Waste Management in Ghana: A Case of Tema and Ledzokuku-Krowor Assemblies

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ABSTRACT-

The study scrutinized the strategies, challenges and opportunities of waste management in Tema, Nungua and Teshie, using descriptive research design. Primary data were obtained using questionnaires and interviews. The questionnaires were given to 300 households as well as enterprises, while the interviews were conducted for 10 officials of the selected Assemblies, 10 officials of private waste management companies operating in the selected areas and 10 waste management professionals. The households and enterprises were randomly selected while the other samples were purposely selected. Secondary data were from official documents, journals and articles. The study concluded that burning, burying, reuse and recycle of used plastic bottles, and dumping in bushes are the approaches adopted by respondents in managing their waste. The study found that the challenges militating against waste management in the three Assemblies are poor planning, financial and human constraints, lack of supporting infrastructure and lack of stakeholder participation. The study established adequate funds, public education, law enforcement, and provision of engineered landfill sites as possible solutions to the challenges. The study also established that tax revenue, employment, foreign exchange, tourism boost, clean environment, and waste for energy are the many benefits that can be gotten from the management of waste. It is recommended that a public private partnership must be established to set up waste to energy, treatment and composting plants. It is also recommended that stakeholder involvement in the planning, formulation, execution and assessment of waste management initiatives is necessary to ensure adequate stakeholder participation, ownership and project sustainability.

Keywords: Waste, Management, Strategies, Solid, Municipal.

I. INTRODUCTION

Waste management in the third world countries has less responsiveness from academicians and legislators as compared to other metropolitan issues regarding the environment. Nevertheless, the unsuitable manner by which waste is handled and thrown away has brought serious problems such as; increased ill health and in some cases deaths in the urban areas especially. Regrettably, activities carried out by people in their day to day operations create waste, and the ways by which they handle, keep, gather, move and finally throw away, these waste has a possibility of causing grave danger to the health of the citizens and their environs. Where there are rigorous human activities, appropriate methods of waste management are very important in fostering better living conditions for the residents in those areas. Even though governments in times past and at present agree to these facts, most communities still struggle to find the efficient waste management procedure.

A greater percentage of waste generated in third world countries such as Ghana end up on prohibited dumpsites, streets, open space and waste lands due to lack of and poor collection and disposal practices. These poor practices include irregular service delivery, poor communal attitudes, inefficient and ineffective waste management services etc [1] [2] and [3]. In the past years, waste management has been a key problem in Ghana due to haphazard dumping, irregular collection of waste generated and insufficient resources to mention a few. Large volumes of waste are produced in the country daily and this has led to various practices of handling waste. These practices have evolved with the social realities but have not efficiently worked to reduce waste in Ghana.

As a result of the challenges faced in waste management, populations remain at risk, and this is also causing huge economic losses to the society. Regardless of this, various waste management practices have emerged to tackle the problem of waste in the country. These practices have been faced with various challenges which have constantly affected efforts towards waste management. Nonetheless, opportunities still remain for addressing waste in Ghana on an extensive basis.

The purpose of the dissertation is to look at the current strategies, opportunities and challenges of solid waste management in Ghana.

Objectives of the study

The objectives of the research were to:

i. Examine the solid waste management strategies adopted in Teshie, Nungua, and Tema Assemblies by stakeholders.
ii. Ascertain the problems militating against solid waste management in Teshie, Nungua, and Tema Assemblies
iii. Identify the opportunities of solid waste management in Teshie, Nungua, and Tema Assemblies

Research questions

i. What are the solid waste management strategies in Teshie, Nungua, and Tema Assemblies?
ii. What are the challenges militating against solid waste management in Teshie, Nungua, and Tema Assemblies?
iii. What are the opportunities of solid waste management in Teshie, Nungua, and Tema Assemblies?

II. LITERATURE REVIEW

Strategies of Waste Management in Ghana

Land filling involves the managed dumping of waste on engineered sites with little or no pre – treatment. That is confining, compacting and covering waste. Kreith and Tchobanoglous (2002) states that some wastes are simply not recyclable and therefore must go to the dump site.

