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TRANSFORMATION OF SOLID WASTE TO WEALTH IN OWERRI MUNICIPAL: ENVIRONMENTAL IMPACTS AND OPPORTUNITIES

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ABSTRACT

The study evaluated solid waste transformation to wealth in Owerri Municipal and its effect to the environment. The descriptive surveying method was used while making use of a questionnaire. It was administered to hundred (100) respondents among scavengers, individuals, men / women in solid waste and officials of ISWAMA (Imo State Waste Agent Management Agency). The result showed that carton with mean of 3.61 is the solid waste that highly affected the serenity of the city while wood with mean of 2.60 had least effect. The most harmful effect was noticed in accident with mean of 3.59 while the least effect is in nuisance with mean of 3.17. ISWAMA officials with mean of 3.63 disposed solid waste effectively while street waste sites with mean of 3.25 had the least effect. Wood with mean of 3.63 is the most solid waste that is being transformed to wealth while rubber with mean of 2.67 is the least. Carton with the mean of 3.72 gives the highest profit to people in its business while rubber with mean of 3.54 yielded the least profit. Mechanical transformation of wood with 2.46 mean is the highest among solid wastes while plastic with the mean of 1.71 is the least solid waste that is being recycled mechanically. Solid waste was discovered to have affected the serenity of Owerri municipal, requires active management; it is a source of wealth, not recycled mechanically. The study provides data to guide policy on waste-to-wealth.

Keywords: Solid waste, Wealth, Municipal, Environment

INTRODUCTION

Solid wastes are all the wastes arising from human and animal activities that are normally solid and that are discarded as useless or unwanted (Esayas, 2004). These solid wastes include among the following: ashes, garbage, garden trash, Municipal waste, residues and rubbish. Solid waste can either be biodegradable or non-biodegradable. The biodegradable solid waste can be broken down through metabolic process by which high energy organics are converted to low energy, CO_2 and H_2O. On the other hand, the non-biodegradable solid waste can be sorted in groups and recycled for other better use. The increase in population all over the world and Nigeria in particular has increased solid waste especially in municipal cities. According to Kristina (2024), the world generates 2.01 billon tones of municipal solid waste annually and that the number is estimated to rise to 3.40 billion tones by 2050. These municipal wastes are normal sized wastes from street clearing and litter collections from residential houses, playgrounds, schools, hospitals, parks, dead animals and public slaughtering houses. These wastes can be converted to energy, auto-purposes through recycling and biological waste management solutions.

The transformations of solid wastes to wealth have taken many forms with their limitation. In the work of Bassey and Akpan (2020), they wrote on the possibility of converting solid waste to art work without stating the value of such a venture to our economy. Solid waste can be converted to wealth through waste prevention/ efficiency, reuse, recycling and composting as propounded by Clark (2015) without practical application of such theories.

Konstantinos *et al* (2022) in their paper states that every venture should sustain each other, thereby eliminating wastes. They were unable to cite examples that can practically explain their claim. In the work of Yao *et al* (2024), they suggested types of transportation needed for municipal waste and possible elements involved. They also stated the health challenges of these solid wastes without stating the economic benefit to the economy.

The problem of municipal waste is a concern to everybody. This is the reasons this paper is adopting the use of questionnaire to get the input of better population in the municipal city. The response will be drawn from scavengers of solid waste, people living in Owerri Municipal, business men and women in solid waste and Imo State Waste Management Agency staff.

The questionnaire will be used to collect data that will enhance the investigation on the current state of solid waste management in Owerri Municipal. Furthermore, the data collected will assist in examining mechanized transformation methods for converting solid waste to wealth, identifying opportunities for business men and women and to provide recommendations for improving waste management and wealth creation through technology.

