanitation related ailment and further put unbearable pressure on the already overstressed health facility in the town.

To curb the problem of waste in Bechem township, an integrated community waste management system was introduced. An Integrated Solid Waste Management (ISWM) system is a comprehensive approach that combines various waste management strategies to effectively handle solid waste. It encompasses waste reduction, recycling, composting, and safe disposal methods, aiming to minimize environmental impact and promote sustainability. According to Usha, ISWM emphasizes the importance of stakeholder participation and the integration of local practices to enhance waste management efficiency (2024). Joseph et al. highlight that ISWM systems are designed to adapt to the specific needs of communities, incorporating technological advancements and regulatory frameworks to optimize waste processing (Emilda, Joseph., Bindi, Varghese., Tomy, Kallarakal., Jose, Antony, 2024). Amid this system, littering in Bechem is on the increase. As to whether the integrated community-based

waste management system is working efficiently or not, it is not very clear. Base on this backdrop, the study therefore, sought to examine the effectiveness of the integrated waste management system in Bechem in the Tano South Municipality of the Ahafo Region of Ghana.

1.3 The Purpose of the Study

The purpose of the study was to examine the effectiveness of the integrated community-based waste management system in resolving waste issues in Bechem in the Tano south Municipality in the Ahafo Region.

1.4 Objectives of the Study

The research was thus aimed at achieving the following objectives:

1. To analyse how the waste collected is finally disposed-off in Bechem in the Tano south municipality through the integrated waste management system.
2. To evaluate the equipment and resources available in collecting and disposing solid waste generated in Bechem in the Tano south municipality through the integrated waste management system
3. To assess the capacity of the integrated waste management system in managing solid waste in Bechem in the Tano south municipality.
4. To examine the effective ways of managing solid waste in Bechem in the Tano south municipality.

1.5 Research Questions:

1. How is waste collected and disposed off in the Bechem in the Tano South Municipality of the Ahafo Region through the integrated community-Based waste management system?

2. What equipments and resources are available in collecting the waste generated in Bechem in the Tano south municipality through the integrated community-Based waste management system?
3. What is the capacity of the integrated waste management system in managing solid waste in Bechem in the Tano south municipality of the Ahafo Region?
4. How can solid waste be effectively managed in Bechem in the Tano South Municipality of the Ahafo Region?

1.6 Justification of Study

Tano South Municipality has a projected population of Ninety-eight thousand nine hundred and ninety-four (GSS, 2021). Human nature is such that waste generation cannot be avoided. Averagely, each person in the Tano South Municipality generates about 0.65 volume of waste per day. The serious challenge facing the Municipality in terms of waste management is that a total volume of 64,346.1 tons of waste is being generated each day (Labambe, 2024). Out of this volume of waste generated per day only two thousand three hundred and seventy-six (2,376) tons that is (3.7%) is being collected and disposed off by Zoomlion Ghana Limited in a month. What is so alarming is that only three hundred and thirty-seven (337) households have access to waste containers and waste collection disposal services from Zoomlion. About 98,661 of the population do not have any proper means of collecting and disposing the waste they generate. Even those who have access to the improved waste containers do not disaggregate the waste they generate. All the household wastes are being put together in one waste container; plastic waste and degradable waste are all put together.

Another biggest challenge facing the people within the municipality in terms of waste management is that there is only one dumping site that serves the population. The large quantity of the waste that is not collected finds its way into river bodies, gutters and

into the environment. Most of them block the gutters thereby causing flooding in some parts within the township, and also, leading to opportunistic infections such as cholera and malaria.

The current system of waste management in the Municipality is that those who have access to Zoomlion Ghana Company Limited system of collection of waste leave the waste they have generated in the waste containers and leave it at their door steps for collection. Normally they should pick the waste in every three days but it takes Zoomlion three to four weeks before they come for the waste. This can also cause disease to the household. The challenge here is that only 219.05 tons of waste can be collected by the waste truck from Zoomlion in the municipality within a day. Also, the waste truck is only one serving the entire population. Those who have access to this service do pay for their services each month. The very few wastes that Zoomlion Ghana Company Limited collects get its way into the approved refuse dump sites and later they burn them without sorting. This system of burning also causes air pollution thereby bringing respiratory diseases to the people.

Moreover, the plastic waste generation in the Bechem Municipality is increasing, but unfortunately, the management of the waste is highly unsustainable due to weak institutional capacity. This has led to indiscriminate disposal of plastic waste in surface drains, canals, and streams, creating unsanitary and unsightly environments in many parts of the city. This study seeks to support Tano South Municipal in a circular economy approach to reduce plastic pollution at the municipal and community levels through enhanced public and private participation. The project will build community capacity in the efficient collection of waste and design technology solutions to improve reusability, refurbishment, and recyclability of plastics. Solid waste management has become a demanding developmental problem in Bechem in recent times. It is therefore

very important that the district assembly, waste management institutions, corporate bodies, non-governmental organizations and individuals alike find a lasting remedy to the problem. Wastes are a fundamental mismanagement of the resources of the earth and can therefore not be corrected by a reactive strategy which only moves the problem around. It represents a strain on human as well as financial resources, which invariably affects the development of the Town and the entire country at large. It is as a result of this background that this study is being undertaken.

Despite the seriousness of the problem in the Town, very little research has been conducted into solid waste management in the Town. The study will therefore serve as a reference point for the district assembly and the waste management department, and other agencies as far as solid waste management in the Town is concerned. It will provide a clear understanding of the nature of the problem and the remedying strategies that can be adapted to solve the problem. It will further encourage studies into the problem in similar Towns in Ahafo and Ghana at large.

1.7 Scope of the Study

Geographically, the area of study is BechemTownship in the Ahafo Region of Ghana. Bechem is the capital of Tano South District. Bechem is a rapidly growing Town and thus faced with the problems other rapidly growing urban localities in the country face. Contextually, the study will focus on domestic solid waste management. Most of the wastes generated in the Town are from domestic sources, hence the scope. The scope will cover the capacity of the District Assembly and Zoomlion to manage the domestic solid waste effectively. The context will also include the methods of domestic solid waste collection and disposal; the availability of collection containers and proximity of residents to collection points; the financing of solid waste management; and public education and sensitization on domestic solid waste management.

1.8 Organization of the Research

This work is organised into five chapters. Chapter one contains the general introduction for the study, the scope, objectives, research questions, justification, and organisation of the work. The chapter two contains the literature on the subject of solid waste management. Chapter three makes up the research methods used for the study. Chapter four presents the findings and discussion of the processed data collected from the field. And chapter five summarises the key findings for the study. It also presents the recommendations and the general conclusion of the study.

1.9 Limitations of Study

The following hindered the smooth completion of the study. These are enumerated below.

Inability to obtain the total female population figures between the ages of 20 years and above for the study was a limiting factor. Additionally, the female population for each of the selected areas could not also be obtained. This explains why the sample size was divided equally among the areas of study.

Some potential respondents wanted to be compensated for the time spent in responding to the questionnaire. This makes the administration of questionnaire quite difficult.

1.10 Research Direction

The chapter provided an overview of the topic on waste management. This included background to the study, statement of the problem, objectives, scope and justification. The next chapter reviews literature on solid waste management. It examines key concepts and methods of waste management.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Literature review is important in such work, to give a panoramic view of the terrain in which a particular research travers. It enables the researcher to capture a cross section of perceptions and positions on the subject matter and contextualizes the study. Consequently, it helps the ultimate reader to appreciate a particular study against the backdrop of existing knowledge and viewpoints. It is in this connection that an overview of relevant literature on solid waste management is hereby made.

2.2 Definition and Historical Background on Solid Waste

According to Tsiboe and Marbell (2015), events of the 20th and early into the 21st century indicate that waste in whatever form or classification- solid, liquid or toxic have become a major consequence of modernization and economic development. Throughout history, cities and towns have struggled with how to collect and dispose of the refuse generated by their populations (Tong & Tao, 2016). Waste is a dynamic concept which can be defined in different ways (Ebikapade & Jim, 2016). The Ghana Innovation Market Place (2019) popularly known as 'GIM` defines solid waste as neither wastewater discharges nor atmospheric emissions, arising from domestic, commercial, industrial, and institutional activities in an urban area. Waste also refers to an item, material or substance you as an individual consider useless at a given time and place (Tibihika et al., 2021). According to Abdulfatah (2023) Municipal waste refers to wastes from domestic, commercial, institutional, municipal and industrial sources, but excluding excreta, except when it is mixed with solid waste. Solid waste also known as garbage is not very different from municipal waste. This study takes on the definition by Marcussen (2020). that defines solid waste as organic and inorganic waste materials

produced by households, commercial, institutional and industrial activities that have lost value in the sight of the initial user.

2.3 Source, Type and Classification of Solid Waste

Waste arises in many different forms and its characterisation can be expressed in several forms. Some common characteristics used in the classification of waste includes the physical states, physical properties, reusable potentials, biodegradable potentials, source of production and the degree of environmental impact (Amasuomo, & Baird, 2016). Although it is clear that several classifications exist in different countries. The most commonly used classifications are illustrated below.

A. Physical state

1. Solid waste
2. Liquid waste

B. Environmental impact

1. Hazardous waste
2. Non-hazardous waste

Solid Waste/Rubbish

Solid rubbish can include a variety of items found in a household along with commercial and industrial locations. Solid rubbish is commonly broken down into the following types: (Chandrappa & Das, 2012).

Plastic waste: This consists of bags, containers, jars, bottles and many other products that can be found in a household. Plastic is not biodegradable, but many types of plastic can be recycled. Plastic should not be mixed in with a regular waste, it should be sorted and placed in a recycling bin (Chandrappa & Das, 2012).

Paper/card waste*:* This includes packaging materials, newspapers, cardboard and other products. Paper can easily be recycled and reused so it is important to place them in recycling bin or take them to recycling depot (Chandrappa & Das, 2012).

Tins and metals*:* This can be found in various forms throughout our homes. Most metals can be recycled (Chandrappa & Das, 2012).

Ceramics and glass*:* refers to discarded materials from the production, use, or disposal of ceramic and glass products. These wastes can come from various sources and have different environmental impacts and recycling potentials (Chandrappa & Das, 2012).

Liquid Waste: Liquid waste is commonly found both in households as well as in industries. This waste includes dirty water, organic liquids, wash water, waste detergents and even rainwater (Singh, et al., 2022). It is worthy to also know that liquid waste can be classified into point and non-point source waste. All manufactured liquid waste is classified as point source waste. On the other hand, natural liquid waste is classified as non-point source waste (Maschal Tarekegn, & Truye, 2018).

waste comes in many different forms and may be categorized in a variety of ways and there may be considerable overlap so that one waste entity may fall into one-to-many types; agricultural waste, animal by-products, biodegradable waste, biomedical waste, bulky waste, business waste, chemical waste, clinical waste, coffee wastewater, commercial waste, composite waste, construction and demolition waste (C&D waste), consumable waste, controlled waste, dog waste, Domestic waste, electronic waste (e-waste), Food waste, gaseous wastes, green waste, Hazardous waste, Household waste, Household hazardous waste, human waste, Sewage sludge, Industrial waste, Inert waste, Inorganic waste, Kitchen waste, Liquid waste, Marine debris, medical waste, Metabolic waste, Mineral waste, Mixed waste, Municipal solid waste, nuclear waste, Organic waste, Packaging waste, post-consumer waste, Radioactive waste, Low level

waste, High level waste, Recyclable waste, Residual waste, Retail hazardous waste, Sharps waste, Slaughterhouse waste among others.

Biodegradable Waste

Biodegradable waste includes any organic matter in waste which can be broken down into carbon dioxide, water, methane or simple organic molecules by micro-organisms and other living things by composting, aerobic digestion, anaerobic digestion or similar processes (Kiyasudeen, et al., 2016). It mainly includes kitchen waste (spoiled food, trimmings, inedible parts), ash, soil, dung and other plant matter. In domestic waste collection, the scope of biodegradable waste may be narrowed to include only those degradable wastes capable of being handled in the local waste handling facilities (Krishnasamy, 2019). Biodegradable waste when not handled properly can have an outsized impact on climate change, especially through methane emissions from anaerobic fermentation that produces landfill gas. Other approaches to reducing the impact include reducing the amount of waste produced, such as through reducing food waste (Zamri et al., 2020)

Municipal Solid Waste

Municipal solid waste (MSW), commonly known as trash or garbage in the United States and rubbish in Britain, is a waste type consisting of everyday items that are discarded by the public. "Garbage" can also refer specifically to food waste, as in a garbage disposal; the two are sometimes collected separately. In the European Union, the semantic definition is 'mixed municipal waste,' given waste code: 20 03 01 in the European Waste Catalog. Although the waste may originate from a number of sources that has nothing to do with a municipality, the traditional role of municipalities in collecting and managing these kinds of waste have produced the particular etymology 'municipal.

In developing nations including the Philippines, Indonesia, Thailand, Malaysia, and Vietnam, a community-based organization that encourages recycling has been developed. This has benefited both individuals and communities (Kubota et al., 2020). Community involvement and participation in garbage management and recycling techniques are the cornerstones of the strategy known as community-based solid waste management (CBSWM) (Dhokhikah et al., 2015).

CBSWM intends to recover recyclable materials, decrease the amount of solid waste delivered to landfills, and cut waste at the source (Sukholthaman & Sharp, 2016). The Philippines (Wynne et al., 2018) and Thailand are two emerging nations where CBSWM has a substantial impact on solid waste management (Sukholthaman & Sharp, 2016).

In the Indian cities of Chennai and Hyderabad, CBSWM was put into practice by creating a community-driven material recovery facility (CdMRF) that gave local scavengers financial incentives and employment chances (Indrianti, 2016). Only recently have national plans been established for the management of the environment and natural resources. Natural components are not the only ones affected by the use of natural resources; there are also other components, such as production factors, such as capital, power, management techniques, such as processing, market, and transportation. At the moment, environmental damage and/or pollution are occurring everywhere at a very quick rate. Currently, numerous parties are emphasizing environmental issues, since the environment provides what humans need to survive (Sulphey, & Safeer, 2017). When the population of Ghana was 27,043,093 people, the trash generation rate at the household level was 0.47 kg/person/day, or approximately 12,710 tons of rubbish per day. Ghana generated 0.318 kg of biodegradable trash per person per day, making up 61% of the country's solid waste stream (Miezah et al., 2015).

