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RESEARCH ARTICLE

Waste Management in Enugu State: Challenges and Prospects

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Abstract

The study seeks to investigate Waste Management in Enugu State: Challenges and Prospects Specifically, the study adopts fund availability and people's attitudes as the independent variable while ESWAMA performance and clean environment serve as the dependent variable. A descriptive research design survey was adopted for the study. The primary source of data was adopted where a well structure questionnaire was administered to the employees of ESWAMA and some residents of the Enugu metropolis. The data collected were analyzed using statistical tables. Simple percentages and the chi-square (XC^2) method was used to test the hypothesis formulated for this research. The result revealed that both fund availability and people's attitude have significant positive effects on the performance of ESWAMA and clean environment with (p – Value is 0.82299>0.10) in Enugu state. We conclude that the challenges have a significant effect on the prospect of waste management in Enugu State. We recommended that the; Enugu State government should properly fund its waste management agency. As such, more funds should be allocated to ESWAMA to carry out its waste management responsibilities effectively.

Keywords: Waste Management; ESWAMA Performance; Clean Environment; Enugu State

Introduction

The management of solid waste has become a global issue that every government in the 21st Century has shown uncommon commitment to tackle, especially when making policies on public health and the environment (Okoli et al, 2020). This is due to the rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization, and industrialization (UNEP, 2009). Waste management or waste disposal includes the process and actions required to manage waste from its inception to its final disposal. This includes the collection, transportation, treatment, and disposal of waste, together with monitoring and regulation of the waste management process and waste-related laws, technologies, and economic mechanisms. However, history revealed that in the early years before the 18th century, the amount of waste generated by the human population was densities and low exploitation activities.

Common waste produced during the early ages was mainly ashes and human & biodegradable waste, which were released back into the ground locally with minimal environmental impacts. With the advent of the industrial revolution in the late 18th century, the management of waste became a critical issue as a result of population increase and the massive migration of people to industrial towns and cities from rural areas, which in turn posed a threat to human health and the environment. The generation and disposal of waste is an intrinsic part of any developing or industrial society. Thus, commercial and domestic waste source has grown significantly in Nigeria over the past decade. The percentage of Nigeria's population living in cities or urban areas has more than doubled in the last 45 years (Jimoh, 2021). The continuous growth in the number of people living in the cities and urban areas has contributed immensely to the enormous solid and liquid wastes generated in Nigeria.
Waste management in urban areas in Nigeria has moved from solely public management to public-private participation. Enugu like most other urban areas of the developing world is experiencing rapid and uncontrollable growth typified by poor planning, rapid growth in population, inadequate amenities, and poor sanitation (Hardoy and Satterhwaite 2019). However, past and present administrations in Enugu State have made several attempts to address the challenges of waste management in the state. In 2004, the then administration in Enugu State established the Enugu State waste management authority (ESWAMA) to replace the defunct Enugu State Environmental Protection Agency (ENSEPA), Which failed to meet the challenges of modern-day waste management system, as waste dumps were seen located close to residential areas, markets, farm, and roadsides.

In 2007, the administration of a governor, Dr. Sullivan Chime demonstrated his commitment to ensuring the cleanness of the State when he launched the 15 waste disposal compaction vehicles and 1000 refuse bins at Okpara Square Enugu, as part of plans to keep the environment clean and maintain a healthy environment. Rather than improvement in the waste management in Enugu State, it has degenerated to the lowest ebb, with the environment already feared to be contaminated and disease-borne-waste heaps have taken over Enugu metropolis, a situation which generated fears of an outbreak of epidemic in the State. The Insider weekly newspaper of August 2nd, 2021 reported that findings have shown that diarrhea especially, among the infant population is on the increase in recent times as such that urgent measures are needed to combat the challenges of waste management in Enugu State.

Statement of the Problem

Waste management has become an area of major concern in Enugu State today. It appears to be a losing battle against the harmful consequences of unguided waste and the attainment of a clean healthy environment for all indigenes of the State. It is a common sight in Enugu today to see heaps/accumulation of festering waste dumps in parts of the State. However, the challenges associated with the management of waste in Enugu do not completely appear to be the absence of a legislative framework for waste management because there exists state sanitation legislation. Meanwhile, could it be that the government of the State lacks the political will needed to ascertain congruence of actions and promises as well as fails to meet up with its founding responsibilities? Or could it be that the authority in charge of waste management in the State cannot boast of competent waste managers, to monitor and Control the system, on the other hand, could it be that the people's negative attitudes regarding waste disposal and its agency/agent could pose a very big challenge to waste management system in the state whatever constitutes the problem, the fact remains that the task of keeping the state clean is the responsibility of the States waste management authority (ESWAMA). In this work, attention would be focused on ascertaining whether the

aforementioned problems are responsible for the challenges of waste management in Enugu and proffer suggestions that may assist in addressing the challenges.