Nigeria is a developing country with a population of about 200 million and a growth rate of 2.38 according to the 2006 Nigeria census. It has a population distribution of 48.3% for urban cities, 57.7% for rural dwellers and population density of 139 people per square km. Waste management present problems in Mega cities like Owerri Municipal. (Exp WAQEX, 2020). Solid waste is one of the major wastes prevalent with urban cities like municipal councils in Nigeria. Solid waste is all the wastes arising from human and animal activities that are normally solid and that are discarded as useless or unwanted (Essyas, 2004). These solid wastes can be resources for creating wealth. Manufacturers needs raw materials and energy which can be obtained from solid waste like metal, wood, plastic, leader, glass, agricultural products and electrical/electronic waste (Konstantinos *et al*, 2022). However, Nura and Felix (2024) opined that the level of solid waste management affects the quality of life of people living in such area.

These municipal solid wastes can be classified into residential, industrial, commercial, institutional,

construction/demolition, municipal services, agricultural and processes. The above listed classification can be termed source based classification. Solid waste can be classified based on type like physical, chemical and biological characteristics. Ibrahim *et al* (2022) classified municipal wastes and their composition as follows: food 15%, yard trimmings 14%, wood 6%, Plastic 13%, metal 9%, glass 4%, paper 27% and others 3%.

The presence of solid waste in municipal cities has impact on the health of human beings as well as the way in which it was disposed off. Solid waste can be corrosive, ignitable, reactive and toxic. Human beings' health can be affected through chemical poisoning and chemical inhalation. Uncontrolled waste can obstruct runoff water resulting in flood, leading to low birth weight, causing cancer, leading to Congenital malformations, making people to have neurological disease, nausea and vomiting: Mercury toxicity from eating fish with high level of mercury can be as a result of high algal population in rivers and seas caused by wastes and can also lead to degradation of water and soil quality. (Pervez and Kafeel, 2013). The solid waste in an area can pollute the ground water of an area. Agada and Yakubu (2023) confirmed that the ground water in Damaturu, North East Nigerian pollution was linked to metal waste poisoning.

The solid waste from the municipal can be treated and disposed through incineration, compaction, pyrobysis, gasification and composting. In China, solid waste management and its percentage are as follows: sanitary landfill 60.20%, incineration 29.80%, uncollected waste 1.80% and others 8.20%. According to Shewata (2019), the practice of municipal solid waste management is carried out in six functional components: generation of waste, storage of waste, collection of waste, transportation of waste, process of segregation and disposed of waste. In a city with high level generation of degradable waste and lack of efficient waste collectors, there will be high level of pollution of all kinds (Agbe *et al*, 2023).

Municipal wastes can be transformed into wealth through many forms. Municipal solid waste can be used to create art work (Bassey and Akpan 2020). According to Kristina (2024), waste can be turned into wealth through reuse of waste, recycling, conversion to energy and biological treatment to produce fertilizer. Finally in the work of Kimothi, *et al* (2020), many agricultural solid wastes can be converted into solid waste such as: preparation of handmade paper from jute waste, Lac mud as organic manure, microbial protein using corn cob and oil palm factory waste for mushroom production.

In Owerri Municipal, there is high level generation of solid waste. These wastes can be turned into wealth easily. The aim of this paper is to show the need of mechanized recycling of solid waste in Owerri Municipal. Many business people in solid waste within the Municipal export them outside the state. Similarly, it is unknown about the extent of mechanical transformation of solid waste in the area. The extent of profit margin in solid waste business in the area is another aspect that needs to be determined and documented.

MATERIALS AND METHODS

The research methodology was done on the following heading: research design; area of the study; Population of the study; sample and sample techniques; instrument for data collection; validation of the instrument; reliability of the instrument; method of data collection and method of data analysis.

Research Design

Descriptive survey is the design for the study. This will provide the opinion of the respondents on transforming solid waste to wealth in Owerri Municipal and its effect to the environment. The study comprises of four sets of groups: the scavengers of solid waste; people living in Owerri municipal; business men and women in solid waste business and Imo State waste Management Agency Staff.

Nwogu (2006) defines descriptive survey design as those studies that aim at collecting data and describing them in a systematic way using the features of a given population.