Additionally, it has been acknowledged that waste-related greenhouse gas emissions play a significant role in contributing to global warming (Caiado et al., 2017). Urban SWM is a major issue that is growing with rapid urbanization and growth and is impacted by things like the burdensome nature of municipal budgets and the high costs of managing them (Azevedo et al., 2019). Any sort of development can only be long-lasting if all of the garbage it produces is reused, recycled, and recovered. Attempts to recover energy from waste are one tactic to accomplish this (Abbasi, 2018). In this way, waste-to-energy systems can produce renewable energy and improve the sustainability of Solid Waste Management (Tan et al., 2015). However, even if trash is exploited as a resource for energy production in wealthy nations, poor nations still face pressing problems with the collection, transportation, and disposal of waste (Moya et al., 2017). In metropolitan regions of poor countries, when taking into account the effects of residents on public health (Azevedo et al., 2019). There are various alternatives for the Solid Waste Management, depending on the nation and its level of development. While developing countries, where populations are more concerned with short-term gain or survival, turn to less expensive low-tech approaches, developed countries, which experience a higher level of economic development, reach a high level of public awareness and adopt preventive approaches to waste more easily (Chalhoub, 2018). The amount of solid waste dumped in landfills in European nations has significantly decreased as a result of their emphasis on energy recovery (Selau, 2018). However, emerging nations experience a socio-environmental crisis as a result of inadequate SWM since the economic potential for reuse is lower than anticipated, making it challenging to adopt the viewpoint of sustainable management with social inclusion. (Selau, et al., 2018).

Based on its opportunities and obstacles compared to other emerging and developed countries, Brazil's National Solid Waste Policy (NSWP) can instruct other countries in Solid Waste Management (De Sousa Jabbour et al., 2015). Evaluations of public policies for SWM, however, show that it is challenging to combine several techniques and themes into a unified model that can be used in various circumstances (Soltani et al., 2015). Additionally, although being anticipated in the NSWP, the issues of incineration and energy recovery of residues are only lightly explored in both academic research lines and the literature. Because of this, the lack of technical, economic, and general information on the issue highlights a reality that is still prevalent in developing nations: the use of landfills for the final disposal of MSW, which entails consequences like the contaminating of natural resources and issues with public health (Ramos et al., 2020). Additionally, research that specifically examine integrated urban Solid Waste Management are lacking, particularly from the perspective of developing nations (Leal Filho et al., 2019). In this regard, integrated solid waste management (ISWM), which takes into account the entire MSW management chain and integrates relevant operations to operationalize a full waste management system, is a developing field to solve the expanding issues of disposing of MSW in megacities (Asefi et al., 2020). On the other hand, effective waste management plans are crucial at the federal, state, local, inter-municipal, and municipal levels. These businesses are tools that ensure that societal and corporate goals are regularly attained and evaluated (Lima et al., 2018). However, the integrated management and sanitation plans in developing nations fall short of the required minimums, which hinders municipal planning. Most towns lack structured data and technical staff, which forces them to produce plans quickly and with more attention paid to presentation than to the quality of their content (Marotti et al., 2017).

Additionally, there are not enough diagnoses that allow for the development of objectives for society that are in line with local realities through actions, procedures, and goals (Schalch et al., 2019). Applying facilitative tools for the social control of public policies, with a focus on strategic guidelines, institutional arrangements, legal considerations, and financing mechanisms, is necessary to get past these obstacles and address numerous environmental liabilities, particularly the mountains of MSW discarded in an erroneous manner. Identifying the ISWM alternatives that are currently available and must be the highest combination of accessible alternatives adapted to society is also necessary to avoid further environmental harm caused by MSW (Malav et al., 2020).

Prior to final disposal, solid medical waste (SMW) must undergo particular treatment due to its hazard. There is a paucity of knowledge about SMW management in non-traditional settings such residences, chemical seller (CS) shops, and homes of traditional birth attendants (TBAs). To determine the main disposal methods and perceived risks related to SMW and to ascertain their opinions on segregation as a feasible management strategy, a descriptive and exploratory study was conducted. Poor management of SMW produced by households could put people at risk, particularly garbage scavengers, unofficial waste porters, and gullible bystanders. Companies that collect rubbish from homes and whose employees might come into contact with these waste components (if they are not protected) are likewise at danger (Udofia et al., 2018).

The Portuguese trash industry has established the regulator's responsibility for determining rates and offering the right incentives to promote efficiency and added-value. In this situation, legislation was suggested to adopt a tariff setting system based on an X factor connected to revenue limitations and related to productivity. By using a catch-up factor (static efficiency determined by Data Envelopment Analysis) and a

production technology change or frontier shift (dynamic efficiency determined by a Törnqvist index), this novel application (in the waste sector) determines the X factor (Marques et al., 2018). In this context, regulation can play a significant corrective role by promoting the "waste hierarchy" among other things (Van Ewijk and Stegemann, 2016).

Solid waste management (SWM) is still a significant and challenging issue in many cities all over the world. SWM now has negative effects on social and economic as well as environmental surroundings. In municipal SWM, integrated waste management (IWM) is a choice that needs to be investigated. In order to connect the formal system (government) with the non-formal systems (the informal sector/IS and community-based activities), it is important to build models of an IWM system (Satori et al., 2018). The review of current policy framework, the analysis of the potential for resource recovery from food waste at the national, community, and organizational levels, the proposal of alternative waste management strategies, the examination of challenges and opportunities with regard to the economic, environmental, and social dimensions of waste management sustainability, and the examination of opportunities are all used in this paper to present a systematic framework for sustainable organic waste management and valorization in the UK (Ng et al., 2019).

The UK's Clean Growth Strategy (HM Government, 2017), Resources and Waste Strategy for England (HM Government, 2018), the Roadmap to a Resource Efficient Europe (COM/2011/0571) (European Commission, 2018), and the United Nations Sustainable Development Goals (SDG) 12.3 all call for urgent action to reduce and divert food waste from landfills (United Nations, 2015).

Currently, UK policy encourages a socially focused voluntary approach to waste management through prevention of food surplus that is safe for human consumption

(examples include education, re-labeling "best before" and "use by" dates on food, and redistribution to charities), while paying only minimal attention to the recovery of valuable resources from food waste. The majority of policy discussions center on food waste from homes, while food waste from businesses is frequently disregarded (European Parliament, 2017). Supermarkets, which are large, out-of-town stores with their own land, may monitor and control food supply and purchase as well as food surplus and waste in the current situation to significantly improve the effectiveness of waste management operations at the local community level (Schanes et al., 2018).

Solid waste, or garbage, is made up of organic and inorganic materials that have outlived their usefulness and needs to be properly managed to protect the environment. The way we live and the materials we use have a big impact on how much and what kinds of waste we produce. Rising household income also causes a rise in the diversity of waste-generating methods. The impact of waste management training on understanding and application of the waste management guiding principles of reducing, reusing, and recycling The knowledge and principles of reducing, reusing, and recycling in waste management are evaluated by the researchers as a result of waste management training (Supinganto et al., 2022). Solid waste, or garbage, is made up of organic and inorganic materials that have outlived their usefulness and needs to be properly managed to protect the environment. The way we live and the materials we use have a big impact on how much and what kinds of waste we produce. Rising household income also causes a rise in the diversity of waste-generating methods. the impact of waste management training on understanding and application of the waste management guiding principles of reducing, reusing, and recycling the knowledge and principles of reducing, reusing, and recycling in waste management are evaluated by the researchers as a result of waste management training. For city authorities in

emerging nations, trash management is a difficulty, particularly given the rise in waste. The financial strain placed on the city due to the high costs of management and a lack of knowledge about the variety of factors influencing the various phases of management. The discrepancies that emerge at various levels of administration are observed and analyzed in this research using comparative and descriptive analysis (Amri et al., 2020).

As the quantity of products and consumption habits expand, household waste output rises daily. Reducing the volume of waste at the source through empowering the community is one way to combat the rise in waste volume (Ramandei, 2020). Consumption patterns within a community play a role in the production of a variety of wastes, the total amount of waste produced, and the lack of public awareness of community-based waste management. Storage, collection, transfer, transportation, and final disposal are among the waste management infrastructure options that the city of Kediri's municipal government will provide (TPA) (Pujowati, 2021). Policy No. 3 of 2015 relating to Kediri's waste management. Additionally, regulations for waste management are essential for ensuring legal certainty, accountability, and communities' and enterprises' ability to handle garbage in a professional, effective, and efficient manner.

There are many well-known community-based trash management techniques for cities. On a micro level, however, it is now necessary to establish micro household waste management, which is connected to initiatives to lessen social impacts during the pandemic. development analysis (R and D) (Husen, 2022). Using life cycle assessment (LCA) and life cycle costing, Dan creates a method for analyzing municipal solid waste systems (MSWS) that integrates environmental and economic factors (LCC). The technique was tested in the medium-sized Brazilian city of Sorocaba, which is

representative of many developing nations. System expansion, which coupled the effects of MSWMS with those of primary production and recycling processes, was taken into account while analyzing environmental effects (Paes et al., 2020).

The most ridiculed practical approach for attaining integrated solid waste management and comprehensive community development is the participatory intervention model (Amelia, 2020). Despite inadequate services, public agencies handle solid waste in poor nations. There is no public participation structure in place in Malawi to address this issue. This inadequate garbage management harms the ecosystem horribly. In Malawi's peri-urban Chitete township in Kasungu, the goal of this integrative study is to evaluate community-based participatory initiatives in solid waste management. (Amelia, 2020)

Solid wastes comprise all the wastes arising from human and animal activities that are normally discarded as useless or unwanted (Tchobanoglous et al., 2017). The Sanitation Connection, (2015) also regards solid waste as "material that no longer has any value to the person who is responsible for it, and is not intended to be discharged through a pipe. It does not normally include human excreta. It is generated by domestic, commercial, industrial, healthcare, agricultural and mineral extraction activities and accumulates in streets and public places. The words "garbage", "trash", "refuse" and "rubbish" are used to refer to some forms of solid waste". Solid waste is therefore any solid material that comes from domestic, commercial, industrial, agricultural and demolition activities, and is regarded as unwanted by those who own it.

2.2.2 Sources and types of solid wastes.

Solid waste is generated from various sources. These sources relate to the different land uses in a community. Tchobanoglous et al (2017) classify the sources of solid waste in a community by;

1. Residential, this consists of combustible and non-combustible solid wastes from residential areas. It contains materials such as food waste (garbage), paper, corrugated cardboard, plastics, textiles, rubber, leather, wood, and yard wastes. The non-combustible (inorganic) part consists of items such as glass, crockery, tins, cans, aluminium, ferrous metals and dirt. A great portion of the residential waste are putrescible, that is wastes which decompose quickly, especially in warm weather. These putrescible wastes come from the handling, preparation, cooking and eating of foods. Tchobanoglous et al (2017) also identified bulky items, consumer electronics, batteries, oil and tires as special residential wastes which are collected separately. According to them, bulky items include large worn-out or broken-down items such as furniture, lamps, bookcases, filing cabinets, and other similar items.
2. Commercial, wastes from these sources are similar to those from residential sources, except for those related to cooking and eating.
3. Institutional, the generators of this source of wastes include government offices, schools, hospitals, and prisons. They added that most hospitals' medical wastes are handled separately from the rest of the solid wastes stream.
4. Another source of waste they mentioned is the wastes from demolition and construction activities. This result from the repair of individual residences, commercial buildings, and 9 other structures. It may also include wastes from razed buildings, broken-out streets, sidewalks, and bridges.
5. Municipal services, other waste from street sweepings, roadside litter, municipal litter containers, landscaping and tree trimmings, catch basin debris, dead animals and abandoned vehicles are categorized as wastes from municipal services.

6. Other sources of wastes include treatment plant wastes, industrial solid wastes, and agricultural wastes.

2.3 Typical Waste Generation Facilities, Activities and Location Associated with Various Solid Wastes.

Table 1.1 Sources of wastes, the locations and the types of wastes.

SOURCE	TYPICAL LOCATION	TYPES OF SOLID WASTE
Residential	Single-family and multifamily dwellings, low-medium, and high-rise apartments.	Food wastes, rubbish, ashes, special wastes
Commercial/ Municipal	Stores, restaurants, markets, office buildings, hotels, print shops, auto repair shops, medical facilities and institutions.	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes
Industrial	Construction, fabrication, light and heavy manufacturing, refineries, chemical plants, lumbering, mining, demolition.	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes.
Open areas	Streets, alleys, parks, vacant plots, playgrounds, beaches, highway and recreational areas.	Special wastes, rubbish
Treatment plant sites	Water, wastes water, and industrial treatment processes.	Treatment plant wastes, principally composed of residual sludge

Source: Tchobanoglous et al 2017 p.52-53.

It is important at this stage to further distinguish between food waste, rubbish, special waste, and ashes and residue (Tchobanoglous et al., 2017). Food waste, these are wastes resulting from the handling, preparation, cooking and eating of food. They are more generally referred to as garbage. These wastes are highly putrescible and decompose rapidly, especially in warm weather and give off very offensive odour. The 10-putrescible nature of these wastes has strong bearing on the design and operation of wastes collection services. Rubbish, according to Puopiel (2015) consists of combustible and non-combustible solid wastes from household, commercial and institutional activities. It however excludes food waste and other highly putrescible materials. Combustible materials include paper, cardboard, plastics, textiles, rubber, leather, wood, furniture, and garden trimmings. Special waste, these include consumer electronics, batteries, oil and tires. Ashes and residue, these are remains of materials which have been burnt.

Having examined the types and sources of solid waste, the next section will look at the various components of solid waste. Components of solid wastes, the domestic solid waste stream also contains different components which are used to classify them into such types as organic or inorganic, biodegradable or non- biodegradable. For example, plastic, paper, glass, ceramics, textiles, metal and inert wastes (Baabereyir, 2019) as shown in table 2.2. A study conducted by Surrey County UK in 2002/2003 (cited by Baabereyir, 2019) analysed the composition of the solid waste stream in the County as containing: paper/card, plastic film, dense plastic, textiles, miscellaneous combustibles, glass, ferrous metal, garden waste and food waste (Baabereyir, 2019). The organic matter (paper, wood, food waste) is that aspect of the waste stream that is compostable. The inorganic matter on the other hand, is non-compostable (rubber, leather, plastic, metal, glass, fabric and battery, among others). The other classification is into

biodegradable and non-biodegradable. The biodegradable waste matter is a type of waste, typically originating from plant or animal sources, which may be broken down by other living organisms. For example, green waste, food waste, paper waste, biodegradable plastics, human waste and sewage. 11 non-biodegradable waste will not break down (or won't for many years). Examples are plastics, metal and glass. Dangerous chemicals and toxins are also non-biodegradable, as are plastic grocery bags, Styrofoam (polystyrene), and other similar materials. It is important to state here that the aforementioned components of waste apply to the domestic waste stream. Having identified the various concepts associated with solid waste, solid waste management in its entirety will be looked at in the next section.

2.4 Solid Waste Management.

Management of solid waste has become a major challenge in most cities in developing countries (WaterAid, 2018). It is believed that if solid waste is properly managed, it can be a valuable resource, but if not effectively managed, it can become a source of environmental and human hazards. The NGO believes that solid waste management is one of the most important components of urban sanitation.

