STRATEGIES FOR EFFECTIVE URBAN SOLID WASTE MANAGEMENT IN NIGERIA

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Abstract

The aim of this paper is to proffer urban solid waste management strategies which will effectively address the problems emanating from solid waste management. Three layouts in Enugu city. Namely, Independence Layout (low density), Idaw River (medium density) and Uwani (high density) were used for the study. 310 households selected randomly from these layouts participated as respondents. Principal Components Analysis (PCA) version of Factor Analysis was used to analyze the responses of respondents. The PCA was used to reduce the 27 considered management options into 7 composite strategies which should be adopted for effective urban solid waste management. They are citizen mobilization and environmental education, strengthening of public agencies, responsible government, logistics and infrastructural improvement, legislation, appropriate technologies, monitoring and surveillance. It is recommended that all segments of the society must team up with public agency to find a panacea to urban solid waste management.

Keywords: Solid waste, effective management, responsible government, Logistics improvement, public involvement and funding

Introduction

The defective strategies and arrangements adopted for solid waste management in Nigerian cities create the erroneous impression that urban waste management problems are intractable. This sterns from the fact that the rate of collection and evacuation perpetually lag behind the rate of generation which makes solid waste accumulation a major source of

environmental nuisance in Nigerian cities. Solid waste management therefore, concerns the interplay among generation, storage, collection and final disposal (Omuta, 1988). Sada (1984) has observed that in 1980, on the average, a balance of 100 metric tons of solid waste are pilled up daily in Benin City. This is because while about 350 metric tons of solid wastes are generated daily, the maximum rate of evacuation achievable was only 250 metric tons daily. Uchegbu (1988) remarked that big cities like Enugu, Lagos, Kano, etc in Nigeria produced on the average 46kg of solid waste per person, per day. As living standards rise, people consume more and generate more waste. Right from 1990s Enugu city has metamorphosed into a resort center because of its congenial living environment which attracts an influx of weekend leisure seekers into the city. These leisure seekers merely come into Enugu to relax, consume and enjoy themselves every weekend thus contributing enormously to weekly waste generation in Enugu City. Atuegbu (2007) reports that between 500 and 850 metric tons of waste are generated daily in Enugu city. At Abakpa, the rate of waste generation is so high that in one night, a refuse dump site that was cleared the previous day could be replaced with an equal volume of waste the following morning, thus creating the erroneous impression that it was never clear before. The scenario is the same at Asata, Emene and Coal Camp areas of Enugu Metropolis.

Unfortunately, many people in African countries including Nigeria, until recently, regard the concern for effective strategies for managing urban solid waste as a less important issue which may distract attention from the most urgent and serious problem of achieving a fast rate of economic growth. This attitude stems in part from the belief that environmental degradation with urban solid waste generation is an inevitable price of development (Salau, 1992; Chukwu, 2010).

Literature Review and Theoretical Framework

Literature indicates that much attention has been given to the studies of waste management problems in Nigeria. These studies cover cities of various sizes and different ecological, climatic, cultural, religious and economic regions. These studies emphasize that solid waste problems have been intractable and appear to defy all policy options suggested for improvement. Rosenbaum (1974) argued that solid waste is an unofficial measure of prosperity since wealthy nations produce more wastes than poor ones but Omuta (1988) argues that what causes waste problem is not volume produced but the degree of effectiveness of solid waste management. This explains why, although Americans have been quoted to be the most prolific producers of solid waste on earth yet they have not produced the filthiest cities on earth. The uncharted volume of wastes that are visible along almost all

the roads and streets of our urban neighborhoods is an indication that the adopted strategies to cope with the inevitable byproducts of development are ineffective. In fact, the problem of solid waste management occupies a central place at both national and international conferences. However, most of the work carried out centered mainly on classification of urban solid waste (Ekwueme and Achikanu, 2000), environmental impacts and consequences of solid waste generation (Nyeenenwa, 1991) and recycling of mixed waste plastic products (Chukwu, 2007). Surprisingly, little work has yet been done to address the key issue of effective strategies for the management of urban solid waste in Nigeria cities. This study is therefore designed to close the identified research gap in literature.

