Appraisal of Waste Management Practice in Warri and Environs, Delta State, Nigeria

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Abstract

This study appraised the current municipal solid waste management practice in Warri and Environs. Over the recent times, Warri metropolitan city is experiencing speedy urbanization leading to overcrowding and the development of slums and unorganised settlements with impoverished waste management practices. Urban denizen generally burn more resources than rural denizen, and so produce large amount of solid wastes. The research used quantitative research techniques to determine the status of municipal solid waste management practice in Warri and Environs. A total of 664 Warri metropolitan residents responded to the online interview evaluating their knowledge and perception toward waste management practice. The result showed that very high and significant (p<0.05) proportion of the respondents do not carry out solid waste segregation at the point of generation (66.9%) likewise their neighbours (53.6%). According to the survey results, waste management is not due to lack of awareness but weak institutional arrangement and capacity of local council who are in charge of municipal solid waste management at the metropolis. This paper suggest the encouragement of waste segregation at source of generation and activities that promotes sustainable waste to wealth practices. Also this study recommend examination of the solid wastes management practice tool in planning for environmental sustainability in Warri and Environs to ensure healthy environment for all.

Key words: *Municipal Solid waste, Waste disposal, Waste segregation, Waste management, Warri and Environs*

I.   Introduction

Waste management is a serious challenge for cities in developing countries, owing to the increasing waste generated, driven by population growth, industrialization and urbanization (Ekeu-wei *et at.,* 2018). According to the World Bank (2013) report, population of developing nations is likely to be twofold from 2 to 4 billion between 2000 and 2030. UNEP (2013) estimated that the expected population growth of the world will be intense in the urban area of the developing nations until year 2050. Rapid urbanization evolution has resulted in a number of land uses and infrastructural challenges including municipal solid waste management (MSWM). Developing and emerging countries suffer constant, continuous and uncontrolled waste disposal as a result of human activities which generate serious pollution that affects the terrestrial and aquatic domain (Vogdala *et al.*, 2019). Nationals and municipal governments in developing countries are often having insufficient fund to meet the growing demand of solid waste management. The solid waste management is the single largest budget item for many cities (UNDP, 2013). In most of the developing nations the explanations for lack of capacity of governments to mediate the effect of population increases with economic growth and reduction of poverty incidence remain the major challenges of the urbanization in those countries.

Warri and its Environs has faced inefficient management of solid wastes. However, municipal solid waste is collected through the door to door collection system from households by Micro and Small Enterprises (MSE) often twice a week and this waste is conveyed to a designated solid waste storage container (skip point). Warri is facing rapid urbanization per annum, leading to overcrowding and the development of slums and informal settlements with poor waste management practices. Urban dwellers generally consume more resources than rural dwellers, and so generate large quantities of solid waste and sewage (Ejati et al., 2018). Waste management in these areas is hampered by multiple land tenure system with many tenants not having a right to the land and therefore not able to manage waste domestically and also the urban authorities are overwhelmed by the sheer volumes if garbage generated (Emmanuel et al., 2018, Gutberlet and Uddin, 2017).

Consequently, a few generated solid waste in the city is left uncollected and dumped in unauthorized areas such as road, drainage channel, fields, ditches, and streets. Some people in highly dense populated areas

have no access to local government disposal skips point and private collectors are too expensive for these poor households hence forced to practice indiscriminately disposed-off garbage in drainage channels, road sides and abandoned buildings (Asibor and Edjere, 2017). As the generation of solid waste increase, the cost of its removal increases too. Solid waste management is not an isolated phenomenon that can be easily compartmentalized and solved with innovative technology or engineering (Naibbi and Umar, 2017). It is particularly an urban issue that is closely related, directly or indirectly, to a number of issues such as urban lifestyles, resource consumption patterns, jobs and income levels, and other socio-economic and cultural issues. Given this situation there is need to promote complimentary alternatives such as community initiatives to manage garbage in a sustainable manner in addition to being a potential source of income for the poor. In lower-income countries, as well as poorer parts of middle-income nations such as Warri and its Environs, an estimated of 40 to 60% solid waste produced in the areas is left uncollected. Some viral and other infectious diseases are associated with waste and also serve as habitat formation for breeding insects and mosquitoes (Issa *et al.,* 2021). The major solid waste management processes start at solid waste production, storage and followed by waste segregation, solid waste collection, transportation and transferring. This study aimed at evaluating the municipal solid waste management practice in Warri and its Environs with the view of suggesting ways for it improvement and sustainability.