Incineration is the burning of organic substances contained in waste materials. Wastes collected from communal containers are conveyed to dumpsites for open air burning. This method helps to decrease the quantity and heaviness of solid waste, leaving an inert residue of ashes, non-combustible materials and water vapour.

Recycling is defined as the recovery and reuse of some portions of solid waste which still possess economic value. Recycling is a very important strategy in the minimization of household solid waste [4].This is because materials such as paper, metal, glass, plastic and rubber can be recycled by households prior to the disposal of the unrecyclable items. These materials that can be recycled must be separated at source or at the central processing sites.

Composting is another method used for treating waste. Centre for Environment and Development describes it as the biological process in which microorganisms are used to reduce the organic composition of the waste. It is seen as a form of recycling since it reclaims the organic part of the waste for reuse as soil conditioner.

Dumping is the main approach used in waste management in Ghana. The wastes are used to fill quarries, dug outs and mining pits among others. Dumping does not only stop the burning of waste, but assist in reclaiming lands for reforestation, agriculture and construction among others.

Challenges of Waste Management in Ghana

A third to half of the waste generated in developing countries such as Ghana end up on illegal dumpsites, street corners, open space and waste lands due to lack of and poor collection and disposal practices such as irregular service delivery, poor communal attitudes, inefficient and ineffective waste management services [1] [2] and [3].It is estimated that about 83% of the population in the Greater Accra Metropolitan Area (GAMA) dump their refuse at unapproved places in the vicinity and this creates unhealthy conditions in the community[5].

Opportunities of Waste Management

Even though there may be countless disadvantages of improper management of waste there is no doubt that it also has several benefits if properly managed. In recent times experts in waste management believe waste is a critical resource that can bring any country lots of economic, social and financial benefits. Energy, tax revenues and employment are among the many benefits.

III. RESEARCH METHODOLOGY

Population

The population consists of households, businesses, officers of Teshie, Nungua, and Tema Assemblies; staff of the private waste management companies operating in the selected area and waste management professionals. Waste is generated by homes and businesses and therefore, the target population was all the households and enterprises in Tema, Nungua and Teshie. The waste management professionals are individuals who are neither from the Assemblies nor the private waste management companies.

Sampling Technique

A sample is a sub group of a population chosen to take part in the research[6].A sample of three hundred and thirty (330) respondents from the population was considered. These are made up of three hundred (300) households and enterprises (consisting of market persons), 10 officials of the selected Assemblies, 10 officials of the private waste management companies operating in the selected areas and 10 waste management professionals. The households and enterprises were randomly selected while the professionals, Assembly and company officials were purposely selected. Random sampling is a sampling technique in which each individual or study item has the same opportunity of being chosen. Since all household and businesses generate waste, the researcher considered all of them equally in investigating their waste management practices. The officers of Teshie, Nungua and Tema Assemblies; staff of the private waste management companies and waste management professionals were selected by purposive sampling based on their role, knowledge and experience in the subject matter. The formula and computation of the sample size are as follows:

$$n = \frac{N}{1 + N(e^2)} = \frac{2{,}000}{1 + 2{,}000(0.05^2)} = 333.33$$

Where n is sample size required
N is the size of the target population
e is the margin error which is 0.05.

Table 1: Sample of Respondents

Area	Households	Businesses	Assembly Officials	Private Waste Mgt. Co.	Experts
Tema	60	40	5	6	
Teshie	70	30	3	2	10
Nungua	70	30	2	2	
Total	200	100	10	10	10

Source: Field Study (2019)

Data Collection Instrument

Primary and secondary data were used for the study. Primary data were obtained from the markets, households and businesses in the Assemblies as well as city officials, waste management companies and waste management professionals. The primary data sources are structured questionnaires and interviews which contained both yes and no questions as well as expressive questions. Secondary source of data included books, journals, reports, articles and website publications on waste management and waste management in the country.

Data Collection Procedure

The questionnaire and interviews were conducted in person so as to afford the researcher the chance to brief the assenters on the study to ensure that respondents understood the study well enough to provide accurate, valid and reliable responses. The interviews were recorded and transcribed. The respondents were requested to complete the questionnaire after which follow-ups were made to remind respondents to fill the questionnaires and make them available for pick-up. The follow-up was to achieve a high response rate. Literate respondents answered the questionnaire themselves while less educated respondents were asked the questions in their local dialect (Twi and Ga) to which they gave their responses.

