FROM HOUSE TO HIGHWAY: ANOTHER STAGE/STOP IS IMPERATIVE IN THE STRATEGY FOR SOLID WASTE MANAGEMENT IN OGBOMOSO, NIGERIA

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ABSTRACT

The bulk of the solid wastes carted away from residential precincts of Nigeria and other Third World cities often form high heaps in dumps at the city outskirts and transit highways; constituting bigger nuisance and health hazards to a larger, unsuspecting populace. This study examines routes of solid wastes from the various household generators to their destinations in a typical solid waste management strategy in Ogbomoso, a medium city in Nigeria. It appraises the mechanism for the movement of solid wastes generated from households to neigbourhood dumps and finally to their ultimate destinations. The efficiency of and satisfaction with the operative mechanism for pooling and removing these wastes from individual houses and residential neigbourhoods are examined among residents through questionnaires. These are administered to sampled houses from three distinct residential populations density zones in the city. Through observatory trips, the movement pattern of these wastes were followed from each household to their final dump sites, along highways and at designated spots at the city. Pheriphery! The result shows that no further action is taken on the wastes except for occasional, unsuccessful burning attempts. The shortcomings in these strategies are highlighted and recommendations made towards the treatment of the wastes for healthy environment and enhanced socio-economics of residents and local administrations.

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INTRODUCTION

A clean, healthful, sanitary environment is an important attribute of housing habitability. Such a living environment should adequately, be rid of all forms of vermin-induced pollutants, including household and industrial effluent waste waters, chemicals, obnoxious gaseous emissions, domestic and industrial noise, solid waste or refuse, etc.

Literature is replete with the different methods and strategies for ridding residents' environments of pollutants of these various kinds. The focus of this study, however is on collection and management of solid wastes in the residential environments of Ogbomoso, a Third World city.

Ogbomoso doubles as the headquarters of Ogbomoso North and Ogbomoso South Local Government Areas of Oyo State, Nigeria. It is a medium sized, Nigerian city (Tanimowo, 1997; Atolagbe, 2011), located at about 105km north-east of Ibadan, headquarters of Oyo State; 58km, north-west of Osogbo, headquarters of Osun State; 53km/south-west of Ilorin; headquarters of Kwara State of Nigeria, (Abodunrin, 2004; Ojo, 2006; Jelili, 2006; Atolagbe, 2011).

Studies already undertaken on solid wastes collection and management in Nigerian cities are many; majority of which concluded and or recommended the use of regular burning on site, landfills and incinerators as final treatment. Only a few of the studies carried out in the South-Western part of Nigeria, the same geographical and socio-economic region with the study area, Ogbomoso, are reviewed in this study. They include that of Lagos Mainland by Adedibu and Okekunle, (1989); in Ogbomoso by Atolagbe and Tanimowo (2006); and Lagos Metropolis, by Olorunfemi (2009).

The study by Atolagbe and Tanimowo (2006); like the current study, also focused on the study area, Ogbomoso. While identifying solid wastes among the most acute pollutants in the city, the study only carried out examinations on, and made recommendations on the abaitment of noise pollution in the city.

Adedibu and Okekunle (1989), identified papers as constituting 90 percent of the ten (10), categories of solid wastes generated in Lagos Mainland. The study then recommended the use of incinerators at good proximity to the sources of papers and other combustible wastes. In addition, it recommended that other wastes (10%), be carted into designated landfills. This solution may lead to an improvement in ridding Lagos Mainland of solid wastes, but, it is our contention in this study, that burning of wastes at the scale recommended may spell a greater

disaster on the larger environment. Besides, proliferation of landfills, filled with plastic (1.8%), nylon and polythene (7.6%), cans and bottles (9.6%) and other non-degradable components of the 2.6 percent unclassified wastes in the city as recommended in the study, would amount to a waste of the land resources used as landfills. Indeed, landfills, especially when located near where it is visible constitute eye-sores to the environmental scenery! Furthermore, reactions, end products and emissions from burning of lead batteries, radio-active components of fridges, computer parts, etc, that constitute part of the wastes in the landfills have been established as hazardous to human, plants and animal health (Directory, Non-Timber Building Materials.htm). This category of wastes must not be managed by burning, or left in the landfills, more so that, they are becoming rather prominent in the Nigerian environment.