II. Material and Method

Description of Study Area

Warri is one of the major hubs of oil activities in Southern Nigeria and is located at 5º31'N, 5º45'E. The Atlantic Ocean is few kilometer away from the city. Some Oil and Gas companies like Warri Refinery and Petrochemical Company, Nigerian Gas Company, Matrix Energy etc are located within the Metropolitan city, thus putting the city as one of the main oil city in Nigeria. The Warri Metropolitan city is the most highly populated metropolis in Delta State. Warri South, Uvwie, Okpe, Udu, parts of Ughelli South Warri-South-West Local Government Areas (Figure 1). The waste generation per capital of Warri city is estimated at 0.5kg per person per day equating a total of 4,395 kg per day in total (Sunday *et al.,* 2013)

The waste characterization from the selected dumpsites are organic, nonorganic, hazardous and non-hazardous. The origin of these waste could be from domestic, agricultures and industrial.

The city is experiencing some emergence unplanned expansion of illegal settlements in the city clustering areas, lands are traded causally and structures were erected without due consent to the authorities, when these acts continue over time it affects the existence of the municipality and waste management plan (Open Wash, 2016). Illegal settlement households has not been benefited from the sub-cities of MSWM services, rather those households have been indiscriminately thrown away solid wastes nearby open spaces, rivers, ditches and unauthorized areas.
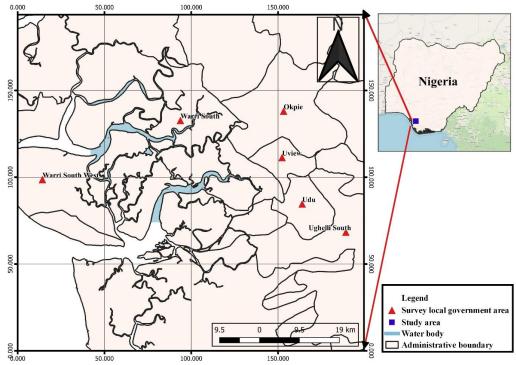

Figure 1: Map of Warri Metropolis showing the investigated waste dumpsites

Sampling Techniques

The study employed simple random and a purposive sampling techniques for the residents/head of households.

Sample size was determined using *Glenn* (1992) formula; at 95% confidence level, the variability (P) of a household unit is less variable or highly homogeneous population, therefore the researcher had taken a precision level (e) at 5% or 0.05.

$$n = \frac{N}{1 + N(e)^2}$$

Where, N= total number of housing units

n= sample size of housing units

e= allowable error or precision level

Google platform was used to conduct the online survey to assess the current solid waste management practice in Warri metropolitan city. The survey was lunched through social media groups use within Warri and Environs on 17th May, 2021 and was closed in 20th July, 2021 which lasted for about two (2) months. The total number of the respondents were 664 household for the period of survey.

III.   Results And Discussion

Evaluation of the knowledge and perception of Warri metropolitan residents on waste management

A total of 664 Warri metropolitan residents responded to the online interview evaluating their knowledge and perception toward waste management within their environs. Table 1 shows summary of the sociodemographic characteristics of the respondents. The responses increased with age thus more responses were obtained from the older than younger people. Equally more responses were obtained from males than female; married than single as well as divorced; tertiary education level than other; and civil servants than other occupation.