There are two major approaches to waste management in Nigeria. They are private and public arrangements. The private system is a contractual arrangement between an individual or group of persons who undertake waste disposal as a business venture and the waste generator. This system is common among the high and medium Income households who can afford the charge. The public system is more conventional. This is a situation where government establishes a waste disposal agency whose responsibility it is to collect waste from waste generators and dispose them at disposal depots. Some cities adopt the combination of the two systems particularly when the public system is ineffective to cope with the volume of waste generation; the private system is adopted to compliment the efforts of the public arrangement. This hybrid arrangement is quite common in Nigerian Cities such as Enugu, Port Harcourt, Aba, Owerri, Ibadan and Kano. (FMHE, 1983). The hybrid system has many attributes which support its adoption. While the public system is under state government control and supervision, the private system, because of its profit motive tries to offer satisfactory service so as to get more customers and enlarge its area of operation. This motive in turn ensures that efficiency is maintained (Omuta, 1988).

Methods of Data Collection and Analysis

This research conducted between March 2007 and May 2008 covered three residential densities in Enugu city. The residential areas are Independence Layout (low density), Idaw River (medium density) and Uwani (high density). Data for the study were collected by pre-coded questionnaires, structured interview and direct observation. A total of 310 households participated in this study. The distribution is as follows, 120 households from Independence Layout, 100 from Uwani and 90 households from Idaw River. These households which were administered with the pre-coded questionnaires were randomly selected. 60% of the household heads were females while 40% were males. This is based on the fact that women are much more critical of environmental cleanliness than their husbands. This view is

supported by other researchers, for example, Doxiadis (1973) argues that 80% of housing decisions taken by his clients were made by housewives, while Rapoport (1980) contends that women are more affected by inappropriate environment and are much more identified with the neighborhood and home. Onibokun (1974) also argued that women, as homemakers, stay at home and interact with the housing environment more than men.

Each questionnaire contains 27 strategy options considered good enough for effective waste management (see Table 1). Each respondent (household) is requested to indicate any five out of the 27 options considered the most effective and appropriate options. All the distributed questionnaires were returned. The analytical tool employed is the Factor Analysis Model because of its data reduction capability. The variant used is the Principal Component Analysis (PCA) which is capable of transforming a given set of variables into a new set of composite variables or principal components that are orthogonal (uncorrelated) to each other. This PCA was used to reduce the 27 variables to fewer dimensions of interrelated variables and a 310 x 27 data matrix was derived for the effective options. The technique yielded 7 factors (see Table 2) which were given descriptive names on the bases of their most functional variables (Joshi, 1973). Where one variable loads very high on more than one factor, the variable is grouped with the factor where it shared the greatest commonality (Ombokun, 1973). Table 2 gives details of the factor loadings and the proportions of the variance accounted for by each of the seven factors. Table 3 shows the factor descriptions based on the variable loadings on the factors. In the discussion of the 7 factors, use was made of the outcome of interviews and observations.

Discussion of Findings

The identified effective solid waste management options based on the factor loadings and percentages of the total variance explained by each of the composite factors are discussed hereunder;

Citizen Mobilization and Environmental Education

Five variables loaded high on this factor. For effective waste management, the citizens must be mobilized through sensitization and environmental education. Sensitization will bring about adequate citizen participation and private sector partnership. The public agency such as Enugu State Waste Management Authority (ESWAMA) cannot alone achieve success in waste management without corresponding positive collaboration of the citizens and the private sector. Citizens and public sensitization will bring about the much needed development and initiation of neighborhood spirit. Through sensitization and environmental education, the attitude of the people towards improving and maintaining the neighborhood

quality will be achieved. The residents will then develop a sense of belonging, some emotional attachment to their neighborhood and thus display a sense of commitment to the cleanliness of the neighborhood. If residents of a neighborhood are properly organized, sensitized and educated, they can be mobilized to team up and on their own become committed to their neighborhood to the extent that they can on their own take decisions to clean up their neighborhoods and thus improve the processes of waste management.

Strengthening Waste Management Agency

Six variables loaded high on this factor. Strengthening a public waste management agency requires a responsible government that will be committed to the cleanliness of the cities by beefing up the personnel strength of the agency, improving the circulation infrastructure and logistics. These will enable the agency to operate at a high level of efficiency. Good enough, the present administration in Enugu State led by Governor (Barr.) Sullivan Iheanocho Chime has mounted an aggressive attack on urban filth by reinforcing and equipping Enugu State Waste Management Authority (ESWAMA), the agency responsible for waste management in Enugu State. On 18th April 2008, the agency acquired fifteen waste compactor trucks and one thousand dumpsters for effective and efficient discharge of its assignments. The dumpsters have been kept at different locations along the roads in the city for waste deposition. This is a laudable achievement but a lot more needs to be done. There is need to apply the "polluter-must-pay" principle as well as upward review of sanitation fees so as to generate revenue and ensure' adequate funding of the agency. During the colonial administration, sanitary inspectors were used to keep Nigerian cities clean. There is a need for the re-introduction of sanitary inspectors to enforce hygienic occupancy In our cities as well as in the rural areas.