In his study to critically examine the impact of landfills as a waste, Olorunfemi (2009) confirmed that communities in Nigeria were, more or less still living with wastes depending on their relative distances from these landfills. Besides, the study showed that landfills in Lagos do not conform to international standards. This maybe the reason why landfills in Lagos and other parts of Nigeria were, indeed, sources of obnoxious odour, smoke (from burnings), flies, rodents, among others.

This paper is an attempt to study the method of solid waste collection and treatment used in each of, and across the residential zones of the city as well as the proximal adequacy of the location of neighbourhood waste bins to households. We also made an effort to evaluate the satisfaction rating of residents with the efficiency of waste management services and the shortcomings inherent in these methods. The residents' view on a healthy and friendly environment was also assessed. Finally, the dump sites where wastes are deposited and treated were visited to make physical observations.

METHODOLOGY

For the purposes of this study, the study area, Ogbomoso was grouped into three physically identifiable residential density zones (Fig. 1). These are the high density, inner or city core pre-colonial, indigenous settlement part of the city; the medium density, intermediate and colonial settlement zone, forming a ring around the indigenous zone; and the new, developing, low density, post-dependence residential, outer ring of the city.

About 50 percent of the total number –in a multi-stage, sampling approach- using Ogbomoso Street map. This gave a total of 18, 15 and 14 streets in the high, medium and low

density residential zones, of the city, respectively. Every fifth house was then systematically sampled on each sampled street. Thus, a total of 506, 377 and 359 houses from the high, medium and low density residential zones, respectively were selected (Table 1). The household head was interviewed in each sampled house to collect data on the proximal adequacy of the neighbourhood waste collection bins or vehicles to their house and the satisfaction of the household with the rate of removal of wastes from the bins. Using the Likert scale, response for each of the questions were categorized into very close, close, cannot decide, far; and very far and very satisfactory, satisfactory, cannot decide, unsatisfactory and very unsatisfactory, for the questions, respectively.

A Chi-square test was used to examine the significance of the distribution of the resulting scores across the residential zones of the city (Table 1).

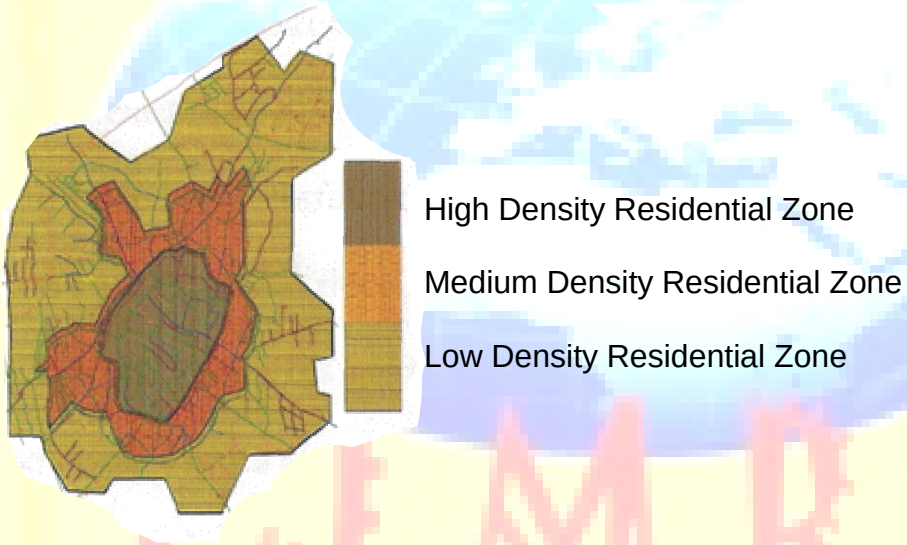

Fig. 1: Map of Ogbomoso Showing Three Distinct Population Density Zones

FINDINGS, RESULTS AND DISCUSSIONS

Location of Solid Waste Bins at accessible proximities to houses is a popular method of pooling wastes from residential neighborhoods in Ogbomoso for onward transportation to designated dump sites at city outskirts

