

REDUCTION, REUSE AND RECYCLING OF SOLID WASTE IN THE MAKURDI METROPOLITAN AREA OF NIGERIA: PUBLIC OPINIONS AND PERCEPTIONS

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ABSTRACT

Waste is a global environmental issue that is becoming most noted in developing countries. Public attitudes towards reducing, reusing and recycling solid waste in the Makurdi Metropolitan area of Nigeria have been sought, in tandem with their awareness of waste management options, to determine the extent to which these various approaches are utilised and to identify strategic avenues for improvement. To date, the waste management strategies of the study area, which are typical of many developing countries, remain focused on more traditional waste collection and storage methods (dumped outside the city limits in an uncontrolled landfill site) that are not conducive to sustainable futures. Questionnaires were distributed (n = 560) throughout low (Zone I), medium (Zone II) and high density (Zone III) population areas, with different income levels, and the respondent data analysed (n = 545). These reveal that most respondents (>80%) in all of the three zones are aware of solid waste reuse, recycling and reduction from source and that many of them (>90%) are willing to participate in any associated schemes. Opinion on the responsibility for managing waste was divided, with the most affluent neighbourhood (Zone III) believing the government was accountable and the less affluent neighbourhoods disagreeing. Moreover, many from the least affluent neighbourhood (Zone I) considered solid waste to be both a serious environmental and public health risk. Concomitant with these findings, it is apparent that the infrastructure and the societal means to facilitate solid waste reduction, reuse and recycling is

drastically lacking. Since there is a clear public knowledge and willingness to engage in sustainable waste management approaches, across all levels of society, it is recommended there is a shift in local authority strategy towards a sustainable hierarchy and federal government funding be forthcoming to make necessary infrastructure improvements and embrace public attitudes to solid waste reduction, reuse and recycling.

Key words: Public awareness, Waste hierarchy, Management strategy, Developing countries.

1. INTRODUCTION

The concept of sustainability is one that has become foremost in the minds of politicians over recent decades and the wider issue of sustainable development has been addressed at numerous global conferences. The United Nations Conference on Environment and Development (UNCED), otherwise known as the Rio Earth Summit, was held in Rio de Janeiro in Brazil in 1992 and resulted in a detailed action plan known as Agenda 21 that has been adopted by more than 178 governments worldwide, including Nigeria (Sales *et al.*, 2006). Chapter 21 of Agenda 21 deals specifically with the management of solid wastes and recognises that “environmentally sound management of wastes was among the environmental issues of major concern in maintaining the quality of the Earth’s environment...” (United Nations, 1992).

The waste industry has seen increasing pressure in recent years due to a steady rise in waste production (Burnley, 2007), fuelled by increasing population growth, rapid urbanisation (Agdag, 2008) and the need for more sustainable and environmentally acceptable waste management strategies (Hazra and Goel, 2008). As a result, management practices have evolved and, in keeping with the policies outlined in Agenda 21, there has been a paradigm shift from ‘waste management’ to a more ‘resource management’ philosophy (International Solid Waste Association (ISWA), 2009). For instance, Adewumi *et al.* (2005) state that solid waste could be considered “a resource in the wrong place”. However, it is inevitable that anthropogenic activities will produce solid waste but it is also possible to restore some value by creating management strategies that concentrate on value as a resource rather than something that requires disposal.

Nigerian waste management strategies have historically focused on collection and storage (Banar *et al.*, 2008). For many parts of Nigeria this strategy is still favoured (Babayemi and Dauda, 2009), particularly in Makurdi where waste is dumped in an uncontrolled landfill close to the city limits (Plates 1 and 2). Concomitantly, solid waste is also dumped at roadsides at a rate that collections are unable to keep pace with and, as such, roads are often blocked by excess waste.