Data Analysis

Statistical Package for Social Sciences (SPSS) was used for data analysis by using it to categorise, code and arrive at the descriptive statistics used on chapter four. Frequency tables, percentages and descriptive statistics such as mean, standard deviation was used to analyse the data collected. Tables were used to present the data.

IV. DISCUSSIONS

4.1 Type of Waste Generated

The goal of this question is to identify the types and forms of waste generated in the surveyed cities.

Table 2: Type of Waste Generated

Type of Waste Generated	Frequency	Percentage (%)
Food remains	110	33
Used polythene bags & other plastic materials	102	31
Paper waste	63	19
Used bottles & cans	54	16
Others	3	1
Total	332	100

Source: Field Study (2019)

The results reveal that 33% of the wastes generated in the communities are from food remains; 31% of the wastes generated are from used polythene bags & other plastic materials; 19% of the waste generated are from paper waste; 16% of the waste generated are from used bottles & cans while 1% of the waste are from other sources. The challenge to cities is the slow pace at which food and organic waste are converted to compost, biogas or properly disposed off. From this research, plastic is the second largest type of waste that is generated. This is due to the fact that all packaging materials are plastics. Thus from the grocery store, to the food joints to the markets places, all purchases are packaged in plastics and therefore people end up generating piles of plastic after uncovering their wares. The 1% of other waste generated in the Assemblies included tree and plant trimmings.

Segregation of Waste

The practice of waste separationwas investigated among the respondents.

Table 3: Segregation of Waste

Segregation of Waste	Frequency	Percentage (%)
Yes	96	32
No	204	68
Total	300	100

Source: Field Study (2019)

The outcomes showed that 68% of the respondents do not segregate their waste while 32% of the respondents segregate their waste. Out of the 68% (204 respondents) of the respondent that do not segregate their waste, 62% (126 respondents) are households while 38% (78 respondents) are businesses. Also, of the 32% (96 respondents) that segregate their waste 68% (65 respondents) are households while 32% (31 respondents) are businesses.

The study revealed that segregation is not a popular strategy adopted among respondents in disposing off waste. This finding signifies that, waste management in the areas of Nungua, Teshie and Tema is not fully effective. The study also found that the 32% of respondents who segregated their waste were not engaged in full scale segregation. They only segregated flexible plastics which they sell to companies to make extra income, instead of segregating their waste into plastics, paper, organic, glass, metals etc. It was also observed from this research that part of the respondents who do not segregate their waste indicated that they see it as a waste of time since everything would be lumped back together at the final disposal site, whiles the rest says they do not have the receptacles they will use for the segregation.

Waste Collection and Disposal Measures

The waste collection methods and waste disposal measures practiced by the respondents.

Table 4: Waste Collection and Disposal Measures

Waste Collection and Disposal Measures	Frequency	Percentage (%)
Municipal waste collectors	41	13
Registered private waste collectors	86	28
Unregistered private trucks	149	48
Others	34	11
Total	310	100

Source: Field Study (2019)

The outcome show that 48% of the respondents' waste were collected and disposed by unregistered private trucks; 28% of the respondents' waste were collected and disposed by registered private waste companies; 13% of the respondents had their waste collected and disposed by municipal waste collectors while 11% of the respondents had their waste collected and disposed by other means. The study found that well-demarcated residential and high-income communities used registered private waste collection services while low-income communities use the services of unregistered private trucks for their waste collection. For those who used the services of the unregistered private collectors, their concern is that the registered collectors charge exorbitant fees which they cannot afford. Again the 13% of respondents who use the services of the municipal assemblies are mainly schools and a few businesses. The 11% of respondents who claim to use other means, it was observed had dug out pits into which they dump their refuse and burn.

Alternative Waste Collection and Disposal Measures

Besides the regular waste collection and disposal measures, the study looked into the alternative waste

collection and disposal methods adopted by the respondents.