The term solid waste management has been defined differently by different writers and authorities. For example, the Sanitation Connection (2016) defines it as all activities that seek to minimise the health, environmental and aesthetic impacts of solid wastes. A much more comprehensive definition has been provided by Tchobanoglous et al. (2017), which states that solid waste management is: that discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations and that is also responsive to public attitudes. Inherent in this definition

is the solid waste management process, which includes wastes generation, storage, collection, transfer and transport, processing and disposal of the wastes. Also included here is the way the wastes are handled until they are stored in storage containers.

2.4.1 Solid Waste Management Process

The main components of the solid waste management process include generation, storage, collection, transfer and transport, processing and final disposal. It is also important to include handling in this process because until the waste are placed in storage containers, the way they are handled; especially hazardous waste, is important.

2.4.2. Generation

Waste generation comprise those activities in which materials are identified as no longer of any value by the owners/users and either thrown away or gathered for disposal (Momoh and Oladebeye, 2016 cited by Puopiel, 2016). The United Nations Environmental Programme believes that quantifying and qualifying the types of waste generated is the most fundamental step in solid waste management. Having the necessary information on the amount of solid waste generated is an important prerequisite for effective waste management, since without this information the design of mitigating measures will be hampered. The UNEP (2019, cited by Puopiel, 2015) further states that in 2006, the amount of municipal solid waste (MSW) generated globally reached 2.02 billion tones, making for a 7 percent annual increase since 2003. It estimates that between 2007 and 2011, the generation of solid waste globally will rise by 37.3 percent, representing an 8 percent increase per year. Srinivas (2006) states that municipal solid waste represents about 14-20 percent of all waste generated. He further adds that per capita waste generation varies with a high of 5.3kg/day for OECD countries to less than 0.8kg/day in developing countries. He believes that ineffective policies, changing lifestyles, lack of awareness, among others will increase the rates

over the next decade. Larbi et al. (2015) made similar assertions about solid waste generation in the two largest cities of Ghana, Accra and Kumasi.

2.4.3 Handling

Tchobanoglous et al. (2017) explain waste handling to comprise activities associated with managing wastes until they are placed in the containers used for their storage, before collection or return to recycling centres. The specific activities associated with handling wastes material at the source of generation will vary depending on the types of wastes materials that are separated for reuse and the extent to which these materials are separated from the waste stream, they stated. They also noted that handling may be required to move the loaded waste from the collection centres to the final disposal sites; this however depends on the type of collection services available.

2.4.4 Storage

This refers to the place where the generated solid waste is stored until it is collected, as explained by Tchobanoglous et al. (2017). They believe that the storage of solid waste is affected by factors such as effects of the storage on waste components, type of container, the container location and the contamination of waste components. These factors have a greater bearing on the storage of putrescible materials, which decompose rapidly and so, must be collected quickly.

2.4.5 Collection

The collection of solid wastes involves gathering of the waste's materials, transport by vehicles after collection to the location where the collection vehicle is emptied (Tchobanoglous et al., 2017). The collection is provided under various management arrangements, ranging from municipal services to franchised private services conducted under various forms of contracts. Some collection methods they identified include communal collection points, curbside collection and drop-offs.

2.4.6 Separation

processing and transformation This functional element of the solid waste management process according to Tchobanoglous et al. (2017), involves the recovery of separated materials, the separation and processing of solid wastes components, and the transformation of the solid wastes that occur primarily in locations away from the source of generation. The methods used for recovery of wastes materials that have been separated at source include kerbside collection, drop-off and buy back centres. The separation and processing of these wastes usually occur at recovery centres, transfer stations, combustion facilities, and disposal sites. The wastes components are often separated by size using screens, manual separation of the waste components and size reduction by shredding, separation of ferrous metals using magnets, volume reduction by compaction and combustion (Tchobanoglous et al, 2017). They also established that transformation processes are used to reduce the volume and weight of wastes requiring disposal and to recover conversion products and energy. The organic fraction of municipal solid wastes can be transformed by a variety of chemical and biological processes. The most commonly used chemical transformation process is combustion, which is used in conjunction with the recovery of energy in the form of heat. Composting is the most commonly used biological process for solid wastes transformation. They also noted that the selection of a 14-given set of processes would however depend on the waste management objectives to be achieved.

2.4.7 Transfer and Transport

Tchobanoglous et al. (2017) identified the transfer and transport of solid wastes to comprise two principal steps.

1. The transfer of wastes from the smaller collection vehicle to larger transport equipment, and

2. The subsequent transport of the wastes, usually over long distances, to a processing or disposal site. The transfer usually takes place at a transfer station. Although motor vehicle transport is most common, transport by rail and barges is also available. For example, in San Francisco, the collection vehicles which are relatively small because of the need to manoeuvre in the narrow city streets, haul their loads to a transfer station at the southern boundary of the city. At the transfer station, the wastes are unloaded from the collection vehicles into large tractor-trailer trucks. A similar system of transfer is found in Ghana where tricycles are used to transfer the solid wastes to storage containers, where they are subsequently transported to the disposal sites.

2.4.8 Disposal

The final element in the solid waste management process is disposal. Tchobanoglous et al. (2017), believe that land filling or land spreading is the final destination of all solid wastes, whether they are residential wastes collected and transported directly to a landfill site, residual wastes from recovery facilities, residue from combustion of solid wastes, compost or other materials. Rainer (2015) articulated this idea when argued that landfill would always be needed as a final destination of residue from wastes incineration. It is must be said here that a sanitary landfill is not a ‘dump’ but an engineered facility used for disposing of solid wastes on land or within the earth’s mantle without creating nuisances to public health or safety, such as breeding of rodents and insects, and the contamination of groundwater (Tchobanoglous et al, 2017). Having examined the functional elements of the solid waste management process, the next section will look at the goals of solid waste management.

2.4.9 Goals of Solid Waste Management

The management of solid is not an end in itself but a means to achieve certain goals which are related to public health and aesthetics of the urban area. This was clearly communicated when the United States Congress enacted the Resource Conservation and Recovery Act (RCRA) in 2018, which authorized the EPA to regulate waste management and disposal practices. The goals of waste management that were set by the RCRA include:

1. the protection of human health and the environment from the hazards posed by waste disposal
2. the conservation of energy and natural resources through waste recycling and recovery
3. reducing or eliminating the amount of waste generated, and
4. ensuring that wastes are managed in an environmentally-safe manner (RCRA, 2018, cited by Baabereyir, 2019).

The Ghana EPA also stated that the management of waste is important for the following reasons:

1. To protect human health against waste-related hazards and risks.
2. To prevent pollution of the environment and its natural resources like air, water and land.
3. To produce energy, this could be an alternative for the fast-depleting fossil fuels and other conventional sources of energy.
4. To make optimum use of the waste generated for a better and sustainable future. (Ghana EPA, 2018 cited by Baabereyir, 2019) Schubeller et al. (2016, cited by Baabereyir, 2019) also noted that the goal of municipal solid waste management is to protect environmental health, protect the quality of the environment,

support the efficiency and productivity of the economy, and the generation of employment and income for the people. They stated that the principal goal of solid waste management is to collect waste and dispose it off in an environmentally friendly and socially acceptable manner. We have identified the goals of solid waste management. We shall now look at the early practices of solid waste management in the next section.

2.5.1 Early Solid Waste Management Practices

Tchobanoglous et al (2017) identified the early practices of solid waste management, perhaps before the proliferation of advance knowledge on best ways of managing waste. These practices include:

1. Dumping on land, canyons and mining pits
2. Dumping in water
3. Ploughing into the soil
4. Feeding to hogs
5. Burning

These practices are still practiced in these modern times, when we are supposed have found better and sustainable ways of managing waste. In most of the towns and even cities of Ghana, these ways of managing solid waste are clearly evident as the inhabitants dump waste in every available open space and depressions. Burning is also not uncommon in both the urban and rural areas of the country. Solid wastes are also dumped in gutters and drainage channels leading to flooding, especially in the cities where the situation is rampant. The next section will examine the shift in the waste management paradigm, from old and ancient methods of managing solid waste to the modern methods.

2.5.2 Modern Solid Waste Management Practices

Judging from the myriad of environmental problems created as a result of the conventional and early practices of solid waste management, there is the need to explore better and environmentally 'friendly', and socially acceptable methods of managing solid waste. Some of the recent methods of managing solid waste include source reduction, composting, recycling, incineration and sanitary land filling.

2.5.3 Source reduction

Waste reduction is the reduction of the volume, weight and the toxic level of waste before incinerating, or land filling. There are various methods of reducing waste at source, including waste minimization and re-use. Waste minimization according to Srinivas (2016) is aimed at reducing the generation of waste through education and improved production processes rather than focusing on technology to improve management. Minimizing the amount of waste produced has the potential of reducing costs or increasing profits by maximizing the use of resources and by reducing the amount of waste to be disposed. Reuse has to do with sorting out materials such as bottles, plastic bags, cardboard and cans for domestic purposes. Reuse plays a very important resource conserving role. It also has a linkage with onsite separation and processing, where materials that are still of economic value are separated. Other materials which can be recycled are also separated for recycling. Tsiboe and Marbell, 2019 stated that Austria, the Netherlands, and Denmark, have evolved necessary management processes to efficiently resolve the waste disposal problem by essentially coaxing their citizens to separate their domestic solid waste into glass, paper, plastic categories; thereby enabling easy collection and consequently reuse.

2.5.4 Composting

According to Thompson (2016), composting is the process of turning organic household waste into fertilizer through aerobic fermentation. This fertilizer can be used in lawns, parks, and gardens. Composting is a minimally used form of waste disposal in Accra and does not contribute to the danger of food pollution. Of the 1250 tons of garbage collected per day, about 10 – 15% is composted (Dreschel, 2018 cited by Thompson, 2019). Composting is an excellent method of recycling biodegradable waste from an ecological point of view. However, many large and small composting schemes have failed because composting is regarded as a disposal process, and not a production process. It is essential - as in any production process - to pay careful attention to the marketing and the quality of the product. Composting should be an activity of the agricultural sector, not the waste management sector (Sanitation Connection, online). The UNEP (2019, cited by Puopiel, 2019) stated that composting is the option that, with few exceptions, best fits within the limited resources available in developing countries. A characteristic that renders composting especially suitable is its adaptability to a broad range of situations. The solid wastes which are usually composted are putrescible in nature and decompose rapidly.

2.5.5 Recycling

According to Momoh and Oladebeye (2019: 1, cited by Puopiel, 2019) recycling is a very important method of reducing the number of wastes that enter disposal sites, while also providing the needed raw materials for industries. To them, it has been affirmed that recycling is the best, effective and efficient method of managing solid waste. Recycling converts material which will otherwise remain useless into valuable resources, capable of generating employment and bringing in economic returns. It also yields environmental, financial, and social returns in natural resource conservation,

energy conservation, pollution prevention, and economic expansion and competitiveness. More importantly, a sizeable portion of what is thrown away contains valuable resources—metals, glass, paper, wood, and plastic—that can be reprocessed and used again as raw materials (USEPA, 1999 cited by Puopiel, 2019). According to Puopiel (2019), Kreith (2017) believes that recycling is the most profitable and doable of all solid wastes management options. The benefits of recycling do not lie solely in diversion of waste away from disposal but, even more importantly, in the reduction of the amount of virgin resources that need to be harvested and processed for the manufacture of new products (Srinivas, 2016). Recycling though looks promising and a creative way of reducing the proportion of waste that makes its way to the final disposal sites, it remains an option which has not been explored to a higher degree in Ghana. Since only a few materials are salvaged (which sometimes occur at the disposal sites) by scavengers, leaving the great volumes into the waste stream.

2.5.6 Incineration

The Centre for Environment and Development (2016: 9 cited by Puopiel, 2016) defined incineration as a controlled combustion process for burning combustible waste to gases and reducing it to a residue of non-combustible ingredients. According to the Centre, during incineration, moisture in the solid waste gets vaporised and the combustible portion gets oxidised and vaporised. Carbon dioxide, water vapour, ash and non-combustible residue are the end products of incineration. Incineration reduces solid wastes 90% by volume and 75% by weight (Rainer, 2016). Incineration is a veritable way of energy recovery, where the heat generated from the burning of waste is used for example heating swimming pools. Incineration however needs to be supported by land filling since there will always be residue after the process (Rainer, 2020). He also believes that incineration while solving the problem of land pollution inadvertently

creates air pollution. Puopiel (2016) shared in this believe when he stated that incineration has the tendency to pollute the environment through emissions of carbon dioxide.

2.6.5 Sanitary landfill

A sanitary landfill is a carefully engineered site used for disposing of solid wastes on the land without creating hazards to public health or safety. This practice minimises pollution of air, water and soil, and other risks to man or animals. Aesthetic considerations are also taken into account. The wastes are carefully placed, compacted and covered. It is important to emphasize here that sanitary landfills are different from open dumps due to their level of engineering, planning and administration. Most sanitary landfill designs attach considerable importance to preventing polluted water (leachate) from escaping from the site. It has been shown that large quantities of leachate can be produced by landfills, even in semi-arid climates. (Scheu, 2020 cited in Sanitation Connection, online). Most designs include expensive and carefully constructed impermeable layers which prevent leachate moving downwards into the ground and drainage systems to bring the leachate to a treatment plant or a storage tank. According to Kreith (2019 cited by Puopiel, 2016) landfills are one form of waste management that nobody wants but everybody needs. He further states that there are simply no combinations of waste management techniques that do not require land filling to make them work. Of the basic management options of solid waste, landfills are the only management technique that is both necessary and sufficient. According him, some wastes are simply not recyclable, many recyclable wastes eventually reach a point where their intrinsic value is completely dissipated and they no longer can be recovered, and recycling itself produces residuals. It must be remembered that landfill will always be required not only because certain materials cannot be processed or

recovered but also because there is always a residue from the other waste management options mentioned above (Rainer, 2019 emphasis mine). According to the United States Agency for International Development (USAID 2019) sanitary landfills require much greater initial investment and have higher operating costs than controlled dumps. Full community involvement throughout the life cycle of the project is essential. Proper design, operation and closure also require a much higher level of technical capacity. They have therefore provided the following suggestions for managing sanitary landfills:

2.5.7 Sitting:

Sitting is possibly the most difficult stage in landfill development. Landfills should not be sited in wetlands or areas with high-water table, in floodplains, near drinking water supplies, along geological faults or seismically active regions, within two kilometres of an airport. They can however be sited on clay deposits. If a landfill is near a high water table, this leachate can easily seep into the groundwater, contaminating it with harmful chemicals and pathogens.

2.5.8-Design:

To mitigate environmental impacts, sanitary landfill designs should include:

1. An impermeable or low-permeability lining (compacted clay and polyethylene are most common in developing countries; geopolymers and asphalt are prevalent in the developed world).
2. Leachate collection, monitoring, and treatment.
3. Gas monitoring, extraction, and treatment.
4. Fencing to control access.
5. Provisions for closure and post-closure monitoring and maintenance.

These guidelines will ensure that sanitary landfills are properly managed to forestall any potential surface and groundwater contamination; health and physical threats to waste pickers and sanitation workers; and methane emissions.