The proximal convenience of the location of these waste bins and where bins are not available, the station points of solid waste collection vehicles to the households, in the different residential zones of the city are as indicated in Table 1. The result generally shows, that more residents (44.3%), in the city consider the location of waste bins/vehicles as “far” or “very far” to

their houses; as against 42.8 percent that rate their locations "close" or "very close". Residents in the medium (49.6%), low (44.3%), and high (37.8%), density residential zones, respectively, rate their proximity to the neighbourhood waste bins as either "close" or "very close", in that order. Conversely, 36.8, 37.1 and 54.9 percents from the medium, low and high residential density zones rate these locations "far" or "very far". Thus solid waste bins/vehicles are located closest to households in the medium and least so, to those in the high density residential zones of the city. The result, with a Chi-square value of 29.588 is significant at 99 percent level of confidence (Table 1). Thus, availability of waste bins/vehicles is rare among the relatively more economically buoyant residents in the low density residential zone and the collective environmental sanitation activities in the zone are very low. Individual households in this zone often set their wastes on fire in the confines of their, substantially fenced-in, premises. Others carry their wastes in bags to waste bins in the city or dump sites at the outskirts of cities at individuals' daily or weekly outing opportunities.

The higher proximal adequacy of waste bins recoded by residents in the medium density residential zone may be due to the nature of road network in this zone. Though fewer than in the low density area, the roads are more thorough and mostly overlaid with asphalt. Thus, the bins located along these streets are more accessible to households and also easier for the vehicles that carry the wastes to dump sites. On the other hand, many houses in the high density zone have no vehicular war accessibility to the fewer network of roads in the zone. Thus, many households cannot easily reach the waste bins from the access-locked interiors. Residents here therefore dumping resort to most of their wastes in open fields (Figs. 2 and 3), gutters and stream courses (Figs. 4 and 5) and dilapidated house sites. Attempt at burning these unsanitary heaps of wastes on the sanitation days are also rarely successful, as accumulated wastes consisting of wet and non-combustible materials do not burn easily; but rather, generate huge smoke, resulting from incomplete combustion often seen hovering above the city, accompanied with stinking smells. Little wander, why residents in this zone (high residential) recorded a significantly low rating for proximal adequacy in the location of waste bins.

Residents in the low residential zone have the largest network of roads in the city. These roads are however among the least in quality and accessibility. As a result most of the streets in this zone have no solid waste bins assigned to them. However, most of the residents here are of high income group, high car ownership and other socio-economic indices (Atolagbe, 2011). By

this status, a lot of the residents who are mobile by virtue of owning their private cars carry their solid wastes to designated bins, where they are available within other zones or major dump sites, which can be seen along expressways, or other sites outside the city fringes (Fig. 6). Others in this zone cast their wastes on available vacant plots around or set a substantial part of it on fire within their often fenced-in properties.

Table 1: Proximity of Solid Waste Bins to Households

Variable	Response Category	Residential Density Type								Chi-Sq Value	P. Value
		High		Medium		Low		Total			
		No	%	No	%	No	%	No	%		
Proximity to solid waste bins	No response	3	1.0	7	1.9	15	4.1	27	2.2	29.588	0.000
	Very Close	35	6.9	25	13.8	29	8.1	116	9.3		
	Close	152	29.9	135	35.8	130	36.2	417	33.5		
	Cannot Decide	37	7.3	44	11.7	52	14.5	133	10.7		
	Far	185	36.4	100	26.5	81	22.6	366	29.4		
	Very far	94	18.5	39	10.3	52	14.5	185	14.9		
	Total	506	100	377	100	359	100	1244	100		

Source: Author's Survey in Atolagbe (2011)

Residents' Satisfaction with Solid Waste Removal from Neighbourhood: In tandem with the poor rating of waste bin distances to neighborhoods which increased from the medium, to the low and high residential zones of the city, residents' satisfaction with the waste management mechanism in the city is low on the average. Only 17.8 percent of residents in the whole city expressed "very satisfactory" (1.7%), or "satisfactory" (16.1%), with waste removal services in the city. A greater majority (70.6%) of the residents across the city are either unsatisfied (46.2%) or very unsatisfied (24.4%). About 25.9, 14.6 and 14.4 percents of the residents are either satisfied or very satisfied, decreasingly, from low, to medium and high residential zones, respectively, with the efficiency of this strategy in the city.