Table 1:Sociodemographic characteristics of the interviewees

Characteristics	Frequency (N = 664)	%
Age (years)		
18 – 24	120	18.1
25 – 34	168	25.3
35 – 44	184	27.7
45 and above	192	28.9
Sex		
Male	484	72.9
Female	180	27.1
Marital status		
Single	244	36.7
Married	412	62.0
Divorced	8	1.2
Highest level of educational qualification		
No formal education	12	1.8
Secondary	36	5.4
Tertiary	600	90.4
Training workshop	16	2.4
Occupation		
Trading	68	10.2
Civil servant	340	51.2
Corporate body	60	9.0
Others	196	29.6

The knowledge and perception of Warri respondents on waste management obtained via the online survey are summarised in Table 2. Approximately 84.3% of them have idea of solid waste management while 96.4% opined that solid waste can be converted into useful material as well as reused and recycled. High proportion that constituted 90.4% opined that there is useful material in solid waste while 69.3% expressed that waste segregation at the source is beneficial to health, furthermore, 66.9% expressed that it is not ideal to put all your waste in a single bag. Approximately 91.6% were aware that people make living from transacting waste items. Generally, these responses varied.

Table 2:Knowledge and perception of waste management

Characteristics	Frequency N = 664	%
Do you know any form of solid waste management		
Yes	560	84.3

No	72	10.8
I can't tell	32	4.8
Do you think solid waste can be converted into useful material		
Yes	640	96.4
No	12	1.8
I can't tell	12	1.8
Do you know if solid waste can be separated at source		
Yes	508	76.5
No	96	14.5
I can't tell	60	9.0
Do you know waste can be reused and recycled		
Yes	640	96.4
No	20	3.0
I can't tell	4	0.6
Do you think waste segregation at the source is beneficial to health		
Yes	460	69.3
No	96	14.5
I can't tell	108	16.3
Do you know if there is any useful material in solid waste		
Yes	600	90.4
No	44	6.6
I can't tell	20	3.0
Do you think it is ideal to put all your waste in a single bag		
Yes	184	27.7
No	444	66.9
I can't tell	36	5.4
Do you know that people buy waste items		
Yes	608	91.6
No	44	6.6
I can't tell	12	1.8

The responses of interviewees on awareness and willingness to pay for waste management are presented in Table 3. Significant proportion of the interviewees were aware of waste management processes involving composting and waste segregation and this proportions were significantly higher (p <0.05) than those unaware. The result showed that very high and significant (p<0.05) proportion of the interviewees do not carry out solid waste segregation at the point of generation (66.9%) likewise their neighbour (53.6%). Significant proportion (95.2%) we aware that organic waste can be a source of manure. Also, the field data showed that 64.5% of the interviewees currently pay for monthly tariff for sanitation and solid waste management in Warri and environ.

Figure 1: Level of agreement with waste management practices

Table 3: Awareness and willingness to pay for waste management

Characteristics	Frequency N = 664	%
Do you know about composting		
Yes	460	69.3
No	96	14.5
I can't tell	108	16.3
Have you heard of waste segregation at source before		
Yes	468	70.5
No	184	27.7
I can't tell	12	1.8
Do you carry out solid waste segregation at the point of generation (in your household)		
Yes	184	27.7
No	444	66.9
I can't tell	36	5.4
Does your neighbor practice it		
Yes	68	10.8
No	356	53.6
I can't tell	240	36.1
Would you contribution to solid waste segregation at the source of generation (household)		
Yes	516	77.7
No	60	9.0
I can't tell	88	13.3
Do you know your organic waste can be a source of manure		

Yes	632	95.2
No	28	4.2
I can't tell	4	0.6
Do your household currently pay for monthly tariff for sanitation and solid waste management		
Yes	428	64.5
No	204	30.7
I can't tell	32	4.8
Will you be willing to pay N500 monthly for waste management		
Yes	524	78.9
No	140	21.1

Table 4: Shows the analysis of awareness and willingness to pay for waste management in Warri metropolitan city. The high percentage of awareness of waste management practice by the respondents indicates a relationship with their willingness to pay for the service. Presently people practicing waste management in this study are as low as 10.8% of the respondents and 78.9% of the respondents are willing to pay N500 monthly for waste management.