2.6 Integrated solid Waste Management Approach

The integrated project includes the following activities:

1. To develop an efficient waste collection system where the sorting of waste is done at household levels. This approach requires the supply of different waste collection bins for degradable and non-degradable materials. This will be preceded by an intensive public education system to teach and train households on the waste sorting system.
2. Another one is the processing of the non-degradable plastic waste into different uses.
3. Also, the processing of the degradable waste into bio-fertilizer. In partnership with the poultry farmers and cattle rears, waste will be collected as inputs into the organic fertilizer production. The project will support the utilization of organic fertilizer for commercial vegetable and food crop production under greenhouse farming systems. Horticultural crops mostly vegetables would be the main productions. Several youths would be employed to produce organic products for the consuming markets under the certification process.

The study however takes into consideration the following areas under integrated solid waste management systems;

1. Integrated community-based waste management.
2. Challenges that confront community-based waste management systems.
3. Measures to improve community-based waste management systems

Integrated community-based waste management

Waste management (or waste disposal) includes the processes and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process and waste-related laws, technologies, economic mechanisms (Costa, et al., 2010)

Waste pickers, burning, e-waste in Agbogbloshie, a site near Accra in Ghana that processes large volumes of international electronic waste. The pickers burn the plastics off of materials, and collect the metals for recycling. However, this process exposes pickers and their local communities to toxic fumes. Waste management deals with all types of waste, including industrial, biological, household, municipal, organic, biomedical, radioactive wastes. In some cases, waste can pose a threat to human health. Health issues are associated throughout the entire process of waste management. Health issues can also arise indirectly or directly. Directly, through the handling of solid waste, and indirectly through the consumption of water, soil and food. Waste management is intended to reduce adverse effects of waste on human health, the environment, planetary resources and aesthetics. Proper management of waste is important for building sustainable and enviable cities, but it remains a challenge for many developing countries and cities. A report found that effective waste management is relatively expensive, usually comprising large percentage of municipal budgets. Operating this essential municipal service requires integrated systems that are efficient, sustainable, and socially supported. A large portion of waste management practices deal with municipal solid waste (MSW) which is the bulk of the waste that is created by household, industrial, and commercial activity. According to the Inter-governmental Panel on Climate Change (IPCC), municipal solid waste is expected to reach

approximately 3.4 Gt by 2050; however, policies and law making can reduce the amount of waste produced in different areas and cities of the world. The cause is due to inefficient garbage management, which has a significant negative influence on the environment and public health. Therefore, environmental conservation and sustainable growth are urgently needed in Pakistan. (Author, 2021).

Integrated Waste Management is a system that seeks to combine waste generation, on site waste handling, waste collection, and treatment and disposal methods in an environmentally sustainable, economically feasible and socially acceptable manner (Asefi, Shahparvari, & Chhetri, 2020). This involves a combination of waste management practices while considering their 'hierarchy'. The hierarchy ranks waste management practices in a preferred order begging with: Waste minimization-Re use of materials-Recycling-Biological Treatment-Incineration (with energy recovery first if possible)-Landfilling.

The IWM approach seeks to integrate waste from different sources-domestic, industrial etc into the system to minimize cost and allow for inclusion of various means of treatment for the aggregate waste. Overall, the system should include:

i. A holistic approach which assesses the overall environmental burdens and economic costs of the system;
ii. Allow for strategic planning using a range of collection and treatment methods which focus on producing less waste and in effectively managing waste which is still produced;
iii. Handling all materials in the solid waste stream rather than focusing solely on specific materials or sources of materials (Hazardous materials should be dealt with within the system, but in a separate stream)

iv. Promote environmental sustainability through reducing the environmental burdens such as emissions to air, land and water;

v. Economically feasible by driving costs out and adopting a market-oriented approach by creating customer-supplier relationships with waste products that have end uses and can generate income;

vi. Enhance social acceptability by incorporating public participation and ensuring individuals understand their role in the waste management system. (This is very key for the success of an IWM system. It could be promoted through education programs, awareness creation through various forums such as public barazas, integration in the education system;)

Many countries face significant challenges with waste management. The main goal of solid waste management is to protect human health, the environment, aesthetics, land usage, and the economy from the negative effects of incorrect solid waste management (Tchobanoglous, 2016). A coordinated effort in public mobilization to influence residents' attitudes toward waste material handling and disposal is thought to increase the effectiveness of waste management strategies.

Challenges that confront community-based waste management systems

The management of solid waste has proven to be a daunting task for many towns and cities in developing countries. This is evidenced by the large number of uncontrolled dumps, gutters choked with garbage to various degrees and the irregular collection of waste among many others (Das, et al., 2019). These problems are financial, technical (this has to with the equipment used) and institutional. This affects the amount of solid waste collected and managed and how well the management practices meet standard methods (Sukholthaman & Shirahada, 2015). Waste management institutions in many countries are faced with financial problems making it difficult for them to pay

contractors and procure equipment's for the collection and disposal of waste while raising the required internally generated funds to support their operations proves daunting for most of the local government (Oduro-Appiah, Scheinberg, Mensah, Boadu & de Vries, 2017). There are also technical challenges facing the waste management departments. This is due partly to the fact that most of their employees lack adequate technical knowledge in managing solid waste. The other technical issue is that the equipment's for waste management are mostly imported and do not last longer due to varying weather conditions. The cost of the equipment sometimes compels the authorities to purchase used ones which are usually at the tail end of their lifespan (Sarfo-Mensah, Obeng-Okrah, Arhin, Amaning, & Oblitei, 2019). In certain cases, equipment is not even available to collect the waste as found by Kironde (2017 cited by Baabereyir, 2019). Poor institutional arrangement has also been found to be a barrier to effective solid waste management in Ghana. According to the UN-habitat (2019 cited by Baabereyir, 2019) it is common to find many institutions involved in the delivery of solid waste management and other municipal services. These institutions often have no clearly defined roles (Ogawa, 2020 cited by Baabereyir, 2019). This situation hampers effective solid waste management as activities are mostly uncoordinated. The enforcement of legal provisions is also an institutional issue, as there are always complains of inadequate staff and logistics. It is important to ensure that these bottlenecks are adequately tackled to ensure effective domestic solid waste management.

Measures to improve community-based waste management system

The importance of raising awareness and educating people about the environment cannot be overstated. The first step in resolving this urgent issue, particularly in developing nations' urban centres, is understanding what residents believe and do about

garbage. In the realm of environmental remediation and agriculture, biodegradable waste materials can be efficiently handled and disposed of for land uses (Adekunle et al., 2020). The informal sectors in underdeveloped nations have played a significant role in controlling solid waste because they gather and recycle used items with economic value. (Wilson et al., 2019). The e-logistic conceptual model for plastic waste that the researchers developed includes raw material data in each bank, allowing each waste bank and the manager of the recycled plastic production process to monitor the data online in real-time. But before applying the suggested model, it should be validated through a numerical experiment using information from local community-based waste banks.(Wulung et al., 2021).

People who work for independently sponsored and organized waste management services in urban areas that are independent of local government bodies typically make up this informal sector of the urban waste management industry (Guibrunet, 2019). Household waste collectors, scavengers and rubbish pickers, unofficial street sweepers, scrap collectors or itinerant waste purchasers, and dealers or traders either financed by non-governmental organizations or independently managed make up the informal waste management sector. Non-governmental organizations (NGOs) and community-based organizations (CBOs) can promote effective trash handling, which enhances the waste management system. In developing nations including the Philippines, Indonesia, Thailand, Malaysia, and Vietnam, a community-based organization that encourages recycling has been developed. This has benefited both individuals and communities. Budihardjo et al. (2022) proposes a community-driven material recovery facility (CdMRFs) in the Indonesian city of Semarang to carry out a descriptive study with the participation of all stakeholders to describe the current state of CdMRFs. The findings suggest that while working at the neighborhood level, CdMRFs have advantages and

disadvantages that must be taken into account. In spite of the fact that CdMRF practices have the potential to generate revenue by recovering the value of recyclable waste materials, some members of the community do not trust CdMRFs to recycle their waste because the majority of CdMRFs are started by individuals rather than as part of a formal local community program (Budihardjo et al., 2022). In several parts of Indonesia, waste bank is used for community-based garbage management. The research in southern Surabaya indicates that there have been 374 garbage banks since 2012, with a 0.55 tonne/day or 0.05% reduction effort against the total waste (Maulana & Soesanto, 2021).

Satori et al. (2018) claim that solid waste management issues affect social and economic environments in addition to the environment. In municipal SWM, integrated waste management (IWM) is a choice that needs to be investigated. In order to connect the formal system (government) with the non-formal systems (the informal sector/IS and community-based activities), it is important to build models of an IWM system. Since there are 59 elements that might affect IWM, it is important to incorporate the roles of all three groups into a single system. All of the elements, however, are not applicable to the execution in the Bandung municipality because every city and nation has unique circumstances and pressing issues (Satori et al., 2018). For the SWM department, AMC, Ahmadabad, Puhorit et al. (2016) offer an m-gov service developed as an Android mobile application. The application uses real-time data gathered from an entirely automated solid waste collection process that integrates RFID, GPS, GIS, and GPRS, as suggested in the authors' earlier work. The mobile application makes it easier for residents to interact with the cleaning process in their neighborhood, file complaints in the event of a failure, and track the progress of their concerns, which SWM personnel may manage using the same app. (Purohit et al., 2016).

Studies are being done in Gunung Kidul Regency to determine how many garbage banks are being reduced in relation to waste generation. The Waste Bank in Gunung Kidul Regency is currently able to reduce garbage by 5.86%, totalling 6,423 m3 of reduced waste per year. The advantages of having a trash bank include those related to waste management from an economic and social perspective. Out of the total non-organic garbage, there is a 17.49% chance of recycling it (Maulana & Soesanto, 2021).

In order to turn the Jodipan slum area in the city of Malang into a tourist hamlet, this study assessed the branding of a slum project as a social marketing venture. An action-evaluation study project was carried out between June 2016 and October 2017 by the communications division of a significant public institution in Indonesia using a combination of marketing and planning-oriented methodologies (Sulistyaningsih et al., 2021). The goal of the study is to examine the changes that must be made in an Indonesian village in order to strengthen the ecotourism industry and resolve severe waste management issues, as well as to examine the innovations made to raise the standard of environmental quality for the community's residents (Apriliyanti & Randelli, 2020)

As a foundation for developing legal arguments for resolving community-based waste management challenges, this study attempts to evaluate laws, regulations, and regional policies regarding trash management. The legal framework for residential waste management at the community level was examined through qualitative study that used the content analysis method. The waste management policy has moved from an initial pattern of garbage collection, transport, and disposal to landfills (TPA) to one of waste management beginning at the source (Pamuji et al., 2022). Integrated solid waste management (ISWM) is an important strategy for Indonesia to control production, it is

also acknowledged that economic techniques must be encouraged in order to tackle the waste issue jointly. In this case study, empirical methods are developed to comprehend how a volume-based waste fee could be incorporated into MSW collection services and how to implement a zero-waste approach in Indonesia by adapting resource recovery initiatives, adapted from Germany's mature experiences integrating the CE paradigm into the latter's MSWM practices (Kurniawan et al., 2021). Although tourism activities on one side bring economic benefits, on the other side they raise environmental problems. One of the problems is the increase of solid waste volume generated by the visitors. This study aimed to map the problems and investigate the stakeholders in current solid waste management in Nglanggeran (Nayono & Nayono, 2021).

In order to alleviate environmental inequities through community-based environmental education, the study looks into stakeholders' opinions of environmental injustices and community-based environmental education at Stortplaats. A problem known as environmental injustice involves an unequal distribution of environmental costs that unfairly exposes human life to environmental risks. Communities of low socioeconomic standing are disproportionately vulnerable to environmental stressors such as pollution, sewage oxidation ponds, unheard-of levels of land degradation from sand poaching, and inadequate infrastructure (Alifia, 2021).

2.9 Theoretical framework

The study adopted the Systems Theory which emerged in the mid-20th century, primarily through the work of biologist Ludwig von Bertalanffy, who introduced the concept of "General Systems Theory" in the 1950s. The theory has since been used across various disciplines, including sociology, biology, engineering, and management, to understand complex systems. the system theory holds several assumptions

First is a holistic perspective which emphasizes understanding a system as a whole rather than merely analyzing its individual components. Each part of the system is interconnected and contributes to the functioning of the entire system. Also, components within a system are interdependent; a change in one part of the system can affect other parts. This principle underscores the importance of considering interactions between components when analyzing systems. Thirdly, every system has defined boundaries that separate it from its environment. These boundaries help identify what is included in the system and what lies outside it. Again, systems often have feedback mechanisms that can be positive (enhancing changes) or negative (counteracting changes). Feedback loops help regulate the system and maintain balance. Lastly, the theory holds that systems are dynamic and can evolve over time. The interactions within the system and with the external environment can lead to changes in structure, funcion, and behavior.

When examining the Integrated Solid Waste Management (ISWM) system in Bechem Municipality, Systems Theory provided a comprehensive framework for understanding how various components interact and impact waste management outcomes. It was a window through which the entire ISWM system, including waste generation, collection, transportation, recycling, treatment, and disposal was analysed in the Bechem Municipality. This approach helps identify the relationships between different stages of waste management and their combined effects within the study area. Also, it, required that an investigation was taken on how various stakeholders (local government, waste management companies, community members, and NGOs) interact within the ISWM system. Understanding these relationships can reveal collaboration opportunities and potential conflicts.

The boundaries of the ISWM system in Bechem Municipality was focused on relevant factors, such as socio-economic conditions, regulatory frameworks, and technological infrastructure. This helped to isolate the internal components from external influences. Moreover, community feedback on waste collection services can lead to adjustments in operational practices, which in turn can improve service delivery.

The ISWM system adapts to changes, such as population growth, changes in waste composition, or shifts in regulatory policies. Understanding these dynamics can inform future planning and resource allocation.

By viewing the ISWM system through a systems lens, systemic challenges (e.g., inadequate funding, lack of public participation) and opportunities for improvement (e.g., enhanced recycling programs, community engagement initiatives were identified. The Systems Theory provided a valuable framework for assessing the Integrated Solid Waste Management system in Bechem Municipality by emphasizing the interconnectedness of various components, the importance of feedback mechanisms, and the need for a holistic understanding of the system.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter elaborates on the methodology employed in this study. This chapter describes the research approach, research design, setting, Population of the study, sample and sampling procedure, instrument of data collection, trustworthiness, data analysis and ethical consideration.

3.2 Research Approach

The research approach used for this study was qualitative. Qualitative research offers the researchers a better understanding of the existing problem (Naslund, 2015) and enhanced the collection of adequate information to identify issues that will set the focus for the next stage of the research.