Table 5: Alternative Waste Collection and Disposal Measures

Alternative Waste Collection	Frequency	Percentage (%)
Burn	149	45
Bury	29	9
Communal disposal sites	132	40
Others	19	6
Total	329	100

Source: Field Study (2019)

The results indicate that 45% of the respondents use burning as alternative measure for disposing of their waste; 40% of the respondents use communal disposal sites as alternative measure for disposing of their waste; 9% of the respondents bury their waste as alternative measure for disposing while 6% of the respondents use other means as alternative measure for disposing of their waste.These measures are not recommended waste collection and disposal measures as they pose serious environmental challenges to the cities and countries as a whole. The study revealed that the 45% of respondents who burn their waste are quite far from the communal disposal site and therefore feel reluctant to carry it there, whiles others are not in a position to pay for the fees charged by caretakers of at the communal containers. The other means used by the 6% of respondents are unapproved dumping sites and bushes.

Solid Waste Reduction Strategies

The solid waste reduction strategies used by the respondents were investigated.

Table 6: Solid Waste Reduction Strategies

Solid Waste Reduction Strategies	Frequency	Percentage (%)
Reuse and recycle (used plastic bottles)	86	28
Burning	173	57
Dumping in bushes	12	4
Mixing it up with soil	34	11
Total	305	100

Source: Field Study (2019)

The results showed that the respondents have adopted burning (57%), reuse and recycle of used plastic bottles (28%), mixing waste with soil (11%) and dumping in bushes (4%) as strategies for reducing their solid waste.

However, the Assemblies advice against practices like burning and dumping in bushes because of the negative effects it has on the environment. The study found that plastics, paper and plants remains are types of waste that are burned by the respondents. This practice, it was revealed caused a lot of problems for neighbours, but respondents insist that it is the only option left to them.

4.2 Waste Management Challenges

This section gives the results on the problems militating against waste management at Nungua, Teshie and Tema. The results are under the themes: Frequency of Waste Collection, Satisfaction with Waste Collection Service, Payment of More for Waste Collection Service, Poor Waste Management and Disease and Problems from Improper Waste Management.

Frequency of Waste Collection

Table 7: Frequency of Waste Collection

Frequency of Waste Collection	Frequency	Percentage (%)
Weekly	219	73
Bi-weekly	66	22
Monthly	15	5
Total	300	100

Source: Field Study (2019)

The study found that 73% of the respondents have their waste collected weekly; 22% of the respondents have their waste collected bi-weekly while 5% of the respondents have their waste collected every month. This weekly collection that the study revealed was for low income earning communities who use the services of the unregistered waste collectors. Unlike the registered collectors who will not be seen in the vicinity until their scheduled collection time is up, these unregistered collectors are always roaming the communities on daily basis looking to render services to anyone who needs it. Even for those registered waste collectors who are supposed to collect the waste on weekly basis, most of them do not, with the complaints of breakdown and fuel shortage.

Satisfaction with Waste Collection Service

Table 9: Satisfaction with Waste Collection Service

Satisfaction with Waste Collection Service	Frequency	Percentage (%)
Yes	177	59
No	123	41
Total	300	100

Source: Field Study (2019)

The study found that 59% of the respondents are content with their service provider while 41% of the respondents are not satisfied with the waste collection service provider. The close margin between satisfaction and dissatisfaction with waste collection providers indicates that the respondents are indifferent about the service delivery indicating the need for improvement of the service.For those 41% who indicated that they are not satisfied with the services of the collectors, most of them stated their reason as the irregularities found in the

collection times by registered waste collectors. Thus the collectors do not come for the waste regularly, leaving most of the residents with piles of rubbish for weeks which end up breeding maggots and insects. They also indicated that the collectors are not swift to change their litter bins when they are destroyed. Most of the collectors also do not pick any waste which is not inside the bins, thus any rubbish put in carrier bags and placed beside the bins.

Problems associated with collection

The study also revealed that the challenges militating against collection as indicated by respondents include irregular waste collection by collectors and high cost of fees charged. Other challenges enumerated were that the collectors were always spilling over as they move along, due to the fact that they do not cover the vehicles properly, the collectors also do not replace broken bins, and rather insist that the customers purchase it and finally frequent breakage of the bins as a result of manhandling by the collectors.