Government Support

In view of the fact that many studies indicate that there is high positive correlation between citizens poverty and waste management problems, Golledge (1960), Gooddey (1973), Omuta (1985), Onokerhoraye (1976), Adedibu (1983), governments should pursue vigorously the program of poverty reduction as a way of addressing urban waste management problems and to ensure its sustainability. In view of the worrisomeness of urban solid waste management problems, there is the need for the introduction of Waste Management Advisers to the state governors and creation of sanitation committees in the State Houses of Assembly. These House Committees will articulate appropriate sanitation measures and regulations which will guide urban sanitation as well as consumer items that generate wastes particularly the non-biodegradable ones. Government through the House Committee on waste

management will ensure that waste management courts are established and offenders duly prosecuted.

Waste Management Legislation

Government should put in place elaborate and comprehensive legislation to guide the waste management behavior of the people. Observation shows that household waste disposal involves children, house helps and maids whose attitude to waste disposal is lackadaisical. Waste legislation should ban such class of people and make it mandatory that only the adults should be involved in household waste disposal. Similarly, general sanitation exercise should be done fortnightly rather than monthly.

Legislation should stipulate standard for distribution of dumpsters and as such increase its distribution density. The suggestion here is that there should be one Dumpster per 50 households. Legislation should make provision for members of the public to have the power and right to sue public-management agency such as ESWAMA for uncleared wastes in the city. Every house should also by law possess a waste dustbin and landlords of filthy yards should be prosecuted.

Infrastructural and Management Improvement

The management of waste management agency such as ESWAMA should be headed by a professional environmental manager who is a well trained environmental practitioner rather than a politically appointed individual who is not knowledgeable about the intricacies of the environment. This will assist in right decisions being taken on waste management. As well, road infrastructure such as route-ways should be improved and properly maintained so as to facilitate routine waste collection from neighborhoods.

Application of Science and Technology

Presently, our waste management programs involve simply moving waste from one place to another and not really managing it. For instance, wastes move from urban areas to landfills at the remote outskirts. It is instructive to warn that these locations considered "'remote" today, may become settlement sites tomorrow, meaning that we are currently burying time bombs that may explode tomorrow to consume millions of human beings.

The landfill site at Ugwuaji in the outskirts of Enugu should be upgraded and properly designed in accordance with environmental standards as pointed out by Agunwamba (2001) and Chukwu (2010) to include six major features. These features include subsites with approved depth (5m) and slope (1:3) of layers, leachate draining system, gas collecting system, leachate treatment system and leachate re-circulatory system. These measures ensure maximum protections against possible health risks that commonly emanate from landfill sites.

Thus a perfect strategy for waste disposal would be the use of scientific techniques to develop appropriate technology that is capable of accepting an unlimited amount of waste and safely containing it forever outside the sphere of human life (Borkin and Keller,1998). This type of technology may not be the best since many valuable resources may be lost. The best technology is that which support the environmental view that there really is no such thing as waste but only resources. With this technology, waste will no longer exist because it will not be produced and if produced, would be a resource to be used again. This will lead to what is referred to as industrial ecology in which our industrial society would function more like an ecological system where waste from one part of the system would be a resource for another part, This technology will pave way for integrated waste management (IWM) which is best defined as a set of management alternatives including reuse, source reduction, .recycling, composting, landfill and incineration (Relis and Dominiski, 1987).

Monitoring and Surveillance

Two variables loaded high on this factor. Women are known to be very committed and thorough in the areas of environmental cleanliness and clean up. Again, they 'are more at home than their male counterparts. Women need to be organized and empowered to constitute waste management "marshals" to mount surveillance within the neighborhood. If they are properly organized and re-orientated they can provide the much needed sanitary watchdogs and controllers. The existing women's organizations such as Christian Women Organization (CWO) and Christian Mothers' Union (CMU) could be of help in this direction since they abound in all neighborhoods. Good enough, environmental cleanliness is already part of their membership cardinal objective.