3.3 Research Design

The design used was a case study. A research design is a strategy for answering research questions using empirical data. Creating a research design means making decisions about: the overall research objectives and approach, the type of research design used, sampling methods or criteria for selecting subjects and data collection methods. Lee and Saunders (2017) also defines research design as the general plan of how the questions would be answered. A case study research design was adopted for this study. In general, the case study design is used when the researcher seeks to find the "how" and "why" of a real-life phenomenon (Yin, 2015). This explains how domestic waste is managed in Bechem and the reasons for the methods employed. The case study is preferred here because it answers questions that deal with operational links needing to be traced over time rather than mere frequencies or incidence (Yin, 2015).

3.4 Setting

The setting of the study is the entire Bechem Municipality. Bechem Municipality is one of the 6 administrative and political districts in the Ahafo Region of Ghana. The district was upgraded to a municipal status in 2019 and this has changed the structure of the area significantly. The municipality lies between latitude 1°40'N and 2°45'N and longitude 9°32 to 10°20W, thus covering an area of approximately 23,474 square kilometres which is about 32% and 2.56% of the total land area of the region and the country respectively.

3.4.1 Location and Size

Tano South is one of the Six (6) Districts in the Ahafo Region of Ghana. It lies between latitudes 7º00'N and 7º25' N and between longitudes 1º45 W and 2º15 W. It is bounded on the North and East by the Offinso and Ahafo-Ano South Districts, both in the Ashanti Region. On the South, it is bounded by the Ahafo-Ano North District, also in the Ashanti Region and on its West and South-West by Tano North Municipal Assembly. The Municipal has a total land area of 1,500 square kilometres, which is about 20 percent of the total land area of the Ahafo Region. The Municipal Strategic Location as the entry point into Ahafo Region from southern Ghana puts it in a unique position to attract tourists if that sector could be well developed.

3.4.2 Structure of the Municipality

Most of the people in the study area are peasant farmers and traders. The population is heterogeneous comprising Akans, Frafras, Dagaabas and Ewes among others. Basically, the agricultural sector supports the major economic activities of the municipality and employs about (66.6%) of the labour force (Abdul-Latif, 2017). The major food crops grown in the area are maize, groundnuts, tomatoes, and yam. Cash crops such as cotton, cocoa, cashew nuts are also found in the area. Abdul-Latif (2017),

observed that the development of the Bechem Municipality is saddled with lack of funds and high rate of illiteracy to deal with when it comes to the collection of revenue for the Assembly. Sanitation facilities in the municipality are still very poor and malaria continues to be a major disease in the area.

3.5 Population

Population is defined as complete set of individuals, objects, or events having common observable characteristics in which the researcher is interested to study (Agyedu et al, 2016). According to Polit and Hungler (2014), a study population reflects the entire aggregate of cases that meet designated set of criteria. It is the participants the researcher made generalizations of his finding on. Bryman (2016) defined population as any set of persons or subjects that possess at least one common characteristic. The population for this study consisted of Bechem Municipal Assembly members, Municipal Finance officer, Zoomlion/ Waste Management Department and the households in Bechem township.

3.6 Sample and Sampling Procedure

A sample is a set of respondents drawn from a larger population about which qualitative and quantitative information is sought. It is desirable to select a sample in such a way that the researcher is assured that certain sub groups in the population (class, sex, etc) would be represented in the sample. Out of the total population of 625 households, a sample size of 12 households were selected through purposive selection. In each household, a maximum of 5 individuals were interviewed in a focused group discussion. In addition, three other participants including one assembly member, the Municipal finance officer and an officer from the Waste Management Department were interviwed through a purposive sampling technique.

3.7 Instruments for Data Collection

The instruments for data collection are the tools used by researchers to actually collect data in the research process. The data collection methods which the researcher used for the study was face-to-face interview. Interview was used to engage senior officers from the Waste Management Department and households in the municipality. The engagements offered the researcher a very good initial understanding of solid waste management by the assembly, including the opportunities and challenges that confront the assembly with regards to waste management.

3.7.1 Face-to- Face Interviews

The face-to-face interviews were used to collect data from the institutions and key stakeholders in Bechem township. Interviewees in the families included both available men and women. Men were taken into consideration here even though it is widely known that women are the housekeepers and are in charge of cleaning and getting rid of rubbish because their resources are needed to pay for services. These institutions and stakeholders in solid waste management included; Waste Management Department (WMD), assembly members and the households in Bechem Township.

3.8 Trustworthiness

Trustworthiness or rigor of a study refers to the degree of confidence in data, interpretation, and methods used to ensure the quality of a study (Pilot & Beck, 2014; Connelly, 2016). In each study, researchers should establish the protocols and procedures necessary for a study to be considered worthy of consideration by readers (Amankwaa, 2016). Criteria outlined by Lincoln and Guba (1985; Connelly, 2016) are accepted by many qualitative researchers. These criteria include credibility, dependability, confirmability, and transferability; they later added authenticity (Guba

& Lincoln, 1994; Connelly, 2016). Each of these criteria and the typically used procedures have been outlined.

Credibility is the how confident the qualitative researcher is in the truth of the research study's findings. This boils down to the question of "how do you know that your findings are true and accurate?" To ensure credibility, the researcher employed peer examination where peer reviewers were made to comment on the findings and also examine the plausibility of the result (Connelly, 2016).

Transferability is how the qualitative researcher demonstrates that the research study's findings are applicable to other contexts. In this case "other context" can mean similar situations, similar populations, and similar phenomena. To achieve transferability, the researcher ensured a detailed description of respondents' characteristics such as age, sex, marital status, level of income and education and other essential demographic characteristics (Connelly, 2016).

Confirmability is the degree of neutrality in the research study's findings. In other words, the findings are based on participants' responses and not any potential bias or personal motivations of the researcher. This involves making sure that researcher bias does not skew the interpretation of what the research participants said to fit a certain narrative. To establish confirmability, the researcher engaged in a thorough reflection, reading and re-reading of responses to avoid possible biases in data interpretation.

Finally, dependability is the extent that the study could be repeated by other researchers and that the findings would be consistent. The researcher allowed for audit trial which made other researchers to read through and authenticate the findings of the research (Connelly, 2016).

3.9 Data Analysis and Presentation

Due to the qualitative nature of the study, the descriptive and thematic analysis were used to analyse the data obtained based on the research questions. As observed by Natamba (2015), data obtained from the field in raw form is difficult to interpret. The initial data collected was subjected to quality checks to ensure that the recordings were correctly done with minimal errors. This entailed transcription of the recorded interviews. The transcripts were then read and re-read to identify and analyse emerging patterns. The researcher looked for connections between these emerging patterns categorizing and grouping similar information under the main themes based on their connections. The researcher deemed it important to note quotations and observations made during the interviews and their sources. Care was taken to avoid discarding any data, as this could be reverted to in a later analysis.

3.10 Ethical Considerations

Ethical considerations in research are set of principles that guide the research designs and practices. Researcher must always adhere to certain code of conduct when collecting data from people. The goals of human research often include understanding a real- life phenomena, studying effective treatments, investigating behaviors, and improving life in other ways (Gupta, 2017). The researcher ensured that, the participants were fully informed about the main purpose of the research. Collection of data from any participant was not done until full verbal consent was obtained. Each participant was told of their right to choose to remain in the research or to withdraw at any stage. Pseudonyms were used to protect the participants' identity and to ensure anonymity. The tape-recorded data was securely stored on a password protected drive during the period of the research.

CHAPTER FOUR

DATA ANALYSES AND DISCUSSION

4.0 Introduction

This chapter presents the data collected from the field in the Bechem Township. The section therefore presents data on types of solid waste generated in the area, place of disposal by households, the availability of domestic solid waste management facilities, solid waste collection and final disposal, resources available for managing solid waste, and the capacity of the waste management institutions in managing solid waste in the area. The households that were interviewed in a focused group discussion were categorized into groups ranging from A to L. Three other participants including one assembly member, the Municipal Finance officer and an officer from the Waste Management Department were interviewed through a purposive sampling technique.

4.1 Biodata of Respondents

The table below presents the data on educational attainment of respondents.

Table 1. Educational background of participants.

Level of Education	**Frequency (F)**	**Percentage (%)**
Never	15	23.8
Primary	7	11.1
Middle school/JSS	8	12.7
Senior High/Vocational	23	36.5
Tertiary	10	15.9
Total	**63**	**100**

Source; Field data (2023)

As illustrated in table 1, 11.1% of the respondents had primary education, 12.7% had middle or Junior High school education, 36.5% had secondary education or vocational

education while 15.9% had tertiary education. However, 23.8% of all respondents have never had any form of formal education. Aggrey and Douglason (2010) hypothesized that the higher people's level of education, the more they would appreciate the consequences of mishandling solid waste, and the more they would be willing to pay in order to avoid the risk of being victims of an unclean environment. They further emphasized that education relates to a better understanding of the problem of solid waste management (Aggrey and Douglason, 2010).

4.1.1 Types of Solid Waste Generated

One of the areas the researcher was interested in was to explain the types of solid waste generated at Bechem in the Tano South municipality. Establishing the types of solid waste generated in the study area is important because adequate knowledge on the types of solid waste generated in the town will give the Waste Management Department/ZoomLion a clear idea about the appropriate method for disposal. This knowledge of the components of the waste stream would enable them to know whether to use the integrated waste management model comprising reduce, recycle and reuse, combined with incineration and some level of land filling or source separation and composting. In view of that the researcher asked the question "Which type of waste do you normally generate". In responding to this question, Adwoa, a participant from household 'A' respondents that;

> There are a lot of plastics that we generate in this community (Atekyem). Sometimes, the skips overflow with plastic waste even more than the organic waste.

Similarly, Kwame from the same household responded that;

> The waste that we generate is mostly a mixture of organic and plastic. Most of it is organic but we mostly have a lot of plastics too. (Kwame).

There were evidences by the blighting of dumps and open spaces by polythene bags, a clear indication that this fabric was greatly used in packaging food in the town. In confirmation to that, another Maame adwoa, a participant in household 'B' responded that;

> Most of the waste generated here are food waste packaged in disposable plastic bags. Most people go to market and come home with a lot of polythene bags which they throw away afterwards

Similarly Owusu, another participant in the same household responded that;

> Mostly the waste is full of organic matter which can easily rot but they are usually mixed with other waste materials that are not organic and so they cannot rot especially the polythene bags

Responding to the same question, Enock, a participant in household 'L' said;

> Most of the waste we generate are usually organic waste from the food stuffs we purchase from the market which we mostly wrap in polythene bags and dump or burn them at our back yard and sometimes we just throw them on the ground because the can get rotten.

The above responses show that most of the plastics generated in the study area were organic and plastics which were usually mixed together and dumped. Even though the Waste Management Department could not provide a percentage breakdown of the share of the various components of the waste stream, scouting in the study areas confirmed that plastics were the highest components of solid waste, by volume, generated by the households. However, the plastics were mixed with large amount of organic waste from households.

4.1.2 Place of Solid Waste Disposal by Households

Solid waste disposal constitutes one of the important elements of the solid waste management process. Positive externalities exist in proper waste disposal, since the whole community receives health and safety benefits from the proper disposal by

others. Knowledge of where the households dispose of their domestic solid waste provides a clear indication of the kind of management system in place for solid waste management. The researcher was also interested in how and where residents in the study area disposed off their waste. To ascertain this, the researcher asked the question "Where do you usually dispose off your waste?" In responding to this, Joshua, one of the participants from household 'D' said;

> For this community [Atekyem] we usually dump our waste in skips provided by the Assembly. It's just that where the skip is located is far from some of us so sometimes we just have to burn it so to avoid walking long the distance.

The study found that most of the residents in the study area disposed their waste inappropriately or at unapproved locations. George, a participant from household 'D' said;

> The challenge is the human attitude towards waste management. Because people dump waste indiscriminately, people will carry refuse from their homes and dump it outside the container, instead of dumping it inside. They claim the waste company will come and collect.

Mr. Selman, a participants in household 'C' also confirmed the poor attitude of the people and alluded to the claim that most of the residents dumped their waste at inappropriately and at unapproved places.

> Some of the urban residents will intentionally litter solid waste, and say that if they don't litter solid waste, the waste companies who are responsible for managing solid waste would not have work to do. The community thinks it is the responsibility of waste management companies to keep the environment clean and will litter indiscriminately.

Some also either burry or burn the plastic waste and dump the organic waste in the community skips provided. Mr. Kumah of household 'G' said;

> For me, sometimes I burn the plastic substances out and throw the organic ones into the community skip. Because I don't mix them up. The plastic ones can burn so I separate it from the food materials and burn it outside and then I package the food ones in a big black polythene and then throw it away.

Taking a walk around the study area, it was observed that most of the skips were overflowing, there were other places where waste was dumped openly, and others dumped their waste in open gutters while others simply burned them at their backyards. As observes in the study area, majority of all households dispose their domestic solid waste at unauthorized places. These include their backyards, open space in front of their houses and open depressions.

The researcher was also interested in finding out how long it took residents to dump waste in the community skips. To achieve this, the researcher asked participant the question "how long does it take to get to the community skips provided? In responding to the question, Mr. Agyapong of household 'K' said;

> The distance from where I stay and where the skip is located is a bit far and my children are the ones that go to dump the waste so they are always keeping long when they go to dump the waste.

In responding to the same question, Joshua, a participant in household 'H' said;

> As I said earlier, it's just that where the skip is located is far from some of us so sometimes we just have to burn it rather than walking that far distance to dump the waste. And mostly, my children are the ones that go to dump it so it takes time for them to return.

Similarly, Joyce from household I responded that;

> The waste skips are located far from some of us so we have a bump site somewhere here that we also dumb and burn. That one is not far from here so it makes it easier to dump our waste.

However, at Atekyem, where the communal skip containers are at acceptable walking distances from the houses, some of the people still dispose of their waste indiscriminately. According to Mr. Edmund, an assembly member responded that;

> Most of the residents in Atekyem and other surroundings towns are not very much educated and so they have little or no knowledge about what proper waste management is. Most of them burn their waste sometimes closer to electricity poles and others will just dump them at any place that is convenient for them. Some also dump them in gutters, hoping that the rains will carry them.

The lower usage of the communal container explains the observation that most areas in the town do not have communal containers for disposal of waste.

One other area the researcher was interested in was to ascertain whether participants paid for waste disposal or not and how much they paid. Below were the responses of participants when were asked how much they paid for waste disposal. Rosemary in household 'E' said;

> The cost of disposing waste in this community (Adum) is too much for some of us. We can't simply afford to pay for it….For every disposal, we have to pay 2 cedis and that is too much.

Mr. Isaac Oppong from the same said;

> The money we pay for waste collection in this area is outrageous. For me I don't want to disclose it for personal reasons but am not happy with how much I pay simply to dispose off my waste.

In response to the same question, Osei, a participant from household 'J' said;

> The residents in this area mostly complain that the fees we charge are high and most urban residents find it difficult to pay, so they still do illegal dumping of refuse. Anytime it rains, they put the waste into the running water.