Area of the Study

The study was conducted around Owerri Municipal Local Government Area.

Population of the Study

The targeted populations are all categories of people living in Owerri Municipal Local Government Area. According to National Population Commission of Nigeria, Owerri Municipal was projected to be about 174, 200 as at 2022.

Sample and Sampling Techniques

The sample size of the study comprise of 100 persons from the four groups. In determining the sample size, easy calculation.com was used with confidence level of 10. The population of 174,200 was used to get a sample size of 96. This determined sample size was approximated to 100. To justify the use of 100 as sample size, central limit theorem states that as sample mean approaches a normal distribution, the sample size increases. This increase obeys the condition of: $np \geq 10$ and $n(1-p) \geq 10$. The use of 100 sample size satisfied the condition. The confidence level of 10% was selected as the study is a preliminary study to find out if solid waste is mechanically being transformed to wealth in Owerri Municipal.

Instrument for Data Collection

The instrument used for data collection was a questionnaire titled "Transforming solid, waste to wealth in Owerri Municipal and its effect to the environment". We developed the questionnaire with 31 items graded on four (4) point likert rating scale of: very great extent (VGE); great extent (GE); Low extent (LE) and Very Low extent (VLE). Section "A" of the questionnaire provides information on demographic data of the respondent while section "B" with clusters (A,B,C,D, and E) centered on the request for the respondent to complete the questionnaire mentioned to answer the research questions posed for the study.

Validation of the Instrument

The instrument for the study was subjected to face validity by experts in measurement and evaluation from Federal Polytechnic Nekede, Owerri. The instrument was considered to be valid by the experts for the study.

Reliability of the Instrument

To ascertain the reliability of the instrument a trial test was carried out. The instruments were administered to ten (10) scavengers in Nekede outside the study area. Cronbach Alpha coefficient of 0.86, 0.89 0.90, 0.94, 0.91 and 0.92 were obtained for clusters A, B, C, D, E, and F respectively. The overall reliability estimate obtained for the instrument was 0.91. This confirmed that the instrument was reliable for the study.

Method of Data Collection
Personal visits were made to hundred (100) selected persons for distribution of the questionnaire. Hundred (100) copies were distributed to the selected respondents and hundred (100) completed copies were also collected on the basis of instant collection from the respondents.

Method of Data Analysis
The data collected from the questionnaire was analyzed using mean score. The mean value of each item was calculated by multiplying the frequency (F) of each response by its appropriate nominal value. The formula used for the calculation of each item's mean value is:

$$\bar{X} = \sum \left(\frac{Fx}{N}\right) \quad (1)$$

Where: X = mean, ∑ = summation, F = frequency of response, X = Nominal value and N = number of response.

The four point likert rating scale were given nominal values as follows: very great extent (VGE) 3.50 – 4.00, great extent (GE) = 2.50 – 3.49, Low extent (LE) = 1.50 – 2.49 and very low extent (VLE) = 0.00 – 1.49.

Decision Rule
To ascertain the decision rule, the formula below was used

$$\frac{4+3+2+1}{4} = \frac{10}{4} = 2.50 \quad (2)$$

The mean range which determine the acceptance level is 2.50 and above. Therefore 2.50 were the cut-off means score for acceptance of each questionnaire item.

RESULTS AND DISCUSSION
Research Question One: To what extent does a type of solid waste affect the serenity of Owerri Municipal?