The majority, 77.3, 77.2 and 54.3 percents, return "unsatisfactory" and "very unsatisfactory" opinions from the high, medium and low density residential zones of the city, respectively. This shows that residents in the high are significantly dissatisfied with solid waste removal efficiency in the city. This is followed closely by residents in the medium (77.2%), and in the low (54.3%), in decreasing order of satisfaction (Table 2). The result, with a Chi-Square value of 92.592, is significant at 99 percent level of confidence.

In spite of better allocation of waste bins in the medium residential zone, dissatisfaction is not relatively different in this zone from what it is in the high residential zone. If anything, the result generally shows that satisfaction is relatively dependent on the ability of residents to privately discharge or eliminate wastes from their vicinities.

Table 2: Residents' Satisfaction with Waste Removal from Bins

Variable	Options	Residential Density Type								Chi-Sq value	P-value
		High		Medium		Low		Total			
		No	%	No	%	No	%	No	%		0.000
Removal of wastes from bins	No Response	9	1.8	1	0.3	8	2.2	18	1.4	92.572	
	Very Satisfactory	8	1.6	3	0.8	10	2.8	21	1.7		
	Satisfactory	65	12.8	52	13.8	84	23.1	201	16.1		
	Cannot decide	33	6.5	30	8.0	64	17.6	127	10.2		
	unsatisfactory	280	55.1	195	517	102	28.1	577	46.2		
	Very unsatisfactory	113	22.2	96	25.5	95	26.2	304	24.4		
	Total	508	100	377	100	363	100	1248	100		

Source: Author's Survey in Atolagbe (2011)

Situation at Dump Sites: The dump sites available and visited for observations were of two categories. The first category are those located in the city. They are mostly in the high residential zone, where access to street bins and refuse vehicles are either distant or not thorough.

They constitute high and extensive heaps of wastes. They are found in Masifa/Bolanta (Fig.2), Akitan Laka (Fig. 3), and in gullies and gutters (Fig. 4) and streams (Fig. 5).

The second category consists of the ultimate dump sites by the waste vehicles. These are found at the outskirts of the city, along the express and major highways (Fig. 6); and other undesignated points which are themselves potential areas for future housing development as the city grows.

CONCLUSION

From the foregoing, the success or otherwise of solid waste management in Ogbomoso can be assessed at two main stages: the collection and treatment stages.

Collection of Wastes: The process of waste collection may have achieved some appreciable level of success in some zones of the city-notably the low and medium residential density zones. Residents in the low density zone of the city are more responsive to waste collection and management issues in their surroundings. Despite the relative absence of waste bins or waste vehicle departure points in this zone, residents rid their surroundings of wastes through personal efforts. The high socio-economic status of residents here may have been responsible for their efforts in achieving a cleaner environment.

Because of better quality of roads and accessibility of households in the medium density zone, to waste bins and waste vehicle points and greater number of bins, and of recent, waste vehicle stops, residents in this zone find it easier to dump their wastes in the neighbourhood bins. And for the same reason of better road accessibility, these wastes get carted away from the bins regularly. A combination of these three factors may be responsible for the relative success of the medium over the high density zones of the city in wastes collection.

Most wastes are pilled up at designated points in the high residential zone of the city; where a substantial number of the households are access-locked. Carting wastes from within the zone to the bins located along the relatively distant streets, is thus less successful.