From the above, it was noticed that residents in the study area were not happy about the amount they had to pay to dispose off their waste. They complained about the fees they had to pay in order to dispose their waste and as a result, they sometimes resort to disposing their waste at unapproved places. There was also the problem of unwillingness or otherwise inability for the residents to afford paying for the disposal of their waste.

However, the indiscriminate disposal of refuse cannot be wholly blamed on the inadequate communal containers in the town. The other is a total lack of education on solid waste management issues. According to Hamdi Nabeel (2016), good solid waste management has much to do with changing behaviours and habits. A person's long held attitude can only be changed through education. The researcher asked the question

'Have you ever been educated on proper waste disposal by the assembly? Joseph from household 'F' responded by saying;

> We have poor communication channels with the Waste Management Department and limited access to information that will help us to support and take part in proper solid waste management.

Similarly, Mr. Abdul Hamid at the Waste Management Department in response the question confirmed by stating;

> What we can say is that we do not provide adequate education and awareness raising on proper solid waste disposal to the urban residents, which is also a cause for the challenges of solid waste management.

Afia from household 'A' responded that;

> I don't remember if there has been any education about how we should properly manage the waste that we produce here (adum). For me, I only see adverts on television that talks about how we should throw (dump or dispose) off the waste

Unfortunately, most of the participants in the study area confirmed that there has not been any form of education to enlighten them on solid waste management. However in Bechem, Safoa of household 'D' responded to have been educated on proper waste management;

> Ohh, not so much, but one in a while some people come around with some car to announce that we should dumb our rubbish here or there or we shouldn't dump it here or there.

4.2 Equipment and Resources Available in Collecting the Waste Generated in Bechem in the Tano South Municipality

The study was also interested in ascertaining the resources and equipment and resources available in managing the waste generated in the study area. In relation to that the researcher sought to find out the quantity of waste generated in the study area. This was important to establish whether the resources and equipments available are sufficient enough to properly manage the waste generated. In view of this, the researcher asked the question 'What is the quantity of waste generated in this Town?. In response to the question, Mr. Agyapong from the Waste Management Department said that,

> A large amount of waste comes from domestic sources and they are organic in nature. Considering the current estimated population (4,943) of Bechem, this provides us with a total daily waste generation of 2,224.35 tonnes.

The ZoomLion Ghana Ltd/Waste Management Department estimated that about 0.45kg of Solid waste is generated per person per day (Mensah and Larbi, 2005) which included food waste, wood, glass, plastic paper and metals. According to Hoornweg and Bhada-Tata (2012), urban residents produce twice as much as their rural counterparts. The amount of MSW is growing faster than the rate of urbanization, 2.9 billion urban residents generated 0.68 billion tons of waste per year sixteen years ago but in 2012 3 billion residents were generating 1.3 billion tons per year (Hoornweg and Bhada-Tata, 2012). The collection of solid wastes involves gathering of the waste's materials, transport by vehicles after collection to the location where the collection vehicle is emptied. However, Mr. Justice, a participant in household 'C' responded that some areas could not be accessed because of their location.

> we have a specific place that has been set for us to leave our waste so that they come to collect it at the appropriate time and that is what most of us do except some few who live a little far away from this place. Sometimes those who collect the waste do not want to go there due to the nature of the road. So sometimes it takes very long before they go to collect their waste.

The regularity of collection was an important component of the study. The population of an area, the composition of the waste stream and the volume of the available skip container play important roles in determining how regular the waste is collected. Collection of solid waste in Bechem was not regular, even in Atekyem where the population density is high. Kwesi from household L, in responding to the question on regularity of waste collection said;

> Our waste is not picked regularly here in Adum, we have to wait for our waste to be collected once every two or three weeks and it disturbs us a lot because it does not make the community look good.

Unlike other places, some of the participants in household I said that they do not have a specific day when waste collectors come for their waste. Desmond-Kwame, a participant from household 'I' said;

> We are not given a specific day when our waste is collected. Sometimes they come early, other times they come late. If they give us a specific time or day when they will come and collect the waste, then we will be ok.

Kudjo from the same household also said;

> Waste collection is poor in this area. Those who come for the waste are not regular at all so we suffer lot because it produces insects that disturb us so much.

When asked why this pattern of emptying the skip containers, Mr. Abdul Hamid from the Waste Management stated that there were no sufficient funds to ensure frequent collection.

> We have to pre-finance the solid waste collection before we are paid and the Municipal struggles to pay us and thereby delaying effective solid waste collection.

This situation can lead to unwholesome behaviours from the people. Some of these behaviours like dumping on the ground, instead of inside the container, and burning of the refuse in the containers, which were evident, especially in Atekyem.

4.2.1 Place of Disposal by Waste Management Department

The final element in the solid waste management process is disposal. This is done either through land filling or land spreading. Engineered land fill sites are the most appropriate place of final disposal for solid waste. Whether the wastes are incinerated or recycled, there would still be the need for some form of land filling. Mr. Abdul Hamid from the Waste Management said;

> There is no particular place the Waste Management Department/ZoomLion Ltd can point to as a final disposal site for solid waste in the Town. They resort to

> dumping in any available depression, whether in or out of town, that can contain the waste for the time being.

Benard, a participants in household 'D' also expressed the casual nature of waste disposal in the study area. These include open dumping which was predominant in the study area.

> This waste is just dumped there in the open. No conscious efforts to prevent it from being blown about by the wind. Interestingly, they are very close to homes. This behavior, if allowed to continue would lead to the bread of rodents and mosquitoes on these sites, and cause flooding.

Another participant, Efua, from the same household said;

> Sometimes because it takes too long before they (Waste Management Department) come to pick up the waste, we are forced to dump the waste ourselves either in the bush or anywhere we think it's good.

From the above, the response from the participants indicate that final disposal of solid waste in the study area is poor. When people generate waste they expect the waste management department to take sole responsibility in final disposal. However, the inability of the Waste Management Department to properly manage the waste affects residents in the study area such as the breeding of mosquitoes and rodents as well as aesthetic blight.

4.3 Capacity of Waste Management Institutions

Assessing the capacity of the Waste Management Department/ZoomLion Ltd will enable conclusions to be drawn on their effectiveness. An interview with the head of Zoomlion Ghana Ltd revealed the equipment holding capacity of the institution as shown below.

Table 1 Capacity of waste management institutions

Equipment	Quantity
Waste bins	20
Waste skips	6
Tricycles	6
Skip loaders	2

Source: Field Data, 2023

From the table above, there were a total number of twenty (20) waste bins, six (6) skips, six (6) tricycles and two (2) skip loaders. Among the selected neighborhoods, it was observed that only Atekyem had a good presence of communal skip containers, which were five (3) containers. Adum had two, even though it is much larger by the area. Even the available containers in Adum were about 800 metres to 1km apart. Zongo had one communal container while Ahenbronoso has none. The rest of the other areas of the town do not have communal skip containers. This situation has therefore led to people finding various ways to dispose-off solid waste, inundating the town with polythene bags. When interviewed, Mr. Abdul Hamid at the Waste Management Department said that;

> The skip containers available in the town are woefully inadequate. The general adequacy of facilities hampers waste management in the study area. And so we are not able to effectively collect all the waste generated in the town. In the area of personnel, the department has only 10 workers. These include the Director, who also mans the Zoomlion Ghana Ltd and other 9 workers, including the driver of the skip truck.

The above confirms the findings of Boadi and Kuitunen, that waste disposal methods used by low and middle-income residents of Accra include dumpsters provided by the Waste Management Department, however, these containers are inadequate and not emptied on time resulting in the disposal of waste into canals, water bodies and surface

drains (Boadi and Kuitunen, 2003). The department was also woefully under-resourced to carry out its duties. Mr. Yaw, a Municipal Finance officer responded that;

> We have solid waste management problems in the municipality, because of the inadequate number of equipment for collecting and disposing of waste. Non-availability of solid waste bins for the urban residents to dump solid waste in the Municipality lead to poor sanitation.

Negative attitudes of urban residents towards environmental sanitation in general, coupled with the perception that public waste will be collected by "the government" was highlighted by participants as a challenge to waste management in the study setting. The participants attributed these negative attitudes and perceptions by the urban residents to a lack of awareness and education on proper solid waste disposal and the potential effects of poor environmental sanitation on health and wellbeing. some participants explained that the majority of the urban residents are unaware of the associated risks and harmful effects of improper waste disposal to human life and the environment. Mr. Yaw, a Municipal Finance Officer said;

> The challenge is the human attitude towards waste management. Because people dump waste indiscriminately, people will carry refuse from their homes and dump it outside the container, instead of dumping it inside. They claim the waste company will come and collect

He further indicated that the urban residents hold the views that the local government authority is responsible for the collection, and final disposal of solid waste through their waste management departments, and their Environmental Health and Sanitation Department. He said;

> In some of the places, littering is perceived as acceptable by community residents since it offers the opportunity for people to be employed by the waste companies. And so if people do not lither or throw rubbish anyhow, they will not also get work to do.

According to Bernstein (2004), an adequate knowledge on attitudes and perceptions of stakeholders is required in the design and implementation of MSWM. He adds that

positive attitudes could be achieved through education and awareness campaigns about the effects of poor waste collection, the importance of proper waste disposal, and their responsibilities as waste generators as well as their right to satisfactory solid waste management services

4.3.1 Cost of Managing Waste

Another equally important area that the study sought to cover was to ascertain the cost of waste management in the study area. To achieve this, the researcher asked the question 'What is the cost of waste collection and who bear the cost of waste collection? In responding to the question, Mr. Abdul Hamid at the Waste Management Department said that;

> The cost of managing solid waste in this town include the fuelling of the skip loader and its maintenance and repairs. The other costs include payment of workers who normally take care of the waste.

Again he added that;

> The Zoomlion Ltd. collects the waste under contractual arrangements by the Municipal Assembly. The fuelling and maintenance of the waste collection vehicle is done by the Municipal Assembly. However, the cost of maintenance and repairs of the vehicle varies from time to time and it's very expensive to repair our machines.

The cost of fuelling the vehicle was however not disclosed. The bottom line was that, the amount designated for waste management was not enough. The Municipal Assembly Common Fund gives only a small percentage for waste management. In this, situation the department always had to wait until funds can be generated internally to empty the skip containers. This quite explains why the regularity of collection is very poor, as identified. Mr. Yaw from the Municipal Finance Office said;

> The Municipal does not charge residence for disposing waste. This is the major reason why the department is unable to provide more communal containers for waste collection (in the absence of funding). The department however expressed

> the willingness to adopt such a method if appropriate provisions can be put in place to ensure its success.

Mr. Abdul Hamid from the Waste Management Department further asserted that they had to rely on the Municipal Assembly for funds to run their services to the study area.

> How we get funding is that we have a contract with the Municipal Assembly and the Municipal pays for solid waste delivery services.

From the above response, it was found that the cost of waste management in the study area was very high which made it difficult to properly manage waste. Kironde (2017) cited by Baabereyir, (2019) opines that the cost of the equipment sometimes compels authorities to purchase used ones which are usually at the tail end of their lifespan. In certain cases, equipment is not even available to collect the waste. The result was the inappropriate alternative of dumping it in the open, into drains or being burnt. It was also observed that the residents in the study area do not practice waste segregation. Most organic waste was mixed up with plastic waste and this makes it difficult to treat waste.

4.4. Ways of properly managing solid waste in Bechem in the Tano south municipality.

One other area the study sought to explore was ways through which solid waste could be managed in the Bechem municipality. In order to achieve this workers at the waste management department were asked the question ‘how can the waste management problems be solved?’ In responding to the question, Mr. Abdul Hamid from the Waste Management Department said;

> I think that proper measures should be taken to ensure that residents do not dump waste at unapproved places. It is also important, that residents are taught to practice waste separations so that it will be easy to recycle the waste.

The response above is in line with Budihardjo et al. (2022) who proposes a community-driven material recovery facility (CdMRFs) in the Indonesian city of Semarang. Their findings suggest that while working at the neighborhood level, CdMRFs have advantages and disadvantages that must be taken into account. In spite of the fact that CdMRF practices have the potential to generate revenue by recovering the value of recyclable waste materials, some members of the community do not trust CdMRFs to recycle their waste because the majority of CdMRFs are started by individuals rather than as part of a formal local community program (Budihardjo et al., 2022).

In responding to the same question, Mr. Yaw from the Municipal Finance Office said;

> There need to be a lot of public education on how residents should manage their waste. Most of them do not have any idea what to do with the waste they generate and even if they have, some of them intentionally do the wrong things with the notion that the waste management department will have to come and clean up the waste that they make.

Similarly, Mr. Justice from household 'J' said;

> One thing is that people should be punished for dumping their waste at unapproved places so that they will desist from the act. If people are not punished, they will not see the need to keep the environment clean. If people are arrested, sent to court and fined heavily for dumping waste into gutters, they will refrain from doing so.

Respondents explained that when bye-laws are effectively enforced, it will force them to pay for solid waste disposal services. This is because should a person contravene any of the bye-laws, he or she would be sent to the sanitation court to be prosecuted.

Philip Osten from household 'J' responded that there should be enough dustbins to properly manage waste. According to him;

> There should be enough dustbins to collect the waste that people generate. Sometimes it is because of the lack of dustbins that people throw their rubbish anywhere. If the communities are provided with dustbins, it will be easier for them to dump their waste.

Agyapong, a participant from household 'A' in responding to the same question said that;

> Residents should be made to pay for waste disposal in the communities so that we can generate some funds to cater for waste management.

Managers avowed that most residents of the Municipality are not interested and willing to pay for the services of waste collection and disposal provided by waste companies but only feel responsible for the cleanliness of their homes. Boateng et al. (2016) are of the view that payments for communal collection services do experience some setbacks due to inadequate interface between service providers and residents. To them it is a cause for concern that about 10 percent of the households dump their refuse in open spaces. This may be attributed to the inability of some households to pay the amount charged for either house-to-house collection or for dumping at the communal refuse site.

CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

Having analysed and discussed the data collected from the field in the previous chapter, this concluding chapter would highlight the key issues worth noting. The various ways in which these issues can be tackled would also be suggested. As identified in the previous chapter, the key issues affecting solid waste management in Bechem are indiscriminate dumping, inadequate skip containers, lack of resources and poor education. Below are the key findings:

5.2 Key Findings

Below are the key findings in Bechem as they related to the functional elements of the solid waste management process.

The study revealed that communal skip containers were woefully inadequate in Bechem culminating in indiscriminate disposal of refuse. Indeed a majority of all households' resort to indiscriminate disposal. These include dumping refuse in open depressions (sometimes these are created by the households), open spaces in front of their houses and their backyards. The percentage share of indiscriminate to proper disposal could further be widened when we look at the whole settlement. The few skip containers available for disposal were however not too far from most households, as most of the respondents (in the neighbourhoods where skip containers were available) reached the sites under 3 minutes. The issue of education is also worth noting here. It has been observed that some households who have skip containers closer to them still dispose of their refuse indiscriminately.