Increasing population growth and lack of efficient waste management strategies at both the local and national level exacerbates this problem. Nigeria is already heavily populated, having a higher population than any other country in Africa (Ogwueleka, 2009), of which an estimated 10% live below the national poverty line (World Bank, 1996). As a consequence, many people attempt to survive by scavenging open dumpsites for materials that they can sell and, as such, this exposes them to a variety of health risks (i.e. exposure to disease causing organisms, bacteria, insects and rodents) (Ogwueleka, 2009). Electronic wastes, such as computers and mobile phones are particularly sought because they offer recoverable parts that may be sold-on for re-use and,

therefore, are appealing to buyers due to potential cost savings. Unfortunately, those engaged in the collection and dismantling process are exposed to many toxic metals (such as lead, mercury and cadmium) (Miller, 2006) (Plates 3 and 4).

Waste Management has proved a huge challenge for local authorities in Nigeria. The Federal Government of Nigeria has implemented various laws and regulations in an attempt to tackle the problem, however, insufficient funds are available at the local level to invest in either training or the technical resources that are needed to tackle waste problems (Ogwueleka, 2009). Landfilling (controlled or otherwise) has become a less preferable option as it requires large amounts of space, poses potential threats to the environment and human health through leaching and gaseous emissions and recovers only a limited amount of energy (Messineo and Panno, 2008). Therefore, many of these laws and regulations attempt to facilitate a shift in strategy towards the more acceptable, newly-established waste management hierarchy that encourages waste prevention, minimisation, recycling and recovery (Banar *et al.*, 2008).

This work aims to (i) gauge public opinions towards reducing, reusing and recycling solid waste in the Makurdi Metropolitan area of Nigeria; (ii) reveal public awareness of waste management options; and (iii) identify appropriate avenues for strategic policy improvements.

2. THE STUDY AREA

Makurdi Metropolitan area is the capital city of Benue State and is located in the middle belt region (north-central) of Nigeria ($6^{\circ}45' - 8^{\circ}15' E$, $7^{\circ}30' - 9^{\circ}45' N$). It has a population of 297,398 spread out over an area of 41,035 km² making it the most densely populated local government area in Benue State, with a mean of 257 people per km². It has a diverse cultural make-up, among which the following ethnic groups are prominent: Tivs, Idomas, Igedes, Hausas, Yorubas and Ibos (National Population Census, 2006).

To date, the collection and disposal of solid waste is the combined responsibility of the Benue State Ministry of Water Resources and Environment (BSMWRE), the Benue State Environmental Sanitation Authority (BENSESA) and the Private Service Provider (PSP). That said, BSMWRE are responsible for orchestrating the process, whilst BENSESA are responsible for the supervision of the PSP and the management of solid waste disposal sites. Established in 2005, during the implementation of landmark state legislation on environmental protection (Gazette Number 14, 2005), BENSESA has publicly outlined its role within the solid waste management context (Table 1).

3. METHODOLOGY

The study was conducted by staff and students from the University of Ibadan, between July and September 2008, and employed a methodology that integrated literature search, questionnaires, formal and informal interviews and the use of observational checklists. The study area was partitioned (Table 2), using population density and income levels, into three distinct areas (designated as Zone I, Zone II and Zone III); with Zone I having a very high density and Zones II and III having medium and low densities, respectively, and Zones I and II having low income levels (mean monthly income of \$100), while Zone III has a high income level (mean monthly income of \$500). The following criteria were then used to define the specific study sites within each zone: (a) management of solid waste had been identified as a problem; (b) populated by people from different ethnic backgrounds who share different beliefs on many issues; and (c) contains politicians, public servants and literate residents that would be able to participate in filling-out questionnaires. The questionnaire (n = 560) was then distributed across the three zones (in compliance with the

University of Ibadan ethics code). Upon return of the data (n = 545; 97.3% response), descriptive statistical analysis was applied.

4. RESULTS

Compositional analysis of solid waste in the Makurdi Metropolitan area (Table 3) indicated a high percentage of waste throughout all the zones is putrescible (57.5, 53.7 and 36.4% of solid waste composition in Zone I, Zone II and Zone III, respectively). The vast majority of the respondents (~90%), more so in Zones I (>95%), are firmly aware of the health consequences of poor waste management and disposal. The results reported here reveal the levels of awareness and acceptance of the need to cutback, reuse and recycle of waste as effective tools in redressing the dysfunctional waste management systems in the study area.