Objectives of the Study

The main objective of this work is to investigate Waste Management in Enugu State: Challenges and Prospects. The specific objectives of the study are:

I. To investigate the effect of fund availability on the performance of ESWAMA in Enugu State.
II. To examine the effect of the people's attitudes towards the authority mandating a clean environment in Enugu state.

Hypotheses of Study

I. Fund availability has no significant positive effect on the performance of ESWAMA in Enugu State.
II. The people's attitudes have no sign towards the authority mandating a clean environment in Enugu state.

Review of Related Literature

Conceptual Review

Waste Management

Graiser (2007) refers to solid waste as 'solid material which is discarded. This definition ignores the relevant issue of the usefulness, value, or desirability of the matter in question, but in as much as discarding is an intentional act, it implies that the discarded judges the material to be of relatively little current value to him. Rodgers, (2011) contends that waste management is a systematic control of generation, storage, collection, transportation, separation, processing, recovery, and disposal of solid waste. In the smallest of places, solid waste management is accepted as a major aspect of the indigenous community organization and traditional home management; hence every house/compound has a designed area for solid waste collection/disposal and or incineration (Sanda 2008). In Nigeria, waste is generated in homes, commercial, industrial sites, hospitals, schools, on streets, and even religious activities. Waste can be described as unwanted or unusable materials, it can also be described as any substance discarded after primary use or is worthless, defective, and of no use. Waste can equally be described as lack of use or useless remains (Concise Oxford Dictionary). However, most human activities generate waste (Brunner and Rechberger, 2014). Despite that, the production of waste remains a major source of concern as it has always been since pre historic period (Chandler et, al, 1997). In recent times, the rate and quality of waste generation have been on the increase, as the volume of waste increases, so also does the variety of the waste increases (Vergara and Tchobanoglous, 2012).

Availability of Fund

Revenues may comprise local taxes or fees for waste management services, revenue from the sale of materials or energy recovered, gate fees at treatment plants or disposal sites, or transfers from local or national budgets. Other, less significant, financing sources include income from permits, the occasional renting of assets, profit-sharing deals (fees from concession), sale of space for advertisement on containers and litter bins, or littering fines. Once current costs and revenues are understood the process of forecasting future revenues and expenditures may commence. Forecasts of future revenues are required to set user fees. Different revenue collection mechanisms are possible, including a tax, a user charge, or a combination of both. A differentiation based on income level is already applied in Dares Salaam but payment rates are low and the city is considering introducing new billing procedures. Changes proposed in the revenue structures or revenue collection methods usually need to be gradually introduced, coupled with improvements in the service and awareness-raising campaigns to ensure social acceptance.

The People's Attitudes

UN-Habitat (2006) defined attitude as a mental state of readiness organized through experience that exerts a directive or dynamic influence upon the individual to which it is related. Bihon, (2008) defines attitude as the predisposition or tendency to react specifically toward an object, situation, or value, usually accompanied by intimate feeling and emotion. Attitude is also seen as the stick which tends to control the radar of knowledge and practice. Attitude influences behaviour and functions to facilitate the achievement of goals (Alem, 2007). This definition signifies that individuals have different opinions of situations. Most people have a nonchalant attitude toward waste disposal, this kind of person could be perceived as people who litter the environment like no man's

business i.e., without regard or respect for the environment. People don't consider the need to appraise or talk to neighbors about changing their negative attitude toward waste disposal. For instance, if an individual is seen littering papers or any form of waste anywhere it is incumbent to inform the person but not by exhibiting any form of annoyance or correction to such a situation (Alem, 2007, Mazhindu, Trynos & Gondo 2010).

The Performance of Waste Management

The performance of waste management systems can have a significant impact on the environment, public health, and overall sustainability of a region or country. Effective waste management involves the collection, transportation, treatment, and disposal of waste materials in a manner that minimizes negative environmental and social impacts. According to Okoye (2008), the public waste management authorities do not measure up to the expectations of the citizens, as proved by the prevalence of waste in all nooks and crannies of the cities. This poor performance in the collection and disposal of wastes can be traced to the nature of wastes generated, very few environmentally controlled disposal sites, often futile official efforts to develop recycling, financial constraint, inadequate infrastructure, high rate of population growth, and poor public perception or awareness.