The regularity of waste collection in Bechem was very poor, to say the least, and quite unacceptable. Waste collection was mostly carried out once in three weeks, sometimes more. This resulted to people dumping the waste any how in the vicinity of the skip containers. As illustrated in chapter four, some of the skip containers are even burnt. But the waste department was quick to blame the situation on lack of funding. Indeed, the department believes that they could be more responsive if the funds for waste collection are incorporated into the Municipal Assembly budget. Currently, they are no budgetary allocation for waste management. Worse still, the Municipal Assembly Common fund (MACF) does not cover waste management, they claim.

There was no landfill site for final disposal of waste. The waste management department resorted to dumping by convenience. By this, they dump the collected waste in any depression they find appropriate, sometimes very close to people's dwellings. This has the tendency to cause fires since waste generates methane gas, which is highly flammable. This is a direct affront to the basic planning principle of health and safety, as it puts properties and persons closer to the sites in danger. The settlement has no town plan to guide its development. It is questionable which factors the Environmental Health Department considers before allocating dumping sites, since they accepted that they determined where the refuse should be dumped. Even though one of the depressions they sometimes dispose the waste is out of town, about 5 kilometres, it is hardly used. The principle of convenience and by extension cost comes into play here, since it is the major reason for this disposal site's apparent unattractiveness. The implication of all this is that the town has no clear policy on what should constitute the most appropriate way of containing its waste.

Another issue worth mentioning here is the financing of waste management, more especially when there is no clear-cut source of funds for carrying waste management

activities in Bechem. The study revealed that waste management could finance itself in Bechem. This is evidenced by the high willingness to pay by most of the respondents. When the "pay as you dump principle" is initiated, it will provide the necessary funds for waste management. Based on the above findings, the following recommendations are proposed to ensure proper waste management in Bechem.

5.3 Recommendations

The following measures have been recommended to ensure effective and efficient waste management in Bechem. It is unquestionable that it will not be easy, but it is pivotal that it succeeds if we are to have a clear roadmap to the future and determine what is just the right way to managing Bechem's waste.

1. **Provision of Skips**

Having identified that the major problem facing domestic solid waste management in Bechem is a general inadequacy of skip containers, it is hereby recommended that more skip containers should be provided to give residents the opportunity to dispose their waste properly. At least, 13 more skip containers would be needed to provide waste management services in the neighbourhoods selected. This is a very conservative figure, and could be more if the whole settlement is covered. These skip containers should be placed within a radius of 200 metres, so that most residents can reach the site under 3 minutes.

2. **Education of Residents**

The provision of skips coupled with a rigorous public education would be the key to transforming solid waste management in Bechem for the better. Most residents do not understand why they should dump in skip containers, when they can just throw the refuse in front of their homes. This needs to be changed and can only be achieved through education. It is therefore recommended here that the radio stations in the town be used extensively to educate the people especially, high radio, Bechem F.M and "After 2 radio''. The Information Services Department van could also be used. Unit committees and religious bodies should also make it a point to educate their members on this very important issue, as it affects their well-being. Habits cannot be changed in a snapshot but with persistence, there would be a breakthrough.

3. Regular Collection

The current system of collection where the skip containers are emptied once in three weeks needs to be changed. The recommendation here is that the skip containers be emptied once in a week, especially at Atekyem where the skips get full speedily. When the skip containers are emptied on time, it will mitigate the current situation whereby the refuse is indiscriminately burnt in the skip containers.

4. Financing of Waste Management

The study revealed that the willingness to pay for improved waste management services is very high. Thus, with the provision of more skip containers, the "pay as you dump principle" should be initiated. The residents are also willing to pay any amount, ranging between GH¢ 0.20 to GH¢ 0.50, which would be imposed by the Municipal assembly. It is recommended here that such a policy should be backed by other provisions that make it criminal to dispose refuse indiscriminately, especially in the areas covered by the skip containers. Since some residents confided that they wouldn't dump in skip

containers if there were no sanctions attached. These sanctions could be in the form of paying fines, high enough to serve as a deterrent.

5. Provision of more Resources

It is understandable that the funds from the "pay as you dump principle" would only finance the collection of waste. It is therefore important that the Municipal assembly resources the waste management department adequately, by providing funds for more skip containers, as well as the maintenance of the skip loader trucks. There would also be the need for a compactor truck, if the recommendation for an engineered final disposal site is heeded.

5.4 Conclusion

Having gone through the various stages of this study, it is important at this concluding stage to examine whether the objectives for the study have been achieved. First, it was our objective to examine the means of waste disposal by households (place of disposal). In the study we identified that the means of disposal was indiscriminate resulting from lack of communal skip containers. Second, to analyse the frequency of solid waste collection in Bechem, to which we found that the regularity of collection was so poor, once in three weeks. Third, to analyse how the waste collected is finally disposed-off. With this, we realized that there was no final disposal site in Bechem and that the collected waste was dumped in depressions inside town. Fourth, to assess the capacity of the waste management institutions in managing solid waste in the area, which we found that the waste management department was seriously handicapped and needed serious resources to enable it rise to the task of effectively managing solid waste in Bechem. Fifth, to make recommendations for effective management of solid waste in the town, this has been done and is summarised below: provide more skip containers, education of residents on proper waste disposal, regular collection of waste, securing a

final disposal site, initiation of a “pay as you dump” principle, provision of more resources to the WMD, and adoption of Integrated Waste Management Model. The final objective was to add to the existing body of knowledge in this field, especially in Bechem. This study has definitely done so, since no study has ever been done on this subject in Bechem, as far as I know. Therefore, all the objectives set for the study have been achieved and are obviously the key factors affecting solid waste management in Bechem. It is therefore important that the above recommendations are implemented to ensure effective and efficient solid (domestic) waste management in Bechem.

5.5 Suggestion for Further Study

The researcher suggests that further research be conducted on the influence of gender on effective solid waste management in the study area.

REFERENCES

Abbasi, S. A. (2018). The myth and the reality of energy recovery from municipal solid waste. *Energy, Sustainability and Society*, *8*, 1-15.

Abdulfatah, A. K. (2023). Exploring Municipal Solid Waste Management in Nigeria: Challenges, Opportunities, and Roadmap for Sustainable Development.

Abdul-Latif, M. (2017). *Challenges of solid waste management in the Wa Municipality.* Thesis submitted to the Institute for Development Studies, Faculty of Social Sciences, University of Cape Coast, Ghana.

Adekunle, M. M., Sangodoyin, A. Y., & Wahab, B. (2020). Status of solid waste composition and quantity among varying households in Ibadan Metropolis, Nigeria. *International Journal of Education and Research*, *8*, 133-156.

Aggrey, N. & Douglason, G.O. (2010). Determinants of willingness to pay for solid waste management in Kampala City. Current Research Journal of Economic Theory, 2(3), 119 122.

Al-Dailami, A., Ahmad, I., Kamyab, H., Abdullah, N., Koji, I., Ashokkumar, V., & Zabara, B. (2022). Sustainable solid waste management in Yemen: environmental, social aspects, and challenges. *Biomass Conversion and Biorefinery*, 1-27.

Amasuomo, E., & Baird, J. (2016). The concept of waste and waste management. *J. Mgmt. & Sustainability*, *6*, 88.

Amri, S., Soesilo, T. E. B., Martono, D. N., & Supriatna. (2020). Optimization of waste management in developing countries with spatial approaches (Study case: Depok City and Curitiba City). IOP Conference Series: *Earth and Environmental Science*, 561(1). https://doi.org/10.1088/1755-1315/561/1/012021

Apriliyanti, A., & Randelli, F. (2020). Implementation of Community-Based Ecotourism through Waste Management: The Study Case of Sukunan Tourism Village, Yogyakarta, Indonesia. *Gadjah Mada Journal of Tourism Studies*, *3*(1), 43–55. https://journal.ugm.ac.id/gamajts/article/view/68449

Asefi, H., Shahparvari, S., & Chhetri, P. (2020). Advances in sustainable integrated solid waste management systems: lessons learned over the decade 2007–2018. *Journal of Environmental Planning and Management*, *63*(13), 2287-2312.

Author, C. (2021). *Content List available at Novus-Publishers (EJAST) European Journal of Applied Science and Technology-Novus e -*. *01*(01), 44–70. *119*(March

2021), 102488. https://doi.org/10.1016/j.habitatint.2021.102488

Azevedo, B. D., Scavarda, L. F. & Caiado, R. G. G. (2019). Urban solid waste management in developing countries from the sustainable supply chain management perspective: *A case study of Brazil's largest slum. Journal of Cleaner Production, vol*. 233, pp1377-1386. https://doi.org/10.1016/j.jclepro.2019.06.162.

Baabereyir, A. (2019). 'Urban Environmental Problems in Ghana: A Case Study of Social and Environmental Injustice in Solid Waste Management in Accra and Sekondi-Takoradi)', School of Geography, University of Nottingham, Bradshaw, A. D.,

Bernstein, J. (2004). Social assessment and public participation in municipal solid waste management. *World Bank Working Paper*, 463617-1202332338898.

Boateng, S., Amoako, P., Poku, A. A., Appiah, D. O., & Garsonu, E. K. (2016). Household willingness to pay for solid waste disposal services in urban Ghana: The Kumasi metropolis situation. *Ghana Journal of Geography*, *8*(2), 1-17.

Budihardjo, M. A., Ardiansyah, S. Y., & Ramadan, B. S. (2022). Community-driven material recovery facility (CdMRF) for sustainable economic incentives of waste management: Evidence from Semarang City, Indonesia. *Habitat International*, 119(March 2021), 102488. https://doi.org/10.1016/j.habitatint.2021.102488

Caiado, R. G. G., de Freitas Dias, R., Mattos, L. V., Quelhas, O. L. G., & Leal Filho, W. (2017). Towards sustainable development through the perspective of eco-efficiency-A systematic literature review. *Journal of Cleaner Production*, *165*, 890-904.

Chalhoub, M. S. (2018). Public policy and technology choices for municipal solid waste management a recent case in Lebanon. *Cogent Environmental Science*, *4*(1), 1529853.

Chandrappa, R., Das, D. B., Chandrappa, R., & Das, D. B. (2012). Waste from electrical and electronic equipment. *Solid Waste Management: Principles and Practice*, 197-216.

Connelly, L. M. (2016). Trustworthiness in qualitative research. *Medsurg nursing*, *25*(6), 435.

Costa, I., Massard, G., & Agarwal, A. (2010). Waste management policies for industrial symbiosis development: case studies in European countries. *Journal of Cleaner Production*, *18*(8), 815-822.

Das, S., Lee, S. H., Kumar, P., Kim, K. H., Lee, S. S., & Bhattacharya, S. S. (2019). Solid waste management: Scope and the challenge of sustainability. *Journal of cleaner production*, *228*, 658-678.

de Sousa Jabbour, A. B. L. (2015). Understanding the genesis of green supply chain management: lessons from leading Brazilian companies. *Journal of Cleaner Production*, *87*, 385-390.

Dhokhikah, Y., Trihadiningrum, Y., & Sunaryo, S. (2015). Community participation in household solid waste reduction in Surabaya, Indonesia. *Resources, Conservation and Recycling*, *102*, 153-162.

Ebikapade, A., & Jim, B (2016). The Concept of Waste and Waste Management. The Journal of Men's Studies, 6(4):88-96. doi: 10.5539/JMS.V6N4P88.

Guadagnin, M. R., Selau, C. C., & Cadorin, S. B. (2018). Management and management of solid waste in the municipality of Criciúma/SC. *Technology and Environment*, *24*, 159-180.

Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste management*, *33*(1), 220-232.

Guibrunet, L. (2019). What is "informal" in informal waste management? Insights from the case of waste collection in the Tepito neighbourhood, Mexico City. *Waste management*, *86*, 13-22. https://doi.org/10.1016/j.wasman.2019.01.021.

Gupta, S. (2017). Ethical issues in designing internet-based research: recommendations for good practice. *Journal of Research Practice*, *13*(2), D1.

Hoornweg, D., & Bhada-Tata, P. (2012). What a waste: a global review of solid waste management.

Husen, A. (2022). Micro household waste management and pandemic social impact relaxation; case study in DKI Jakarta. IOP Conference Series: *Earth and Environmental Science*, 986(1). https://doi.org/10.1088/1755-1315/986/1/01200

Indrianti, N. (2015). Perbandingan Penggunaan Tepung Ubi Kayu dari Umur Panen yang Berbeda dan Penambahan Tepung Jagung dalam Pembuatan Mi Kering. The Use of Cassava Flour from Different Harvest Time with the Addition of Corn Flour in Making Dried Noodle. *Journal Pangan , 24* (1), 63-74.

Jabbour, A. B. L. D. S., Jabbour, C. J. C., Sarkis, J., & Govindan, K. (2014). Brazil's new national policy on solid waste: challenges and opportunities. *Clean*

Technologies and Environmental Policy, *16*, 7-9. https://doi.org/10.1007/s10098-013-0600-z.

Kiyasudeen S, K., Ibrahim, M. H., Quaik, S., Ahmed Ismail, S., Ibrahim, M. H., Quaik, S., & Ismail, S. A. (2016). Introduction to Organic Wastes and Its Management. *Prospects of organic waste management and the significance of earthworms*, 1-21.

Krishnasamy, B. (2019). Automatic Waste Segregation and Monitoring system of Municipal Solid Waste.

Kubota, R., Horita, M., & Tasaki, T. (2020). Integration of community-based waste bank programs with the municipal solid-waste-management policy in Makassar, Indonesia. *Journal of Material Cycles and Waste Management*, *22*(3), 928-937.

Kurniawan, T. A., Avtar, R., Singh, D., Xue, W., Dzarfan Othman, M. H., Hwang, G. H., Iswanto, I., Albadarin, A. B., & Kern, A. O. (2021). Reforming MSWM in Sukunan (Yogjakarta, Indonesia): A case-study of applying a zero-waste approach based on circular economy paradigm. *Journal of Cleaner Production*, 284(xxxx). https://doi.org/10.1016/j.jclepro.2020.124775

Labambe, M. (2024). Predicting Waste Production Trends in Palu City Using Linear Regression Analysis. Advance Sustainable Science, Engineering and Technology (ASSET), 6(3):0240306-0240306. doi: 10.26877/asset.v6i3.523

Larbi, C. O., Atiemo, S. M., Kuranchie-Mensah, H., Kofi, S., Frimpong, W. K., & Aryequaye, F. (2015). Loss of secondary metals from informal recycling of e-waste at Agbogbloshie in Ghana.

Leal Filho, W., Saari, U., Fedoruk, M., Iital, A., Moora, H., Klöga, M., & Voronova, V. (2019). An overview of the problems posed by plastic products and the role of extended producer responsibility in Europe. *Journal of cleaner production*, *214*, 550-558. https://doi.org/10.1016/j.jclepro.2018.12.256.