Payment of More for Waste Collection Service

Table 8: Payment of More for Waste Collection Service

Payment of more	Frequency	Percentage (%)
Yes	180	60
No	120	40
Total	300	100

Source: Field Study (2019)

The study found that 60% of the respondents expressed that they pay more for their waste collection compared to other waste disposal strategies while 40% of the respondents expressed that they do not pay more for the waste collection compared to other waste disposal measures. This indicates that most households are unwilling to pay more and are demanding for a decrease in the monies they take.

Out of the 60% (180 respondents) who expressed that they pay more for the waste collection compared to other waste disposal measures, 74% (133 respondents) are for households while 26% (47 respondents) are for businesses. Also, of the 40% (120 respondents) who expressed that they do not pay more for the waste collection compared to other waste disposal measures, 39% (47 respondents) are households while 61% (73 respondents) are for businesses. These fees, that respondents claim are too much, are mainly charged by the registered collectors.

Problems from Improper Waste Management

Table 9: Problems from Improper Waste Management

Problems	Frequency	Percentage (%)
Flooding	158	34
Air pollution	127	27
High fish mortality	58	12
Pollution of water bodies	125	27
Total	468	100

Source: Field Study (2019)

The study found that 34% of the respondents expressed that flooding is a problem caused by poor waste management; 27% of the respondents expressed that poor waste management causes air contamination; 27% of the respondents indicated that water bodies can be polluted through improper disposal of waste and 12% of the respondents expressed that the highest cause of fish mortality is when fishes choke on plastics and other wastes. The observation is that flooding topped the list of problems because it is always evident how rubbish heaps up in gutters and drains after a heavy downpour, yet most residents engage in indiscriminate dumping.

4.3 Opportunities of Waste Management

This section presents the results on the opportunities of waste management at Nungua, Teshie and Tema. The results are under the themes: Waste for Energy, Ways for Waste Disposal Management and Support for Ban of Plastics.

Waste for Energy

Table 10: Waste for Energy

Waste for Energy	Frequency	Percentage (%)
Yes	249	83
No	51	17
Total	468	100

Source: Field Study (2019)

The study found that 83% of the respondents expressed that they are aware that energy can be generated from waste while 17% of the respondents expressed that they are not aware that energy can be generated from waste. However of the 83% (249 respondents) who knows about waste to energy, 80% (199 respondents) do not know that the waste is segregated before it can be used to produce energy. For them, every waste is supposed to be good for energy production.

The unsegregated (68% of the respondents do not sort their waste in Table 4.3) heterogeneous nature of the waste generated by the respondents serves as a drawback in the utilization of the waste as raw material to generate energy and develop other resources out of the waste. This is because the waste will first have to be segregated, thus, the waste must be grouped into various components, depending on their physical characteristics, in other to be able to generate energy or to be recycled into various items such as paper, plastics, manure, metals,

compressed wood, among other [9]. This revelation brings to the fore; the need for Municipal Assemblies to embark on education so that individuals can better appreciate waste management issues and the need to have everyone contribute to its management.

Benefits of Waste Management

Table 11: Level of agreement on statements relating to waste management

Statements	Mean	SD
1. We can reduce the use of coal drastically if we manage properly	4.256	0.883
2. More employment can be generated through waste management	4.756	0.485
3. Huge revenue can be generated for national development through waste management	4.487	0.615
4. Waste can solve the issue of electricity supply in the country	4.128	1.030
Average	**4.407**	**0.753**

Source: Field Study (2019)

The respondents agreed that we management can bring huge revenue can solve the issues related with power supply, create job opportunities and reduce the use of coal.

Ways for Waste Disposal Management

Table 12: Ways for Waste Disposal Management

Waste Disposal Methods	Frequency	Percentage (%)
Through more and effective education	115	30
Provision of more approved dumping sites	96	25
Strictly enforcing sanitation laws	139	36
Public to pay for waste collected	29	8
Others	5	1
Total	384	100

Source: Field Study (2019)

The study found that 36% of the respondents expressed that waste should be managed by strictly enforcing sanitation laws; 30% of the respondents expressed that waste should be managed through more and effective education; 25% of the respondents expressed that waste should be managed through the provision of more approved dumping sites; 8% of the respondents expressed that waste should be managed by the public paying for waste collected while 1% of the respondents expressed that waste should be managed by other means including the mounting of communal containers for easy access. Through this research it was obvious that respondents know that sanitations laws do not work and therefore they flout it with impunity. The onus therefore lies on the Assemblies to immediately start enforcing sanitation laws and appropriate sanctions given. One way to do this is to reintroduce the town council sanitary inspectors who moved from community to community, inspecting the sanitary conditions of households. Respondents attested to the fact that this practice was effective, and as a result the communities were clean.

