Analysis of barriers and success factors affecting the adoption of sustainable management of municipal solid waste in Nigeria

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**Article Info**

**Abstract**

The poor state of solid waste management in cities of developing countries is fast assuming the scale of a major social/environmental challenge. The main drivers of the waste problem in Nigeria, for instance, are poverty, high population and urbanization growth rates, compounded by a weak and underfunded infrastructure. The gravity of this problem is perhaps best reflected in the level of attention given to it in the United Nations Millennium Declaration in September, 2000. Three of the eight Millennium Development Goals (MDGs) in the Declaration have waste or resource efficiency implications. In response to the waste challenge many developed countries have embarked upon ambitious environmental reforms, recording remarkable advances in best practises and sustainable management of their Municipal Solid Waste (MSW). The same cannot be said for most countries in Sub-Sahara Africa, however, as a result of several barriers militating against sustainable MSW management. Adopting a questionnaire interview methodology, this study surveyed 1557 respondents drawn from households, business and waste policymakers in Abuja, Nigeria. Data analysis was carried out using the Statistical Programme for Social Sciences (SPSS). Multivariate statistical analysis was used to carry out a between subjects multiple comparison of respondents views on the barriers as well as success factors affecting MSW management in the case study area. Findings point towards the need for a sustained public education programme on waste prevention and reuse as the panacea to waste problems in Nigeria. Based on the findings, a case is made for the adaptation of globally successful waste management best practises and strategies to suit local conditions.

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**1. Introduction**

The state of solid waste management in cities of most developing countries is fast assuming the scale of a major social and environmental challenge (Agunwamba, 2003; Ezeah, 2010). In Sub-Saharan Africa in particular, the combined influence of poverty, population growth and rapid urbanization has worsened the situation (AFBD, 2002; Igoni et al., 2007). The gravity of this problem is perhaps best reflected in the level of attention given to it in the United Nations (UN) Millennium Declaration (September, 2000). Three of the eight Millennium Development Goals (MDGs) have waste or resource efficiency implications (UNO, 2007):

- Ensure environmental sustainability by integrating the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.
- Eradicate extreme poverty and hunger by halving between 1990 and 2015, the proportion of people whose income is <$1 a day.
- Develop a global partnership for development by addressing the special needs of least developed countries, landlocked countries and Small Island Developing States.

In response to the waste challenge, many developed countries have embarked upon ambitious environmental reforms, recording remarkable advances in best practises and sustainable management of their Municipal Solid Waste (MSW). Sustainable SWM should aim to continually improve the environment, provide direct health benefits, support economic productivity, and provide safe, dignified and secure employment. Many developing countries such as Nigeria are reported to have fared less well in implementing sustainable SMW management as a result of several barriers militating against municipal solid waste management (Ezeah, 2010).

In many ways Nigeria typifies Sub-Saharan African countries with chronic waste management problems. It has a large population of over 140 million (National Population Commission,
Population growth rate is well above global average at 2.9% per annum. Rapid urbanization and an unevenly distributed wealth occasioned by huge oil income are other factors influencing waste generation in the country (The Economist, 2007). This research investigates the barriers as well as success factors which affect solid waste management in Nigeria, using the capital city, Abuja as a case study. The Federal Capital Territory of Abuja was selected as a case study area based on its geographical, demographic and socio-economic characteristics. Abuja reflects in many ways the wider issues that affect MSW management in Nigeria (Ezeah, 2010).

1.1. Background of study

Fig. 1 is a geographical map of Nigeria. Abuja, Nigeria’s capital since December 1991 is located at the geographical centre of the country (latitude 9° 12' North of the equator and along longitude 7° 11' East) (Adama, 2007; Imam et al., 2008). Abuja has an estimated population of 1.4 million people, of which 405,000 live and work within the Municipality (National Population Commission, 2007). It has a total land area of 713 km² which is divided into six Area Councils: Abuja Municipal, Abaji, Bwari, Gwagwalada, Kuje and Kwali. The climate is tropical with predominantly tropical savannah vegetation except for the southern fringes covered by secondary rainforest vegetation. Total annual rainfall in the city averages 1100 mm per annum (Roberts et al., 2009).

Abuja was designed to serve as a model to other Nigerian cities in the way utilities and services are managed. Over the last decade, the City has grappled with the challenge of managing its solid waste as a result of phenomenal growth in both population and waste generation. It has been reported that the population in some areas in Abuja is growing by as much as 20—30% per annum (World Bank, 2000; Jibril, 2006). MSW management in Abuja is still in its infancy. Institutional and policy frameworks, where they exist, are not in line with global best practises. City specific data on waste necessary for planning are also not readily available. This research carried out in partnership with the Abuja Environmental Protection Board (AEPB), was motivated by the need to fill already mentioned gaps in knowledge by generating empirically tested data on MSW management in Abuja that could underpin future waste management strategies and policies in the City as well as other parts of Nigeria.

2. Methods

To provide a basis for the validation of the main survey, it was necessary to carry out a pilot survey prior to the commencement of the actual survey. Population sample for the pilot survey was drawn from Nigerian students at the University of Wolverhampton (UK) who have had a contextual knowledge of waste management in the case study area. An online format of the survey was adapted using the Surveyor sampling software. This online questionnaire was thereafter mailed to 250 students of the University via the University’s International Students’ Office in June-July, 2008. A total of 57 responses were returned equivalent to ~23% response rate. This rate is well within the norm according to Black et al. (2000), who stated that in most cases a response rate of 20—30% is normal for postal questionnaires. Analysis of the pilot survey results provided useful insight in designing the questionnaires for the main survey and validation of the final outcomes of this research.