Clean Environment

A clean environment is essential for the well-being of both humans and the planet. It refers to a state where the air, water, and land are free from pollution, waste, and other harmful substances. Maintaining a clean environment is crucial for preserving biodiversity, supporting sustainable development, and ensuring a healthy future for generations to come. One of the primary components of a clean environment is clean air. Air pollution, caused by industrial emissions, vehicle exhaust, and other sources, poses significant risks to human health and the ecosystem. It can lead to respiratory diseases, allergies, and even premature death. To combat air pollution, it is necessary to reduce emissions through the use of cleaner technologies, promote renewable energy sources, and enforce strict environmental regulations. Clean water is another vital aspect of a clean environment. Access to clean and safe drinking water is a basic human right. However, water pollution from industrial waste, agricultural runoff, and improper disposal of chemicals threatens the quality of our water sources. It endangers aquatic life, contaminates food chains, and poses serious health risks to humans. Ensuring proper waste management, adopting sustainable agricultural practices, and implementing water treatment technologies are crucial steps toward maintaining clean water sources.

Theoretical Framework

Waste Management Theory (WMT)

Waste Management Theory (WMT) has been introduced to channel environmental sciences into engineering design by Toulmin Stephen (1953). WMT is a unified body of knowledge about waste and waste management. It is an effort to organize the diverse variables of the waste management system as it stands today. WMT is considered within the paradigm of Industrial Ecology and built side-by-side with other relevant theories, most notably Design Theory. Design Theory is a relatively new discipline, still under development. Following its development offers valuable insights into evolving technical theories. According to Love (2002), it is crucial to theory development to integrate theories from other bodies of knowledge, as well as the clarification of the definitions of core concepts, and mapping out key issues, such as domains, epistemologies, and ontologies. At the present stage of WMT development, scientific definitions of key concepts have been offered, and evolving of WMT under the paradigm of Industrial Ecology is in progress.

The function of science is to build up systems of explanatory techniques; a variety of representative devices, including models, diagrams, and theories (Toulmin 1953). Theories can be considered milestones of scientific development. Theories are usually introduced when previous study of a class of phenomena has revealed a system of uniformities. The purpose of theory is then to explain systems of regularities that cannot be explained with scientific laws (Hempel 1966). Formally, a scientific theory may be considered as a set of sentences expressed in terms of a specific vocabulary. The theory will always be thought of as formulated within a linguistic framework of a specified logical structure, which determines, in particular, the rules of deductive inference. (Hempel, 1965).

Empirical Review

Eneh and Anamalu (2012) researched on municipal solid waste management in Enugu: the challenge of public participation. This study investigated the compliance of Enugu residents with the directives of the Enugu State Waste Management Authority (ESWAMA). Results showed that residents significantly complied with all such directives, namely taking wastes to the neighborhood dustbin (75.5 %), bagging waste meant for the neighborhood dustbin (77.5 %), cleaning the neighborhood on the environmental sanitation day (usually one Saturday in a month) (77.8 %), and payment of sanitation rates (77.4 %).

Chukwuemeka *et al* (2012) conducted a study on the challenges of waste management to Nigeria's sustainable development: A study of Enugu State. The study adopted a survey research method. Data collected through the questionnaire were analyzed and hypotheses were tested using Z-test statistical measure. The scientific investigation revealed among other things that resources normally voted by the Government year by year to manage solid waste is always very meager. There is no environmental education at all as was observed during the field investigation. Furthermore, some of the waste management staff were poorly trained, and no plan in the future to give them further training or to improve already acquired skills.

Eneji *et al* (2017) researched Attitudes toward Waste Management and Disposal Methods and the Health Status of Cross River State, Nigeria. the study adopts a descriptive survey design was adopted for the study, the sample for the study comprised traders, farmers, and civil and public servants among others, four hundred respondents were sampled using a multistage random sampling technique. The instrument for data collection was a structured questionnaire with a four-point Likert scale response option. The instrument was personally administered by the researchers and the same was collected by them. Pearson Product Moment Correlation analysis was used to analyze data generated from the field with the instrument. Both null hypotheses tested at 0.05 level of significance and 398 degrees of freedom were significant. This result implies that the residents of Calabar South have a very negative attitude towards waste management and disposal, while the second hypothesis tested also shows a significant influence of indiscriminate disposal of waste and the health status of the residents of Calabar South Local Government Area.

Abun and Racoma (2017) conducted a study on the Environmental Attitude and Environmental Behavior of Catholic College Employees in Ilocos Sur, Philippines. The study was intended to measure the understanding and attitudes of employees of Catholic Colleges in Ilocos Sur Province toward the environment and how such attitudes affect their behaviour toward the environment. It was found that overall, the employees were not certain related to their attitudes toward the environment and such ambivalent attitudes affect their behavior toward the environment.