The study revealed that strict enforcement of sanitation laws, public education, provision of engineered and appropriate landfill sites, public paying for waste collection, combined method to waste management, provision of logistics, effective and efficient waste management system are ways of ensure waste are disposed of appropriately.

Support for Ban of Plastics

Table 13: Support for Ban of Plastics

Support for Banning Plastics	Frequency	Percentage (%)
Yes	195	65
No	105	35
Total	300	100

Source: Field Study (2019)

The study found that 65% of the respondents expressed that they support the call for the ban on plastics in the country while 35% of the respondents expressed that they do not support the call for the ban on plastics in a bid to solve the plastic waste menace. Most of the respondents are obviously calling for the ban because the negative effects of plastic are so evident. They believe very little can be done and has been done in the management of plastic waste and therefore the simplest solution is to ban it. On the other hand, those who do not think it is a good idea to ban says banning is a 'lazy man's approach' to solving the issue. They also cited loss of jobs as one of the reasons why they do not think that it should be banned.

Interventions for Addressing the Problem of Waste

Possible solutions to the challenges of waste management are provision of adequate dumping sites, daily waste collection as well as disposal, public education, public waste bins at vantage points, community participation in waste management planning and implementation of projects, adequate funding, periodic training of human resource personnel, establishment of engineered landfill sites, and enforcement of waste and environment laws, among others.

4.4 Discussion of Interview

The Assemblies have two types of waste management services. They are the door to door service and communal waste management services. The Assemblies indicated that 80% of the waste collection and disposal services in the Assemblies are on contract to private waste collection and disposal companies while 20% of the service is undertaken by the Assemblies. The private contractors include Zoom Domestic, J. Stanley Owusu, Asibod, Daben Cleansing Agents, Rural Waste Collectors, Meridian Waste and Asadu Royal Waste Collectors.

The waste management heads in the three Assemblies indicated that 85% of the contracted (80%) waste collection and disposal services are door to door services while 15% are communal waste management services. From all indication, the Assemblies' core mandate of managing waste has changed to playing supervisory role for the private waste companies. This is so, because there is no funding for the Assemblies to engage in full time waste management and therefore resort to franchising.

Waste management heads for both the private companies and Assemblies mentioned that 168.67 tons of waste is generated on daily basis in the Ledzokuku-Krowor Municipal Assembly (LEKMA) whiles Tema generates 600 – 700 metric tons. They also indicated that about 65% of generated waste is collected, leaving a back log of 35%.

Through the interview, it was gathered that the compositions of wastes are: organic waste (65%), plastics (15%), industrial waste (7%), paper (5%), wood (3%), metal (3%) and glass (2%).

70% (14 interviewees) officials of the Assemblies and private waste management officials expressed that they agree to total ban of plastics; 20% (4 interviewees) agreed to partial ban of plastics while 10% (2 interviewees) did not agree to ban of plastics. The 70% expressed that the ban will be a major stride in their quest to reduce waste generated in the country and Assemblies in particular.

The study revealed that lack of engineered landfill sites, inadequate logistics and equipment for the collection and disposal, poor road network, cost of operation, Lack of and inadequate funds for the payment of recurrent expenditure in the Assemblies as well as the private waste management companies, poor attitude of the community members towards waste management, unwillingness of residents to sign on to waste management services, inability of residents to pay for the services rendered them, political hindrances in the area of enforcement of sanitation laws, delayed payment of wages and meagre salaries of waste collectors are the array of problems the Assemblies are faced with in their quest to manage waste efficiently and effectively.

Interview of professionals in waste management revealed that the country is heading the wrong direction in terms of waste management because the country is tackling waste management by considering just one aspect of waste management which is collection and disposal. Thus, they indicated that the fundamentals are wrong, the structures are not in place and the systems provided so far are not working. For them, government must spearhead the management of waste instead of the supervisory role they are playing.