Crucial to effective waste management is the willingness and ability to cut down on waste production. The study reveals a very high degree of awareness of the importance of solid waste reduction in the fight against the problems of waste management across the study area (Tables 4 and 5). Overall, >80% of the respondents were aware of the great dividend that could be realised from effective cutback in the production of waste. The trouble is, merely knowing something is not, by itself, sufficient to generate beneficial outcomes. The continuing exponential growth of solid waste generation in the study areas suggests that the widespread knowledge of the need to cutback on waste production is hardly producing practical beneficial effects. Knowledge must be backed by willingness and ability to act upon it. Where the cost of cutting back on solid waste production is perceived to be greater than the private benefits (payoff) to the actor who is cutting back on waste, it cannot be expected that such actors will be willing to bear the cost alone. Even where individuals are prepared to bear the cost, they expect their efforts will be complemented by those of others, including the state, in order to have measurable impacts. Individuals that are in doubt as to the real impacts that their efforts may make are unlikely to continue with their efforts in reducing their private waste.

When waste is produced it has to be properly managed. The first step in managing waste is to ensure that only 'true waste' is disposed off – what is reusable should be prepared for re-use, whilst what can be transformed into a reusable resource may be used as such. Current technology advocates reuse and recycling of waste to be the main means through which resources that have been disposed off as waste, may be put to productive uses. Thus, 'waste' is not waste unless it is impossible to reuse or recycle. Again, a very high proportion of the respondents (~90%) accept the proposition that reusing and recycling of solid waste is an effective way of dealing with solid waste management problems. That said, reuse and recycling requires adequate technology and costs that may be beyond the affordability limits of most individuals, given the levels of poverty across the population. At the household level, however, with the right incentives, households may be encouraged to operate small scale reuse and recycling systems to help cut down real waste production. As the results show, >90% of the respondents are willing to engage in household level waste management systems. Even so, >80% across the board advocates for all waste to be sent to landfill or dumpsites sites. This shows that whilst people may be aware of the best means of handling household waste, regardless of where they live, they are predisposed to leaving the action in the hands of the governmental systems, the managers of landfill and dumpsites. This may be because it shifts the direct cost of managing the waste to the state. There is minimal evidence, however, of this translating into real action and, hence, the growing spate of solid waste disposal.

5. DISCUSSION

The production of solid waste is inevitable in a society where consumerism is ripe, and the population is growing (Agdag, 2008). The way in which waste is managed can have a profound impact on public health and quality of life (Agbede and Ajagbe, 2004). There are many different management strategies that could be employed at both local and national levels and recent years have seen a shift towards a new management hierarchy that promotes the reduction, reuse and recycling of waste products (Banar *et al.*, 2008). However, the waste management strategies currently employed in the Makurdi Metropolitan area are still centred on the concept of collection and storage. Unsorted waste is dumped in an unregulated landfill close to the city limits (Babayemi and Dauda, 2009).

A major step towards an effective solid waste management policy is to raise public awareness on the importance of creating a healthy environment (United Nations, 1992), as well as introducing mechanisms to control the generation of solid waste and provide alternative means of disposal (Coker *et al.*, 2010). The simplest way to tackle the waste management problem is to reduce waste at source (Enger and Smith, 2008). This not only reduces the amount of waste that requires management, but reduces the demand for raw materials and favourably impacts the environmental problems associated with the manufacture of goods (such as greenhouse gas emissions) (ISWA, 2009). The results of this study indicate that whilst residents across all three zones were aware that reduction at source is a management option, this did not indicate that it was an option regularly utilised.

Where waste reduction is not possible, it is preferable to reuse and recycle. Reuse of waste delays the need for production of new materials and reduces the amount of waste requiring treatment and disposal (ISWA, 2009). Within the Makurdi Metropolitan area, forms of reuse include salvaging automobile parts, bricks, doors, plastics and clothing for resale and barter. Recycling requires collection and transport of waste to a manufacturing site, where it can be processed and converted to a new product (Calabro, 2009). Indications are that there is sufficient awareness when it comes to the possibility of reuse, however, all too often waste seems to be discarded, particularly in high income areas. In contrast, the low-income areas seem to reuse and recycle more products, which is presumably because they cannot always afford otherwise.