Table 1: Result of Research Question One

S/N	Item Statement	VGE	GE	LE	VLE	X	Decision
1.	Plastic	62	30	6	2	3.52	VGE
2.	Rubber	67	25	7	1	3.58	VGE
3.	Carton	73	17	8	2	3.61	VGE
4.	Metals	38	35	20	7	3.04	GE
5.	Wood	32	7	50	11	2.60	GE
6.	House Demolition	35	23	28	14	2.93	GE
7.	House hold waste	65	22	13	0	3.52	VGE

Mean value = 3.25 GE (Great Extent).
Standard deviation = 0.399

Research Question Two: To what extent does solid waste have harmful effect to Owerri Municipal occupants?
Table 2: Result of Research Question Two

S/N	ITEM STATEMENT	VGE	GE	LE	VLE	X	Decision
1.	Nuisance/eye saw	63	10	8	19	3.17	GE
2.	Air borne disease	70	18	10	2	3.56	VGE
3.	Corrosive effect	63	23	10	4	3.45	GE
4.	Accident	73	13	14	0	3.59	VGE
5.	Other health challenges	65	15	19	1	3.44	GE

Mean value = 3.44 GE (Great Extent).
Standard deviation = 0.166

Research Question Three: To what extent do different types of waste disposal in Owerri municipal affect the cleanliness of the environment positively?
Table 3: Result of Research Question Three

S/N	Item Statement	VGE	GE	LE	VLE	X	Decision
1.	Scavengers	63	20	10	7	3.39	GE
2.	Individual	68	18	10	4	3.50	VGE
3.	ISWAMA officials	73	18	8	1	3.63	VGE
4.	Street waste site	60	15	15	10	3.25	GE

Mean value = 3.44 GE (Great Extent).
Standard deviation = 0.162

Research Question Four: To what extents do solid wastes in Owerri Municipal are being transformed to wealth?
Table 4: Result of Research Question Four

S/N	Item Statement	VGE	GE	LE	VLE	X	Decision
1.	Plastic	72	21	4	3	3.62	VGE
2.	Rubber	34	10	45	11	2.67	GE
3.	Carton	69	23	6	2	3.59	VGE
4.	Metal	62	25	11	2	3.47	GE
5.	Wood	73	18	8	1	3.63	VGE

Mean value = 3.40 GE (Great Extent)
Standard deviation = 0.411

Research Question Five: To what extent does cost of buying, selling and transformation of solid waste to wealth in Owerri Municipal enriches people in such business?

Table 5: Result of Research Question Five

S/N	Item Statement	VGE	GE	LE	VLE	X	Decision
1.	Plastic	75	13	10	2	3.61	VGE
2.	Rubber	70	18	8	4	3.54	VGE
3.	Carton	77	18	5	0	3.72	VGE
4.	Metal	80	10	7	3	3.63	VGE
5.	Wood	73	18	10	1	3.61	VGE

Mean value = 3.62 VGE (Very Great Extent).
Standard deviation = 0.065

Research Question Six: To what extent does solid waste are being transformed to wealth through mechanized recycling in Owerri Municipal?

Table 6: Result of Research Question Six

S/N	Item Statement	VGE	GE	LE	VLE	X	Decision
1.	Plastic	10	18	5	67	1.71	LE
2.	Rubber	15	15	8	62	1.83	LE
3.	Carton	20	12	13	50	1.92	LE
4.	Metal	33	8	14	45	2.29	LE
5.	Wood	43	7	3	47	2.46	LE

Mean value = 2.04 LE (Low Extent)
Standard deviation = 0.3198

Table 7: Demographic Distribution of Respondents

		Frequency	Percentage
Gender	Male	74	74
	Female	26	26
	Total	100	100
Highest Education Qualification	Primary school	11	11
	SSCE	41	41
	ND/NCE	25	25
	Bs.C/ HND	23	23
	Total	100	100
Targeted Respondents	Scavengers	13	13
	ISWAMA Staff	15	15
Municipal	Solid waste business men/women	54	54
	Individuals living in the Owerri Municipal	18	18
	Total	100	100

Table 8: 2024 Average Profit Margins in Naira for Some Solid Waste in Owerri Municipal