On the issue of whether they support the ban on plastics, most (90%) of the professionals in waste management, believe that the issue of banning will not come up if waste management is handled in the proper manner. They indicate that plastic waste is a 'resource in transition' and therefore presents a fine opportunity for other products to be made out of it. They believe governments; both past and present have not explored new and emerging innovations for plastics waste that can help solve the menace. For instance, making pavement blocks out of plastics, making carrier bags that are soluble in water as well as for packaging and plastics that can degrade in the shortest possible time. However, those who support the ban are of the view that it can only be possible when an alternative to the plastic has been found.

The experts in waste management propose certain guide lines to the holistic management of waste which can only work once they are implemented all at once. They proposed segregation at source and at the final disposal sites, education for both the young and old on the proper ways to generate and handle waste, provision of bins or receptacles for both households and on principal streets where commuters can have easy access to, strict enforcement of sanitation laws without any form of interference; establishing treatment, recycle and waste to energy plants and the establishment of engineered landfill sites for the waste that needs to be dumped..

V. CONCLUSION AND RECOMMENDATION

Waste Management strategies adopted by stakeholders

On the waste management approaches used by stakeholders, the study revealed that segregation is not a strategy adopted for management of waste. The study also revealed that registered private waste collectors, unregistered private trucks and municipal waste collectors are waste collection and disposal agents used in the communities. Again, the study also brought to light the fact that burning, reuse and recycle of used plastic bottles, mixing waste with soil and dumping in bushes are the strategies used for reducing their solid waste.

Challenges militating against waste management in Ghana

With regards to the challenges militating against waste management, the study identified irregular waste collection, high cost of waste disposal, rapid urbanization, increasing volumes of waste due to faster rate of generation, inadequate funding, lack of stakeholder engagement, human resource constraints, lack of engineered landfill sites for proper waste treatment, bad road network, high cost of operations and bad attitude of citizenry in the management of waste as challenges militating against waste management.

Opportunities of waste management in Ghana

The study revealed that energy is one of the major benefit or opportunity that can be derived from waste. Apart from energy, tax revenue, employment, foreign exchange, clean and healthy environment and other socio-economic gains can also be gotten from the proper management of waste.

Public Private Partnership

Based on the findings of the study, it is evident that neither government nor the private sector can handle waste management alone. It is recommended that a public private partnership must be established between the two. By so doing, they can join their resources to put up waste to energy plants as well as treatment and composting plant. This will help to convert most of the waste generated into energy to help solve the perennial energy crises in the country. The compost can also be used to fertilize crops for increase yield in the farming sector. The treatment plant will also help minimise drastically the quantity of waste that would be taken to the landfill site.

Education

Again it is recommended that education on sanitation and waste management should be integrated into the education of students at all levels of educational system. This will help in educating, and inculcating positive attitudes and behaviours into the population on waste management. Notwithstanding, the Assemblies must periodically educate residents within their catchment area on the various Assembly by -laws relating to sanitation so that people will be conscious of their responsibilities and the consequences that comes with the neglect of these responsibilities.

Enforcement of sanitation laws

More so, the laws relating to waste management should be enforced to the latter in the country. Government, respondents believed must desist from interfering in the enforcement. Furthermore, it is also recommended that sanctions related to the laws on waste management must be modified to be more punitive and reflect changes in society. Sanitation courts must also be established to immediately prosecute culprits so as to deter others.

Integration

Additionally, it is recommended that waste management should be integrated into the planning and development of the country to help eliminate or reduce to the barest minimum relating effects like flooding, pollution and spread of diseases. In effect monies that will be used to solve these problems can be channeled into productive ventures such as manufacturing, and agriculture among others.

Stakeholder involvement

Finally, it is also recommended that all stakeholders must be co - opted into the planning, formulation, implementation and evaluation of waste management initiatives to ensure adequate stakeholder participation, ownership and project sustainability.

Recommendations for Further Studies

More research can be conducted into segregation, reuse and recycling of plastic waste in Ghana using a large population or sample size and the study area expanded to more than three local areas or a Region. This will help identify and address the waste management challenges of the country.

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