As part of the Nigerian Government's commitment to implementing Agenda 21, these issues need to be addressed and, in keeping with the proposed policy outlines, there needs to be a shift in management strategy to encourage waste minimisation, re-use and recycling, in conjunction with government assistance to make necessary improvements and embrace/educate society to promote sustainable futures (United Nations, 1992).

6. CONCLUSIONS

The promotion of sustainability within the waste management sector is imperative to achieve resource conservation and a healthy environment. Within Nigeria, and the Makurdi Metropolitan area in particular, there remains a more traditional strategy in place that involves collection and storage of solid waste in uncontrolled landfill areas close to human habitation. Whilst the Government at a national and local level has put many policies in place, these policies appear to have minimal impact where funds are not available to provide the correct technical resources for supporting the management initiatives. As such, this study reveals that throughout all three zones, awareness of the reduce/reuse/recycle strategies was fairly high. However, the accompanying facilities and training that would allow residents to implement waste behavioural improvements was lacking. In order for the Nigerian Government to uphold its commitment to the implementation of

Agenda 21 and for its policies to become effective, it is deemed necessary to ensure the physical infrastructure and training is in place to support its sustainable waste management strategies and respond to public opinions on solid waste.

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Table 1: Declaration of the solid waste management roles offered by the Benue State Environmental Sanitation Authority (BENSESA).

	Solid waste management roles
(i)	Liaise with other environmental health departments and institutions to ensure common goals in environmental sanitation.
(ii)	Collect, remove, process, treat and safely dispose of domestic, hospital, commercial, institutional and industrial wastes.
(iii)	Recycle waste.
(iv)	Clear street and public places.
(v)	Advise and make recommendations to the ministry for improvement in collection, removal, processing, treatment and safe disposal of wastes in particular and sanitation matters in general.
(vi)	Remove and dispose of abandoned vehicles and carcasses of dead animals on public highways and other public places.
(vii)	Design, operate and maintain waste disposal facilities.
(viii)	Prepare and adapt from time to time master plans for waste collection and disposal within the state and controlling the resultant waste within the state.
(ix)	Approve and keep watch on waste disposal systems.

Table 2: Environmental zones delineated in the Makurdi Metropolitan area of Nigeria.

Zone	Area names within the Zones	Area (km ²)	Population/km ²	Density classification
I	Madikpo/Wadata	9.38	4,061	High
II	Lobi/Kwararafa	15.78	536	Medium
III	Old Government Reserved Area	15.88	88	Low

Table 3. Typical composition of solid waste in the Makurdi Metropolitan area by generation (July/August 2003) (Sha'ato *et al.*, 2007).

Source	Waste category							
	Putresceable ^a	Plastic/cellophane	Paper	Metals ^b	Glass	Textile	Fines ^c	Miscellaneous ^d
LoDA	57.5	6.10	4.30	2.50	2.30	2.90	21.0	3.40
MeDA	53.7	7.10	4.10	2.01	1.70	2.40	27.1	1.70
HiDA	36.4	8.04	2.59	1.75	0.86	3.67	41.0	5.73
COMM	27.9	10.2	10.9	3.40	6.90	1.20	36.4	3.10
INS	44.8	5.90	8.90	0.90	1.20	0.30	36.4	3.10
SMI	23.4	7.01	2.10	0.70	0.10	6.10	31.7	28.9
MART	36.1	6.86	3.20	1.10	0.10	1.90	48.7	2.01

LoDA = low-density area; MeDA = medium-density area; HiDA = high-density area; COMM = commercial premises; INS = institutional premises; SMIs = small/medium scale industry; MART = Wadata Market.

^aPutresceables includes food remnants, fresh and decaying leaves and vegetation.

^bMetals: mostly cans and bottle caps; few ferrous metal and aluminium items.

^cIncludes ash, dust and sand.

^dOther includes wood, stones and pebbles, discarded shoes and other footwear, wood shavings (from carpenter workshops); styrofoam and discarded dry cells.

Table 4. Respondent opinions of waste reduction, reuse and recycling (n = 545 respondents).