Lee, B., & Saunders, M. N. (2017). Conducting case study research for business and management students.

Lima, P. D. M., Colvero, D. A., Gomes, A. P., Wenzel, H., Schalch, V., & Cimpan, C. (2018). Environmental assessment of existing and alternative options for management of municipal solid waste in Brazil. *Waste management*, *78*, 857-870. https://doi.org/10.1016/j.wasman.2018.07.007.

Malav, L. C., Yadav, K. K., Gupta, N., Kumar, S., Sharma, G. K., Krishnan, S., ... & Bach, Q. V. (2020). A review on municipal solid waste as a renewable source for waste-to-energy project in India: Current practices, challenges, and future

opportunities. *Journal of Cleaner Production*, *277*, 123227. https://doi.org/10.1016/j.jclepro.2020.123227.

Malav, L. C., Yadav, K. K., Gupta, N., Kumar, S., Sharma, G. K., Krishnan, S., ... & Bach, Q. V. (2020). A review on municipal solid waste as a renewable source for waste-to-energy project in India: Current practices, challenges, and future opportunities. *Journal of Cleaner Production*, *277*, 123227.

Marcussen, I. Ø. (2020). *Urban solid waste management, environmental governance, and private sector initiatives: a case from Nairobi, Kenya* (Master's thesis, Norwegian University of Life Sciences, Ås).

Marques, R. C., Simões, P., & Pinto, F. S. (2018). Tariff regulation in the waste sector: An unavoidable future. *Waste Management*, 78, 292–300. https://doi.org/10.1016/j.wasman.2018.05.028

Maschal Tarekegn, M., & Truye, A. Z. (2018). Causes and impacts of shankila river water pollution in Addis Ababa, Ethiopia. *Environ Risk Assess Remediat. 2018; 2 (4): 21*, *30*.

Maulana, Q., & Soesanto, B. (2021). The roles of waste bank as community-based waste management enhancing sustainable waste management in Indonesia.

McAllister, Jessica, "Factors Influencing Solid-Waste Management in the Developing World" (2015). *All Graduate Plan B and other Reports, Spring 1920 to Spring 2023*. 528. https://digitalcommons.usu.edu/gradreports/528.

Mehdi, Ghanbarzadeh, Lak., Milad, Ghaffariraad., HamidReza, Jahangirzadeh, Soureh. (2024). Characteristics and Impacts of Municipal Solid Waste (MSW). Springer water, 31-92. doi: 10.1007/978-3-031-52633-6_2

Mensah, J., Amoah, JO, Mattah, PA, & Mensah, A. (2023). Causes and effects of weak enforcement of environmental sanitation laws in Ghana. *Journal of Human Behavior in the Social Environment*, *33* (5), 663-684.

Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., & Mensah, MY (2015). Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. *Waste management , 46* , 15-27.

Moya, D., Aldás, C., López, G., & Kaparaju, P. (2017). Municipal solid waste as a valuable renewable energy resource: a worldwide opportunity of energy recovery by using Waste-To-Energy Technologies. *Energy Procedia*, *134*, 286-295.

Muthuraman, L., & Ramaswamy, S. (2019). *Solid Waste Management*. MJP Publisher.

Naslund, M. N. (2015). *Counselor education: A personal growth and personal development experience* (Doctoral dissertation, North Dakota State University).

Nayono, S., & Nayono, S. E. (2021). Mapping the Problems, Stakeholders, and Potential Solutions of Solid Waste Management in a New-Emergence Tourist Area: A Case Study in Nglanggeran, Gunungsewu UNESCO Global Geopark. IOP Conference Series: *Earth and Environmental Science*, 832(1). https://doi.org/10.1088/1755-1315/832/1/012066

Ng, K. S., Yang, A., & Yakovleva, N. (2019). Sustainable waste management through synergistic utilisation of commercial and domestic organic waste for efficient resource recovery and valorisation in the UK. *Journal of Cleaner Production*, 227, 248–262. https://doi.org/10.1016/j.jclepro.2019.04.136

Oduro-Appiah, K., Scheinberg, A., Mensah, A., Afful, A., Boadu, H. K., & de Vries, N. (2017). Assessment of the municipal solid waste management system in Accra, Ghana: A 'Wasteaware'benchmark indicator approach. *Waste Management & Research*, *35*(11), 1149-1158.

Owusu, G., Nketiah-Amponsah, E., Codjoe, S. N. A., & Afutu-Kotey, R. L. (2014). How do Ghana's landfills affect residential property values? A case study of two sites in Accra. *Urban Geography*, *35*(8), 1140-1155.

Paes, M. X., de Medeiros, G. A., Mancini, S. D., Bortoleto, A. P., Puppim de Oliveira, J. A., & Kulay, L. A. (2020). Municipal solid waste management: Integrated analysis of environmental and economic indicators based on life cycle assessment. *Journal of Cleaner Production*, 254, 119848. https://doi.org/10.1016/j.jclepro.2019.119848

Pamuji, K., Nasihuddin, A., Muslichah, S., Wahyoeningsih, K., Sukirman, S., Asik, N., & Rosyadi, S. (2022). Regulatory Review of Community-Based Waste Management in Banyumas District, Central Java. 13. https://doi.org/10.4108/eai.8-6-2021.2314338

Puopiel, F. (2015). '*Solid Waste Management in Ghana, the case of Tamale Metropolitan Area',* MSc Thesis, Kwame Nkrumah University Science and Technology, Kumasi- Ghana

Purohit, S. S., Bothale, V. M., & Gandhi, S. R. (2016). Towards m-gov in solid waste management sector using RFID, Integrated technologies. *ACM International Conference Proceeding Series*, 04-05-Marc, 1–4. https://doi.org/10.1145/2905055.2905119

Ramandei, L. (2020). Community participation in domestic waste management in Vim village Abepura district Jayapura city. *International Journal of Scientific and Technology Research,* 9(4), 2781–2783.

Ramos, A., & Rouboa, A. (2020). Renewable energy from solid waste: life cycle analysis and social welfare. *Environmental impact assessment review*, *85*, 106469.

Robin., P., Kaur., Jagdeep, Kaur., Sartaj, Ahmad, Bhat. (2023). Solid waste management: challenges and health hazards. 171-195. doi: 10.1016/b978-0-443-15206-1.00002-5

Sarfo-Mensah, P., Obeng-Okrah, K., Arhin, A. A., Amaning, T. K., & Oblitei, R. T. (2019). Solid waste management in urban communities in Ghana: A case study of the Kumasi metropolis. *African Journal of Environmental Science and Technology*, *13*(9), 342-353.

Satori, M., Megantara, E. N., Primiana, F. M. S. I., & Gunawan, B. (2018). Review of the influencing factors of integrated waste management. *International Journal of GEOMATE,* 15(48), 34–40. https://doi.org/10.21660/2018.48.55459

Schanes, K., Dobernig, K., & Gözet, B. (2018). Food waste matters-A systematic review of household food waste practices and their policy implications. *Journal of cleaner production*, *182*, 978-991. https://doi.org/10.1016/j.jclepro.2018.02.030.

Singh, N., Poonia, T., Siwal, S. S., Srivastav, A. L., Sharma, H. K., & Mittal, S. K. (2022). Challenges of water contamination in urban areas. In *Current directions in water scarcity research* (Vol. 6, pp. 173-202). Elsevier.

Soltani, A., Hewage, K., Reza, B., & Sadiq, R. (2015). Multiple stakeholders in multi-criteria decision-making in the context of municipal solid waste management: a review. *Waste Management*, *35*, 318-328. https://doi.org/10.1016/j.wasman.2014.09.010.

Southwoood, R. & Warner, F. (2018). 'The treatment and handling of waste'. Chapman and Hall, Dickinson, D. (1973). 'Practical Waste Treatment and Disposal', Applied Publishers Ltd, *Environmental Control and Public Health*, Wastes (2018). Units 8-9. Municipal Solid Waste Management. The Open University, Course Team

Sukholthaman, P., & Shirahada, K. (2015). Technological challenges for effective development towards sustainable waste management in developing countries: Case study of Bangkok, Thailand. *Technology in Society*, *43*, 231-239.

Sulistyaningsih, T., Jainuri, J., Salahudin, S., Jovita, H. D., & Nurmandi, A. (2021). Can Combined Marketing and Planning-oriented of Community-based Social Marketing (CBSM) Project Successfully Transform the Slum Area to Tourism Village? A Case Study of the Jodipan Colorful Urban Village, Malang, Indonesia. *Journal of Nonprofit and Public Sector Marketing*, 00(00), 1–30. https://doi.org/10.1080/10495142.2021.1874590

Sulphey, M. M., & Safeer, M. M. (2017). *Introduction to environment management*. PHI Learning Pvt. Ltd.

Supinganto, A., Suharmanto, S., Budiana, I., & Woga, R. (2022). Effect of Training on Organic Waste Management in Neighborhoods of Pejanggik, Mataram, West Nusa Tenggara. *Global Medical & Health Communication* (GMHC), 10(2), 79–85. https://doi.org/10.29313/gmhc.v10i2.8853

Tan, S. T., Hashim, H., Lee, C. T., Lim, J. S., & Kanniah, K. D. (2014). Optimal waste-to-energy strategy assisted by GIS For sustainable solid waste management. In *IOP Conference Series: Earth and Environmental Science* (Vol. 18, No. 1, p. 012159). IOP Publishing.

Tasantab, Chati. (2012). Solid Waste Management In Ghanaian Towns; A Case of Saboba, Northern Region. 10.13140/RG.2.2.23359.53925.

Tchobanoglous, G., Theisen, H. & Vigil, S. (2017). Integrated Solid Waste: Engineering principles and management issues. McGraw-Hill Publishing company, USA. Thompson, A. A (2017). '*Domestic Waste Management Strategies in Accra, Ghana and other Tropical Developing Nations'*. Date accessed (May, 2017).

Tibihika, P. D., Okurut, T., Lugumira, J. S., Akello, C., Muganga, G., Tumuhairwe, J. B., ... & Mugambwa, R. (2021). Characteristics of municipal fresh solid wastes from the selected large urban centres in Uganda: Implication for re-use and soil amendment strategies. *Journal of the Air & Waste Management Association*, *71*(8), 923-933. DOI: 10.1080/10962247.2020.1854369.

Tong, X., & Tao, D. (2016). The rise and fall of a "waste city" in the construction of an "urban circular economic system": The changing landscape of waste in Beijing. *Resources, Conservation and Recycling*, *107*, 10-17.

Tsiboe, A. I., & Marbel, E (2015). 'A Look at Solid Waste problems in Accra, Ghana'. Masters' Thesis, Roskide University. Urban Development Sector Unit, East Asia and Pacific Region (1999). 'What a Waste: Solid Waste Management in Asia'. Date accessed (October, 2011).

Udofia, E. A., Fobil, J., & Gulis, G. (2018). Stakeholders' Practices and Perspectives on Solid Medical Waste Management: A Community Based Study in Accra,

Ghana. *Journal of Environmental Protection*, 09(13), 1295–1313. https://doi.org/10.4236/jep.2018.913081

USHA, B, R. (2024). Solid waste management. Indian Scientific Journal Of Research In Engineering And Management, 08(03):1-11. doi: 10.55041/ijsrem29308

Van Ewijk, S., & Stegemann, J. A. (2016). Limitations of the waste hierarchy for achieving absolute reductions in material throughput. *Journal of Cleaner Production*, *132*, 122-128. https://doi.org/10.1016/j.jclepro.2014.11.051.

Vicknesh, Kumar, Yogamadhavan., Giriraj, Mannayee. (2024). An Evaluation of Various Deep Convolutional Networks for the Development of a Vision System for the Classification of Domestic Solid Street Waste. Journal of Internet Services and Information Security, 14(2):268-283. doi: 10.58346/jisis.2024.i2.017

Wulung, R. B. S., Wibowo, M. D., Suwarno, Y., & Nafiah, R. (2021). Developing e-logistics System for Plastic Recycle in Order to Enhance the Role of Community-Based Waste Bank. *Ieomsociety.Org*, 2018, 1094–1103. http://ieomsociety.org/proceedings/2021indonesia/174.pdf

Yenik, P.. (2021). Policy Effectiveness of Community-Based Waste Management in the City Kediri. *International Journal of Social Science*, 1(1), 23–30. https://doi.org/10.53625/ijss.v1i1.31

Yin, R. K. (2019). 'Case Study Research: Design and Methodology'. Sage Publications, Third edition. Using prison labour to keep the country clean. http://www.modernghana.com/newsp. Accessed on 10/05/2019. Waste management in Ghana, a study of 11 urban centres. Training Network Centre, College of Engineering, KNUST.

Zamri, G. B., Azizal, N. K. A., Nakamura, S., Okada, K., Nordin, N. H., Othman, N., & Hara, H. (2020). Delivery, impact and approach of household food waste reduction campaigns. *Journal of Cleaner Production*, *246*, 118969.

APPENDICES

APPENDIX I

Background Information of Respondents

1. Age

[ ] 20 – 24

[ ] 25 – 29

[ ] 30 – 34

[ ] 35 – 39

[ ] 40 – 44

[ ] 45 – 49

[ ] 50 – 54

2. Highest Level of Education

[ ] Never

[ ] Primary

[ ] Middle School/JHS

[ ] SHS/Technical /Vocational

[ ] Tertiary

APPENDIX II

DEPARTMENT OF SOCIAL STUDIES EDUCATION

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF SOCIAL SCIENCES

The integrated community-based waste management system: A Case Study of Bechem.

Household interview guide

This research is for academic purposes only. Therefore, any answers given shall be treated as confidential.

House number (if any) …….

Date of interview……...

1. Which type of waste do you normally generate?
2. Where do you usually dispose off your waste?
3. If waste is dumped in a communal skip container, how long does it take to get there?
4. How often are the skip containers emptied?
5. Do you pay for waste disposal? If yes, how much?
6. Have you ever been educated on proper waste disposal by the assembly?
7. What measures have been put in place to solve these problems?

APPENDIX III

DEPARTMENT OF SOCIAL STUDIES EDUCATION

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF SOCIAL SCIENCES

The integrated community-based waste management system: A Case Study of Bechem.

Waste Management Department

This research is for academic purposes only. Therefore, any answers given shall be treated as confidential. Thank you.

Name of officer ……..Position……Date of interview……

1. What is the quantity of waste generated in this Town?
2. How often do you collect the waste in these areas?

a. Adum

b. Atekyem

c. Zongo

d. Ahenbronoso

3. How do you finally dispose off the waste?

Logistics for managing waste

4. Waste collection and disposal equipment

Equipment	**Number existing**
Waste bins	
Skip containers	
Tricycle (Aboboyaa)	
Skip loaders	
Others	

5. .How many skip containers do you have in the following neighbourhoods?

a. Adum……b. Atekyem…… c. Zongo……d. Ahenbronoso ……...

6. What is the cost of waste collection and who bear the cost of waste collection?
7. How can these problems be solved?