Methodology

A descriptive research design survey was adopted for the study. The primary source of data was adopted where a well structure questionnaire was administered to the employees of ESWAMA and some residents of the Enugu metropolis. The Study covered the population of 80 staff which constitutes 60 junior staff and 20 senior/management staff of ESWAMA and about 722,664 residents of the Enugu metropolis. Enugu metropolis, the capital of Enugu State was stratified into the three (3) local government areas that made up the State capital namely: Enugu North, Enugu South, and Enugu East local government areas. Two (2) layouts were randomly selected from each of the Local government areas. These layouts are Trans-Ekulu and Abakpa Nike (Enugu East LGA), Achara Layout, and Uwani (Enugu South LGA). New Heaven and Asata (Enugu North). Two (2) streets from each layout were further selected randomly. A total of 240 respondents and 30 staff sampled from ESWAMA constitute the Target population of the study. In other words, the sample size of the study was 270.

Statistical Tool

Simple linear regression was used to analyze the results in each of the hypotheses of interest using Statistical Package for the Social Science (SPSS version 28.0).

Data Collation

A total number of 270 structured questionnaires were sent out by the researcher. A total of twelve (12) questionnaires were issued to the senior staff of ESWAMA, eighteen (18) were issued to the junior staff of ESWAMA, and the remaining two hundred and forty (240) were issued to non-staffs of ESWAMA (traders, households, business outlets, etc.). Out of these numbers of questionnaires that were distributed by the researcher, to the respondents, only 245 (90.7%) of the questionnaires were filled and returned, as tabulated in Table 1 below.

Table 1: Sample Size of the Study

Questionnaire	Total	Percent
Distributed	270	100%
Rejected	25	9.25%
Returned	245	90.75%

Source: Filed work, 2023

Demographic Profile of Respondents

The below tables, percentages, mean, and standard deviations are used to represent the profile of the respondents of the questionnaire which is represented using Table 1 below.

Table 2: Demographic Profile of the Respondents (n = 245)

Characteristics	Category	Frequency	Percent
Gender	Male	199	81.22%
	Female	46	18.78%
Age	<=24	57	23.26%
	25-34	107	43.67%
	>=35	81	33.06%
Experience	< 2 years	66	26.94%
	2-5 years	97	39.59%
	> 5 years	82	33.46%

Table 3: Reliability of the Instrument

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.813	0.813	27

Table 3 displays the reliability test using Cronbach's alpha, the result suggests that the items are reliable based on the fact that the reliability test is above the recommended threshold of 0.7

Hypotheses Testing

Hypothesis One

H_0: Fund availability has no significant positive effect on the performance of ESWAMA in Enugu State.
H_1: Fund availability has a significant positive effect on the performance of ESWAMA in Enugu State.

The effect of fund availability on the performance of ESWAMA in Enugu, Nigeria has been measured by applying a simple linear regression model. For testing hypothesis one, the independent variable is fund availability and the dependent variable is the performance of ESWAMA in Enugu state.

Regression Model of Hypothesis One

Below is the equation for a model for Hypothesis 1

$$\mathrm{PEF} = \beta_0 + \beta_1 \mathrm{FA} + \varepsilon_i \qquad (1)$$

PEF = Performance of ESWAMA in Enugu state.
FA = Fund availability.

Table 4: Regression Coefficient for Model 1

Model 1	**Beta**	**Std. Error**	**t-Statistic**	**P-value**
Fund availability (FA)	0.957531	0.05133	18.6533	0.000
Constant	-1.19862	0.01789	-66.9994	0.000
Adj R^2	**0.6123**			

Source: SPSS 28.0

Table 4 shows the values of adjusted R-Square, unstandardized beta coefficient, standard error, t-statistic, and P-value. The value of the adjusted R-square is 0.6123 implying, a 61.23% variation in the performance of ESWAMA in Enugu state is explained by the fund availability and the rest of the variation is unexplained in the performance of ESWAMA is due to variables that have not been considered in this model. Besides, the value of the unstandardized beta coefficient is 0.957531 which means that if fund availability increased by 0.957531 units, then the performance of ESWAMA in Enugu state will increase by 0.95731 units. This effect is statistically significant given that the P-value is <0.01 which is less than 0.05 at a 95% confidence interval. Therefore, the null hypothesis is rejected, and it can be said that there is a significant effect of fund availability on the performance of ESWAMA in Enugu state, Nigeria.