Statement	Response	Zone I (n=285)	Zone II (n=165)	Zone III (n=95)	All Zones (n=545)
		(%)	(%)	(%)	(%)
Waste can be reduced from the source.	Agree	89.47	75.76	73.68	82.57
	Disagree	10.53	24.24	26.32	17.43
Waste can be reused.	Agree	96.49	95.15	80.00	93.21
	Disagree	3.51	4.85	20.00	6.79
Waste can be recycled.	Agree	85.96	98.18	87.37	89.91
	Disagree	14.04	1.82	12.63	10.09
I am willing to participate in sorting, storage and proper disposal of waste generated from my house.	Agree	96.49	81.82	94.73	91.74
	Disagree	3.51	18.18	5.26	8.26
It is not necessary to have a waste bin in my house.	Agree	17.54	24.24	31.57	28.02
	Disagree	82.45	75.76	68.43	77.98
Solid waste constitute can be a serious health problem.	Agree	96.49	78.78	84.21	88.99
	Disagree	3.51	21.22	15.78	11.01
All the generated wastes should be taken to dumpsites or landfill.	Agree	82.46	78.78	89.47	82.57
	Disagree	17.54	21.22	10.53	17.43
Waste collection and disposal is the sole responsibility of the government.	Agree	60.70	52.72	47.37	55.96
	Disagree	39.30	47.28	52.63	44.04
Some type of waste can be sold.	Agree	90.88	92.72	94.74	92.11
	Disagree	9.12	7.28	5.26	7.89
Waste can be composted and used as fertilizer.	Agree	96.84	98.18	100.0	97.80
	Disagree	3.16	1.82	0.00	2.20
Solid waste disposal in Makurdi is environmentally safe.	Agree	36.49	57.58	63.16	47.52
	Disagree	63.51	42.42	36.84	52.48
I have a container for sorting out solid waste.	Agree	87.72	88.48	89.47	88.26
	Disagree	12.28	11.52	10.53	11.74
I often take my solid waste container outside to be emptied.	Agree	84.91	89.09	100.0	88.81
	Disagree	15.09	10.90	0.00	11.19
I usually pay a solid waste collector to dispose of my waste.	Agree	27.37	71.51	78.95	49.72
	Disagree	72.63	28.48	21.05	50.28
I draw the attention of the solid waste management authority to unkempt dumpsites in my neighbourhood.	Agree	36.49	66.67	78.95	53.03
	Disagree	63.51	33.33	21.05	46.97

Table 5. Analysis of Variance (ANOVA) of differences in the three zones

Statement	n	Mean	Standard Deviation	Sum of Squares	df	Mean Square	F	Significance
Waste can be reduced from the source	⁺ 391	7.532	4.288	[#] 8.988	1	8.988	0.558	0.055 (NS)
	⁺⁺ 154	7.247	3.202	^{##} 8739.974	543	16.096		
	^{###} 545	7.451	4.010	^{###} 8748.961	544			
Waste can be reused	⁺ 391	5.361	1.000	[#] 1.432	1	1.432	1.312	0.023*
	⁺⁺ 154	5.247	1.151	^{##} 592.777	543	1.092		
	^{###} 545	5.328	1.045	^{###} 594.209	544			
Waste can be recycled	⁺ 391	6.056	1.180	[#] 1.002	1	1.002	0.733	0.039*
	⁺⁺ 154	5.961	1.427	^{##} 742.528	543	1.367		
	^{###} 545	6.029	1.169	^{###} 743.530	544			

*Significant at $P < 0.05$, NS = Not significant

⁺Low income (mean monthly income of \$100)

⁺⁺High income (mean monthly income of \$500)

[#]Between group

^{##}Within group

^{###}Total.



Plate 1: Waste at a landfill site – typical of many urban areas of Nigeria.



Plate 2: Unregulated waste burning – a common waste management approach.



Plate 3: Basic domestic dwellings adjacent to a landfill site.



Plate 4: Waste dumping initiative by government using trucks and loaders.



Plate 5: Scavengers gathering discarded electronics products into trucks to sell.



Plate 6: Reclaimed segregated items from a landfill site by waste scavengers.