Policy and Planning Implications

There is hardly any state government in Nigeria that has not shown concern in the area of urban solid waste management yet there is no city in Nigeria that is not groaning under the pressure of uncharted urban wastes. The problem has been that the arrangements adopted in most cases are inadequate. The assignment of solid waste management exclusively to a single agency is totally unacceptable. While it is recognized that the appointment of a public agency is vital in urban solid waste management, it must also be recognized that effective urban waste management demand multi-pronged approach in which all segments of the society must be brought together and made to function like a team. This implies that all segments of the society must be sensitized and properly educated to understand and appreciate the essence of high quality environment. If this happens, urban waste management

becomes a problem for all in which all hands must be on deck to contribute to the success of urban waste management.

Recommendations

Based on the findings of this study, it is recommended that:

(1) Solid Waste Management in Nigeria should become the concern of everybody – the landlords, tenants, school children, traders, business people, civil servants, the privileged, the politicians etc. One single governmental agency cannot alone effectively cope with the volume of solid waste generated in Nigerian settlements.

(2) Agencies charged with the responsibility of solid waste management must be sufficiently supported by way of adequate funding and circulatory infrastructural improvements to enable the agency perform successfully.

(3) Government must also provide congenial enabling legislations and edicts that will establish waste management agencies as Independent Waste Management Authorities which will function like a private business corporations. This will enhance its efficiency because it will aspire to break even and at the same time try to live up to expectations.

(4) Efforts should be geared towards the use of scientific techniques to develop appropriate technologies for dealing with solid waste management such as encouraging the emergences and development of industrial ecology where wastes from one activity are input of raw materials for another activity. Landfill sites should be designed and operated in accordance with W.H.O standards.

Conclusion

Urban waste management requires the concern of government, businessmen, politicians, religious organizations, civil servants, men, women, literate,' illiterate, the rich, the poor and a host of other tangible and intangible groups. All these must be brought together by government policy and legislation to work together like welfare officers to attack vigorously the urban waste problems. Thus, the quest for an effective solid waste management policy leads to a search for a comprehensive, coordinated and governmental planning which will combine with adequate legislation, adequate fiscal provision, public involvement and awareness to bring about the expected improvement in the quality of our urbanscape (Omuta, 1988). This is the only way to ensure sustainable cities in Nigeria.

Table 1: Considered Strategy Options.

1. Citizens Sensitization
2. Environmental Education
3. Scientific orientation
4. Adequate funding
5. Agency personnel and logistic improvement
6. Road infrastructural improvement.
7. Private sector partnership (churches, clubs, Unions, organization, CBOs and NGOs
8. Government supported agency.
9. Initiation and development of neighborhood spirit.
10. Reintroduction of sanitary inspectors
11. Eradication of poverty
12. Polluter-must-pay principle should be applied.
13. Only adults should be involved in household waste disposal
14. Every house should be provided with a dustbin
15. Regulation against waste generating consumer items
16. Suing the agency for any uncleared wastes
17. Annual awards for cleanest neighborhoods
18. Environmental sanitation should become fortnightly.
19. Management of ESW AMA should be headed by environmentalist.
20. Women's organizations should become waste marshals and mount surveillance.
21. Landlords to be penalized for filthy yards.
22. Sanitation fees should be increased
23. Establishment of special courts for sanitation offenses
24. Waste management committees to be created in the House of Assembly.
25. Introduction of special advisers to the governors on waste management.
26. Increase the density and number of dumpsters.
27. Monitoring and surveillance of waste disposal by women.

TABLE 2: Rotated Factor And Factor Loadings Of Considered Strategy Options

S/n	Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
1.	Citizens participation sensitization	(0.796)	0.021	0.001	0.212	0.401	0.001	0.221
2.	Environmental Education	(0.815)	0.011	0.210	0.111	0.061	0.184	0.355