Table 4: Awareness and willingness to pay for waste management

Characteristics	Frequency N = 664	%
Do you know about composting		
Yes	460	69.3
No	96	14.5
I can't tell	108	16.3
Have you heard of waste segregation at source before		
Yes	468	70.5
No	184	27.7
I can't tell	12	1.8
Do you carry out solid waste segregation at the point of generation (in your household)		
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No	28	4.2
I can't tell	4	0.6
Do your household currently pay for monthly tariff for sanitation and solid waste management		
Yes	428	64.5
No	204	30.7
I can't tell	32	4.8
Will you be willing to pay N500 monthly for waste management		
Yes	524	78.9
No	140	21.1

Table 5. Shows the waste management practices by socio-demographic characteristics Warri metropolitan city. The socio-demographic characteristics in the study show no significant difference.

Table 5: Waste management practices by socio-demographic characteristics

Characteristics	Waste management practices (%) (N=664)			X^2	p-Value
	Yes	No	Can't tell		
Age (years)					
18 – 24	68 (56.7)	40 (33.3)	12 (10.0)		
25 – 34	64 (38.1)	96 (57.1)	8 (4.8)	1.544	0.462
35 – 44	48 (26.1)	136 (73.9)	0 (0.0)		
45 and above	88 (45.8)	104 (54.2)	0 (0.0)		
Total	268	376	20		
CORPs sex					
Male	196 (40.5)	272 (56.2)	16 (3.3)	**72.740**	**0.000**
Female	72 (40.0)	104 (57.8)	4 (2.2)		
Total	268	576	20		
Marital status					
Single	124 (50.5)	100 (41.0)	20 (8.2)		
Married	144 (35.0)	268 (65.0)	0 (0.0)	**65.617**	**0.000**
Divorced	0 (0.0)	8 (10.0)	0 (0.0)		
Total	268	376	20		
Highest level of educational qualification					
No formal education	12 (100.0)	0 (0.0)	0 (0.0)		
Secondary	8 (22.2)	24 (66.7)	4 (11.1)	**37.806**	**0.000**
Tertiary	236 (39.3)	348 (58.0)	16 (2.7)		
Training workshop	0 (0.0)	4 (25.0)	12 (75.0)		
Total	268	376	20		
Occupation					
Trading	36 (52.9)	24 (35.3)	8 (11.8)		
Civil servant	128 (37.6)	212 (62.4)	0 (0.0)		
Corporate body	20 (33.3)	40 (66.7)	0 (0.0)	**49.552**	**0.000**
Others	84 (42.9)	100 (51.0)	12 (6.1)		
Total	268	376	20		

The willingness of the respondents to pay by socio-demographic characteristics shown in table 6. Only sex in the socio-demographic characteristics show significant different in their willingness to for waste management practice.

Table 6: Willingness to pay by socio-demographic characteristics

Characteristics	Willingness to pay (%) (N=664)		X^2	p-Value
	Yes	No		
Age (years)				
18 – 24	88 (73.3)	32 (26.7)		
25 – 34	124 (73.8)	44 (26.2)	**18.896**	**0.000**
35 – 44	140 (76.9)	44 (23.9)		
45 and above	172 (89.6)	20 (10.4)		
Total	524	140		
CORPs sex				
Male	380 (78.5)	104 (21.5)		
Female	144 (80.0)	36 (20,0)	0.175	0.676
Total	524	140		
Marital status				
Single	180 (73.8)	64 (26.2)		