Treatment of Wastes: The single, popular method of waste treatment within the neighbourhood in the city zones is by burning. A similar method is employed at the various ultimate dump sites at the outskirts of the city. Otherwise, wastes remain in these outskirts and road shoulders, in indiscriminate and increasing heaps. These heaps, sooner or later, are sure to be sub-sumed in the same larger city as further housing development engulf them. As it is now, the city and its residents are still living with wastes, and perpetrating the prevalent environmental

stress. What options are available to redness the situation? The dump sites at the outskirts of the city or along the expressways to neighbouring towns and cities cannot remain as the ultimate dump site. There must be another stop! A few recommendations are made, in this regard, in the next section.

RECOMMENDATIONS

The waste management situation in Ogbomoso and other cities in Nigeria calls for a new, integrated approach, at all stages from the households (wastes sources), to waste bins locations and final depot and treatment.

The new approach should take off from an intensive public enlightenment campaign for city residents on the advantages of, procedures for, and roles of individuals in the new strategy. The environmental effects and residents hazards inherent in the old method of waste sorting, burning and sporadic dumping at city outskirts should be emphasized and discouraged. The new strategy should be wholistic, starting with sorting of wastes by the households, getting the wastes into the appropriate bins and the final sorting and treatment of wastes at designated industrial sites. The mounting heaps of wastes along highways and dotting the outskirts of the city should be removed for treatment.

Appropriate waste collection method should commence from household sources. Each household should sort their wastes into three identifiable categories, namely: degradable, non-degradable and combustible wastes. These separate parcels must be moved into the designated neighbourhood waste bins in disposable polythene bags, at every outing opportunity, which should not be less than twice, a week. Receptors for these household wastes must also be similarly designated at not more than one hundred metres (100m) apart, along the streets in each neighbourhood. Three mobile containers (for each of the three categories of wastes), should be stationed at each waste bin location; each carrying informative inscription and picture symbols, to guide household refuse depositors. Each category of waste from the households should be dumped in the appropriate container for that wastes category. These bins must be emptied or moved away and replaced at least once in a week in the current policy of weekly (Thursdays'), environmental sanitation days, of the new administration in Oyo State.

Fig. 2: Masifa/Bolanta Neighbourhood Waste Dump

Fig. 3: Akitan Laka Open Field Neighbourhood Waste Dump

Fig. 4: Waste Dumped in Gutters at Laka Neighbourhood

Fig. 5: Waste Dumps along Stream Courses in Aarada Market area of Ora-gada

Fig. 6: Waste Dumps along Roads and Highways.