Months	Plastics	Rubber	Carton	Metal	Wood
January	67,300	64,400	116,500	84,200	70,300
February	71,500	71,200	133,800	86,200	76,700
March	70,250	67,300	137,200	89,300	70,900
April	73,200	68,200	135,200	82,700	73,200
May	71,500	65,300	126,700	88,300	76,400
June	66,250	58,700	103,400	83,200	71,200
July	69,400	60,800	105,500	88,300	72,800
August	70,350	62,500	106,250	87,500	75,700
September	68,400	61,300	118,500	86,300	73,800
October	73,600	74,600	126,300	88,600	78,400
November	77,300	72,500	145,200	90,650	76,200
December	72,400	70,800	128,400	85,400	74,500
Total	851,450	797,600	1,482,950	1,040,650	890,100

The first finding of this study according to table 1 revealed that plastic, rubber, carton, metal, wood, demolished house solid materials and solid household waste affect the serenity of Owerri Municipal environment. The identified area ranked high in the opinion of the respondents. The result is in agreement with Aderoju *et al* (2020). He identified that solid waste is an eye saw to citizens.

More so, the second finding of the study indicated that solid waste is imposing nuisance, cause air borne disease, leads to accident, affect health of citizens and can also be corrosive to people in contact with them. Sanko *et al* (2023) opined that

many health challenges to people are as a result of indiscriminate dumping of solid waste. This is in agreement to the findings of this study.

Furthermore, the third finding of this study identified that scavengers, individuals, street waste sites and ISWAMA (Imo State Waste Agent Management Agency) officials were means through which Owerri Municipal were kept clean. Zhang *et al* (2018) in their research study shows that cities are not kept clean on their own. There are agencies, individuals and regulations that make cities to be kept clean.

Moreover, the fourth findings in table 4 of this study revealed that some solid waste can be transformed into wealth. They include plastic, rubber, carton, metal and wood. This is line with the findings of Kumar *et al* (2017) which showed that there are great opportunities in solid waste despite challenges they pose.

However, the fifth finding of this study from table 5 showed that business men and women in solid waste make high margin profit in their businesses. In Owerri Municipal, some of the solid waste that are being sold and bought includes: plastic, rubber, carton, metals, and wood. In the study of Awosusi and Ogunbode (2017) solid waste management is a source of wealth to those managing them.

Finally, table 6 in the result of the study shows that mechanical recycling of solid waste is not practically done in Owerri Municipal. Most of the solid waste are bought and sold outside Imo State where they are recycled. Adeniyi *et al* (2018) opined that solid waste are bought in one town and recycled in another town. In Table 7, the percentage of male to female respondents is 74% and 26% respectively. The result also shows that at least 89% of the respondents have at least SSCE education with 54% of them being people in solid waste business. Similarly, Table 8 showed that carton gave the highest average profit per year. The result is a guide to help ISWAMA to understand the type of solid waste that has the highest volume. This is also an eye opener to the need of making a tax free holiday for anybody that want to invest in mechanized solid waste transformation in Owerri Municipal especially in carton.

CONCLUSION

Based on the result obtained from investigation of "transforming solid waste to wealth in Owerri Municipal and its effect to the environment", the following conclusion were discovered: Solid waste affect the serenity of any environment; Solid waste can pose a nuisance; Solid waste disposal requires active management decision by ISWAMA; Solid waste can be transformed into wealth; Solid waste is a source of lively hood to men and women that trade on them and there are not noticeable evidence of places where solid waste is being recycled mechanically in Owerri municipal of Imo State. This is in line with the state government renewed hope on reconstruction, rehabilitation and recovery for sustainable cities. The state government and private sector will increase their economy through investment in recycling plants of solid waste.

Furthermore, finance, time and human resources are some of the limitation to the study. The presence of the mentioned limitations will bring improvement to the study.

RECOMMENDATIONS

i. Solid waste business in Owerri Municipal is a lucrative business. It is recommended that men/women interested in such business will likely make a lively hood out of it.
ii. There is a need of mechanical recycling plants for solid waste in Owerri municipal.
iii. Government should come up with regulations that will guide the scavengers of solid waste in Owerri Municipal.

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