Married	344 (83.5)	68 (16.5)	**39.018**	**0.000**
Divorced	0 (0.0)	8 (100.0)		
Total	524	140		
Highest level of educational qualification				
No formal education	12 (100.0)	0 (0.0)		
Secondary	28 (77.8)	8 (22.2)		
Tertiary	468 (78.0)	132 (22.0)	7.811	0.050
Training workshop	16 (100.0)	0 (0.0)		
Total	524	140		
Occupation				
Trading	52 (76.5)	16 (23.5)		
Civil servant	284 (83.5)	56 (16.5)		
Corporate body	36 (60.0)	24 (40.0)	**17.716**	**0.001**
Others	152 (77.6)	44 (22.4)		
Total	524	140		

The generation of waste and subsequent disposal is one of environment challenges that is of considerable concern to inhabitants of any locality as well as the local, state and federal government, and the world in general. This concern triggered huge responses from the Warri residents on their knowledge and perception on waste management in the course of the online survey. The demographic characteristics of the respondents were similar to that obtained by Igiekhume *et al*. (2021) in the assessment of public-private-participation of solid waste management in Warri as high responses were obtained from people with formal education, male, older ones, and civil servants. Based on this, efforts towards improved waste management could be achieved as sensitisation/public awareness campaign in Warri would yield the desired result with targets on younger generation (especially of feminine gender), singles as well as the uneducated. Aminu and Ibrahim (2015) in the study of evolving knowledge management solution for municipal solid waste management problems in Nigeria highlighted the need for adequate information sharing on waste management benefits. When such an approach is implemented in Warri, there are tendencies for wealth generation from the resources assumed as waste. Very high proportion of the respondents opined that people make living from transacting waste items.

The transformation of the existing trends in municipal waste management is critical for a developing nation like Nigeria to ensure sustainable environments and associated benefits. From the result of this study, it is obvious that very high proportion of the respondents were aware of the inherent benefits that municipal waste could be converted into useful material as well as reused and recycled. Waste management practices such as source segregation was strongly supported by the respondents to be beneficial to health but high proportion of the respondents do not carry out solid waste segregation at the point of generation. The result of this study showed that the required awareness for proper waste management in Warri and environ is achievement but there is still needs for enforcement of sustainable municipal waste management practices and producers' involvement in municipal waste management. In the past, quite a couple of approaches and interventions have been established for tackling municipal waste concerns but with little or no progress (Aminu and Ibrahim, 20) Efficiency in management of municipal waste would requires application of knowledge management tools and intensification that assure sustainable environment and socio-economic progress. "Municipal solid waste management is an important part of urban infrastructure that ensures the protection of environment and human health" (Aliyu, 2010).

Warri is among the key cities that drive the economy of Nigeria for over 5 decades (Igiekhume *et al*., 2021) thus efforts to improve municipal waste management therein should be considered important. From outcome of the surveys, it is obvious the factors impeding processes of waste management in Warri and environ count on poor legislation and funding; poor implementation of policy and enforcement of extant environmental laws on waste management, limited infrastructures and expertise, low level of awareness, poor recovery and recycling programme, among other modern disposal technique.

IV.   Conclusion and Recommendations
Conclusion

In conclusion, this study unveiled that significant proportion of the resident therein were aware of waste management processes but do not segregate waste at the point of generation. The existing poor status of municipal solid waste management could be due to weak institutional arrangement and capacity of local council who are in charge of municipal solid waste management at the metropolis and they should encourage waste segregation at source of generation and activities that promotes sustainable waste to wealth practices.

RECOMMENDATION

The finding of the study shows that the existing municipal solid waste management practice in Warri and Environs was insufficient and the services given by the concerned sanitation administration were inadequate in terms of sustaining public health and accessibility. Therefore, the following very important measures are forwarded to overcome MSWM problems and improvement of the system for sustainable service delivery of MSWM in Warri and Environs:

- There should be careful plan on carrying out the attitudinal change of people for waste management system sustainability.
- Engaging the MSE and creating effective channels of communication.
- Give continuous awareness creation or education for the public among schools, institutions, NGOs, businesses and popular individuals via the different medium of communication about MSWM in general and ISWM in particular.
- Creating favourable conditions for continuous public participation and impartial enforcement of rules and code enforcement service regulations

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