Hypothesis Two

H_0: The people's attitudes have no significant positive effect on the authority mandating a clean environment in Enugu state.
H_1: The people's attitudes have a significant positive effect on the authority mandating a clean environment in Enugu state.
The effect of people's attitudes on the effect towards the authority mandating a clean environment in the Enugu state has been measured by applying a simple linear regression model. For testing hypothesis two, the independent variable is people's attitude and the dependent variable is authority towards mandating a clean environment in Enugu state. The effect of people's attitudes on the authority mandating a clean environment has been measured by applying a simple linear regression model. The independent variable is people's attitude and the dependent variable is authority mandating a clean environment.

Regression Model of Hypothesis 2

Below is the equation for a model for Hypothesis 2

$$\mathrm{AMCE} = \beta_0 + \beta_1 \mathrm{PA} + \varepsilon_i \qquad (2)$$

AMCE = Authority mandating clean environment
PA = Peoples's attitude.

Table 5: Regression Coefficient for Model 2

Model 1	**Beta**	**Std. Error**	**t-Statistic**	**P-value**
Peoples attitude (PA)	1.05639	0.41319	2.55666	0.011
Constant	7.08971	0.21026	33.7187	0.000
Adj R^2	**0.404**			

Source: SPSS version 28.0

Table 5 shows the values of adjusted R Square, unstandardized beta coefficient, standard error, t value, and P value. The value of adjusted R square is 0.404 meaning thereby 40.4% variation in the authority mandating clean environment is explained by people's attitude and the rest of the variation is unexplained in the authority mandating clean environment due to variables that have not been considered in this model. Besides, the value of the

unstandardized beta coefficient is 1.05639 which means that if people's attitude increases by one unit, then the authority mandating a clean environment will increase by 1.05639 units. This effect is statistically significant as the P-value is =0.011 which is less than 0.05 at a 95% confidence interval. Therefore, the null hypothesis is rejected, and it can be said that there is a significant people's attitude toward the authority mandating a clean environment in Enugu state.

Discussion of Findings

The study investigated waste management in Enugu state: Challenges and prospects, Nigeria. Items were formulated for the different variables such as authority mandating clean environment, the performance of ESWAMA in Enugu state applied as the dependent variable, and fund availability and people's attitude applied as the independent or predictors variable. The Cronbach's alpha for these selected items was 0.813as shown in Table 3, this result indicates that the items were reliable to measure the variables we have selected.

The regression result for model 1 and 2 as shown in table 4 and 5 suggest that at a 5% level of significance fund availability and people's attitude has a statistically positive significant effect on the performance of ESWAMA and authority mandating a clean environment in Enugu state respectively. This result is based on their respective p-value which is below the threshold of < 0.05.

Summary of Major Findings

I. **Effect of Fund availability on the performance of ESWAMA in Enugu state**
   a. (Coefficient = 0.957531; t-statistic =18.6533; p-value <0.01)
   b. **Adjusted R-Square = 0.6123**

II. **Effect of people's attitude on the authority mandating clean environment in Enugu state**
   a) (Coefficient = 1.05639; t-statistic =2.55666; p-value =011)
   b) Adjusted R-Square = **-0.404**

Conclusion

The rapid urbanization experienced in the Enugu metropolis has accentuated a plethora of environmental challenges within the different residential and commercial areas. Thus, this study discovered that inadequate funding of ESWAMA affects its efficiency to the extent that evacuation and transportation of waste from waste dumps, maintenance of equipment, and payment of workers' salaries causes setback for the agency management. The study also discovered that the monitoring and control unit of ESWAMA displays incompetency and has impacted negatively on the waste management activities in the State. The study further showed that clients' attitudes make it difficult for ESWAMA to perform effectively. These attitudes include failure to pay sanitation rates, Indiscriminate disposal of wastes, failure to bag wastes before disposal, the government does everything philosophy of clients, etc. All of these have a negative impact on waste management in Enugu State and had resulted in shortages of the expected amount of the internally generated revenue in the State. Since both fund availability and people's attitude have significant positive effects on the performance of ESWAMA and a clean environment. We conclude that the challenges have a significant effect on the prospect of waste management in Enugu State.

Recommendation

The following recommendations were made:

I. Enugu State government should properly fund its waste management agency. As such, more funds should be allocated to ESWAMA to carry out its waste management responsibilities effectively.
II. Enugu State government should establish more functional sanitation/environmental Protection courts to try all environmental pollution cases as obtained in other jurisdictions. They should equally organize public sensitization programs through media or classrooms to enlighten and re-orient their client's attitudes towards their environment and ESWAMA as well. And Enugu State government should ensure that the recruitment into waste management agency control and monitoring unit should be on merit. This will aid the effective implementation of waste management policies in the state.

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