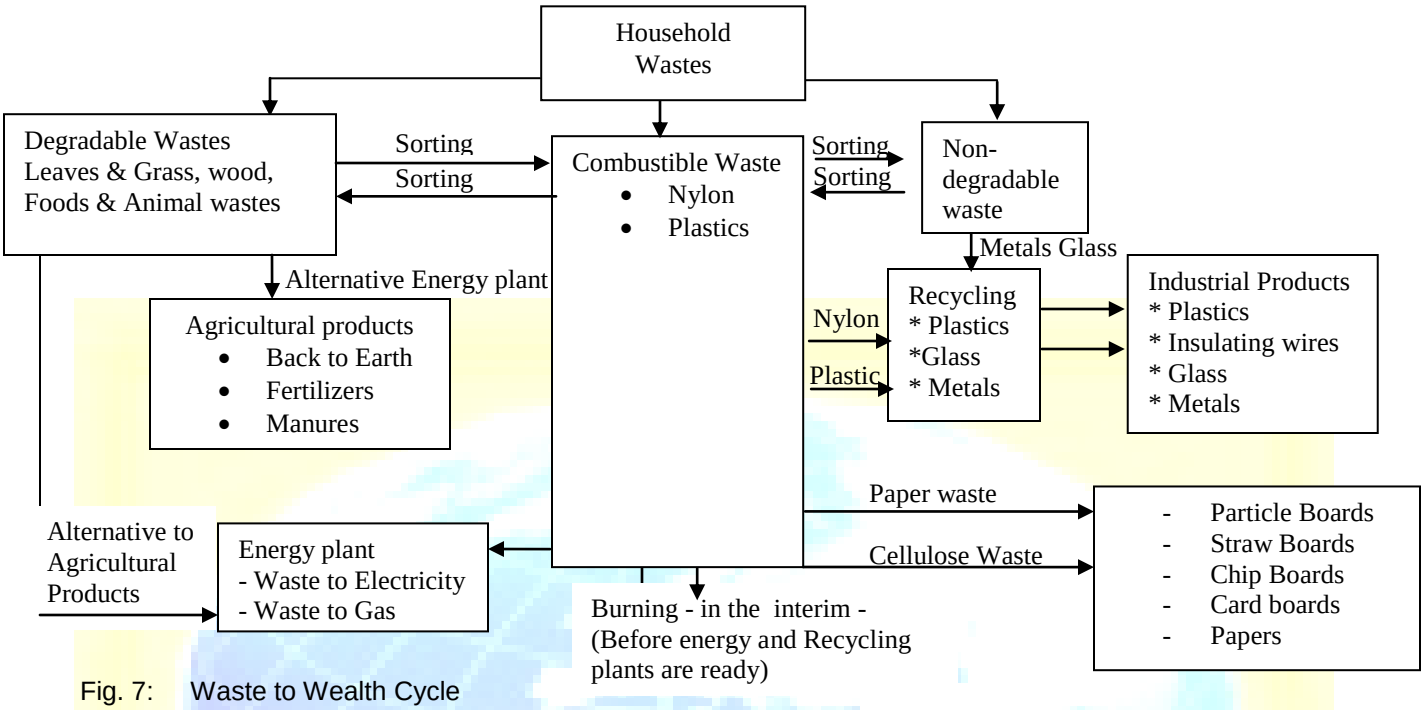

Fig. 7: Waste to Wealth Cycle

Source: Authors proposal (2012)

Residents in the high density zone of the city should not only be encouraged, but policed to carry their household wastes into the waste bin nearest to them, even when it involves relatively longer distances from access-locked locations in the zone.

Dumping wastes in the existing, unsightly heaps in the zone should be prohibited; and any contravention should be strictly sanctioned. Vigilante groups should be evolved in the different wards of this zone to ensure residents do not sneak in wastes into these neighbourhood dumps.

As a matter of state/national policy, a trio of recycling and compositing factories and an energy plant must be built in each Senatorial District to convert wastes to utility in the districts. Each category of wastes should be re-sorted by industry-based agencies for conversion, recycling, compositing and other industrial management processes (Fig. 7).

In the interim, that is, before recycling and energy generation plant is fully in place, combustible materials like nylon, calabash and textile wastes may be sorted for selected burning; and paper wastes into paper mill already existing in the country for recycling. Through small scale industrial processes, non-degradable wastes like stain-glass chips can be grinded for use as

drive-ways, pavements (interior and exterior), drainages and walkways. Milk-jug and other similar plastics can be remoulded and used for playground structures, garden benches, etc; (Shaw, 2006). Other non-degradable wastes like soda bottles (plastics), can be spinned for use as plastic carpets; computer casing can be recast for use as fireproof shingles (for roofing); and glass cutlets can be broken down to constitute a viable 15 percent, of aggregate mix, in concrete works (Table 4)

Table 4: Light Industrial Processes of Waste to Wealth

	Waste	**Treatment**	**Uses**
1	Stained-glass chips	Grind roughly	Pavements, interior and exterior/drive-ways/walkways
2	Milk jug (plastic)	Remould	Playground plastic structures/Garden benches
3	Soda bottles	Spin	Plastic Carpets
4	Glass cutlet	Break into splinters	Constitute 15 percent of aggregate mix in concrete
5	Plastics	Remould	Timber fences Garden decks
6	Computer casings	Recast	Fire proof shingles for roofing
7	Broken tiles	No treatment	For pavement/walk ways Drive-ways
8	Metal cans	Cut and Reshape	Vehicle toys, cooking stove, sieves
9	Metals (aluminum, pots)	Remould	Pots and household containers

Source: Shaw (1996) and Unpublished sources from sundry Architectural and Welding practices.

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