3.	Application of Science and Technology	0.412	0.219	0.012	0.301	(0.728)	(0.985)	0.215
4.	Adequate funding of Agency	0.333	(0.822)	0.221	0.010	0.223	0.137	0.292
5.	Agency Personnel and logistics improvement	0.055	(0.725)	0.081	0.201	0.333	0.412	0.219
6.	Road infrastructural improvement	0.142	0.344	0.218	0.016	(0.899)	0.139	0.444
7.	Private sector participation/partnership	(0.811)	0.017	0.102	0.321	0.441	0.221	0.343
8.	Responsible Government	0.014	(0.851)	0.344	0.202	0.240	0.333	0.299
9.	Development of Neighborhood Spirit	(0.912)	0.248	-0.119	0.131	-0.054	0.427	0.143
10.	Reintroduction of Sanitary Inspectors	0.202	(0.821)	0.363	-0.054	0.143	0.373	-0.190
11.	Eradication of Citizens Poverty	0.248	-0.190	(0.711)	0.273	0.207	0.017	0.131
12.	Application of polluter must pay principle	-0.222	(0.951)	0.034	0.198	0.266	0.274	0.248
13.	Only adults should dispose household waste	-0.034	0.077	0.066	(0.866)	0.237	0.237	0.107
14.	Every house to posses dust bins	0.002	0.305	0.023	(0.929)	0.305	0.023	0.280
15.	Regulation against consumer items	0.103	-0.110	(0.815)	-0.130	0.176	0.277	0.344
16.	Suing agency for uncleared wastes	0.173	0.114	0.070	(0.755)	0.127	0.333	0.012
17.	Annual awarded for most clean Neigbourhood	(0.851)	-0.117	-0.043	0.136	0.120	0.191	0.119
18.	Sanitation exercise to take place fortnight	0.360	0.193	0.116	(0.822)	-0.310	0.541	0.485
19.	ESWAMA to be headed by environmentalist	-0.081	0.311	0.414	0.041	(0.877)	0.262	0.178
20.	Women organization to become waste marshals andsurveillance	0.167	0.247	-0.061	0.358	0.447	(0.570)	(0.830)
21.	Landlords to be penalized for fifty yards	0.235	0.048	0.074	(0.735)	0.214	0.036	0.025
22.	Sanitation fees should be increased	0.081	(0.732)	-0.325	-0.023	0.280	-0.176	0.048
23.	Establishment of sanitation courts	0.002	0.130	(0.776)	0.039	-0.325	0.024	0.003
24.	Sanitation committee to be created in the House of Assembly	0.167	-0.399	(0.822)	0.133	0.025	0.061	-0.048
25.	Waste management adviser to the Govenor	0-.310	0.108	(0.945)	-0.284	0.011	0.395	0.193
26.	Density of dumpster to be increased	0.218	0.340	0.332	(0.818)	0.216	-0.035	0.222
27.	Monitoring and surveillance of waste disposal	0.325	-0.118	0.032	0.001	-0.021	0.016	(0.761)
	Cumulative percentage of total variance explained	19.165	29.035	38.638	46.340	53.106	59.735	66.119

(Significant loadings, ce +/- 0.55 are in parentheses)

TABLE 3: Factor Description And Variable Loading

Factor Number	**Factor Description**	**Variable Grouping**	**Factor Loading**
1	Citizen mobilization and education	Citizen participation and sensitization	0.796
		Environmental education	0.815
		Private sector partnership & participation	0.811
		Development of Neighborhood spirit	0.912
		Annual Award for most clean neighborhood	0.851
2.	Strengthening the waste Agency	Application of polluter must pay principle	0.951
		Responsible government	0.851
		Adequate funding of Agency	0.822
		Reintroduction of sanitary inspectors	0.821
		Increase sanitation fees	0.720
		Agency personnel and logistics improvement	0.725
3.	Government support	Introduction of Waste adviser to the Governors	0.945
		Sanitation Committee to be created in the House of Assemblies	0.822
		Regulation about consumer items	0.815
		Establishment of sanitation courts	0.776
		Eradication of citizens poverty	0.711
4.	Waste Management Legislation	Only adults should be involved in household waste disposal	0.866
		Sanitation exercise should take place fortnightly	0.822
		Density of dumpsters should be increased	0.818
		Sanitation agency should be sued for any uncleared waste	0.755
		Landlords should be penalized for filthy yards	0.735
		Every house should posses a dust bin	0/729
5.	Infrastructural and management improvement	Road infrastructural improvement	0.899
		ESWAMA should be headed by an environmental practitioner	0.977
6.	Application of science and Technology	Application of Science and Technonology to waste management	0.985
7.	Monitoring and surveillance	Women organization to become responsible for waste management	0.830
		Monitoring and surveillance of waste disposal	0.761

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