The study employed three separate questionnaire surveys (for households, businesses and waste policy-makers) in collecting data on the barriers and success factors that affect MSW management in Abuja. These three questionnaires were separately designed and worded in such a manner as to elicit required information from target respondents. The rationales that informed the choice of questions included: (1) The desire to obtain data that on analysis could help realize the immediate objectives of the research and (2) to gather data in critical areas of MSW management in Abuja where presently there are none. The option to adopt questionnaires as a key data gathering instrument in this study was informed by demonstrated effectiveness of the method in earlier studies on waste management in Nigeria, such as Ngwulaka et al. (2009) and Ayininuola and Muibi (2008).

De Vau (2007) outlined the key essentials of a good survey and recommended best practises for questionnaire design and administration. Following these recommendations, the questionnaires were designed for self or guided completion and worded so as to be brief, easy to read and understood; completely without bias or ambiguity. The rationales that informed the choice of questions included:

1. The desire to obtain data that on analysis could help realise the immediate objectives of the research.
2. To gather data in critical areas of MSW management in the city where presently there is none.

Earlier investigations on the subject have identified various barriers and success factors affecting MSW management (Aguwamba, 1998; Adama, 2007; Imam et al., 2008). Identified barriers from literature such as “MSW management policies lack clear strategies for implementation” formed the bulk of factors tested by the questionnaire.

Since this method necessitated interaction with human subjects, it was essential to address various ethical issues in order to ensure efficient and ethically appropriate research. Such issues included ensuring that:

1. Participation in the study was truly voluntary.
2. Consent to participate in the study was obtained from “authentic” participants and their privacy protected.
3. Data protection requirements were strictly adhered to.
Valid appropriateness of questions were determined by subjecting them to an independent research ethics committee for review.

To reduce sampling error and improve the representativeness of sample population, the stratified random sampling technique was adopted by dividing the entire City into subpopulations (stratum) and thereafter randomly selecting equal numbers of respondents from each stratum.

2.1. Sample size determination

During the main survey, questionnaires were administered to three categories of respondents: households, businesses and policy-makers in government departments and agencies charged with waste management responsibilities. Sample size was determined using a sample size calculator. By assuming a City population of 405,000 (National Population Commission, 2007), and a confidence level of 95% (0.05) after Munn and Drever (1990), a sample size of 1064 was calculated for household respondents. Similarly, by assuming populations of 500 and 300 for businesses and waste policy-makers, respectively, sample sizes of 141 and 192, respectively, were calculated; thus giving a total sample size of 1639 for the entire survey. Household questionnaires were to be completed by the head of the household or a responsible adult in their absence.

2.2. Questionnaire administration

A direct door stepping questionnaire administration approach was used after the method adopted by Phillips et al. (2002) and Read (1999). An obvious advantage of this strategy is to enhance the rate of return since the questionnaires were normally delivered directly by hand to the respondents and taken back immediately on completion. In their study, Phillips et al. (2002) reported a return rate of ~ 98%. An important drawback of this approach is that it is laborious, time-consuming and expensive. Using this method, the researcher hired two assistants to assist in the administration of the questionnaires to randomly selected respondents between August and September 2008. At the end of the exercise, a total of 1557 questionnaires were returned, an equivalent to a 95% response rate. Besides ensuring a rather high return rate, direct door stepping questionnaire administration strategy also ensured effective completion of questionnaires by respondents as the authors were at hand to provide guidance. As a result all 1557 returned were effectively completed.

Analysis of data generated from the questionnaire survey was carried out using the Statistical Package for the Social Sciences (SPSS) software. Some of the data from the questionnaire survey were nominal in nature, such data were analysed using descriptive and inferential statistics. Most of the data were, however, ordinal. This group of data were initially subjected to a test for normality which showed that data was approximately normally distributed. Following Tonglet et al. (2004), analyses of such rating data were performed using parametric statistical tests, namely Analysis of Variance (ANOVA) and Chi-square tests.

3. Results: barriers to sustainable MSW management

ANOVA was used to carry out a between subjects multiple comparison analysis of barriers to MSW management in Abuja. A breakdown of responses received on this question from the three respondent groups is as follows: households, 1136; businesses, 192 and policy-makers, 141 responses. Table 1 is an analysis output showing three key descriptive statistical parameters: mean (value describing respondents perception of magnitude of barrier on a scale of 1–6, where 1 implies minor barrier while 6 implies factor is a major barrier), standard deviation and number of responses (N) for the listed barriers affecting sustainable management of MSW in the City.

Table 1, column 1 lists the 10 identified barriers affecting sustainable MSW management in the City while columns 2 and 3 are lists of corresponding respondents and mean values, respectively. Analysis of variance of responses from the three respondent groups on the barriers to MSW management in the case study area was carried out. Each item in the model was tested for its ability to account for variation on the dependent variables. Sample size is represented by N, degree of freedom (df = (N − 1)) while the ratio of mean square deviation is given as the (F) statistic. Where the significance level (P) is less < 0.05, there is an indication of a strong statistical variation.

Model-estimated marginal means and standard errors were calculated at 95% confidence interval. The upper and lower values for each variable have been estimated and mean value calculated. Fig. 2 is a graphical plot of calculated grand mean values against the
standard deviation and number of responses (output showing three key descriptive statistical parameters: mean, 190 and 150 responses respectively. Table 2 is an indicates that households, businesses and policy makers had 1153, in Abuja. A breakdown of responses received on this question comparison analysis of success factors affecting MSW management

3.1. Results: success factors affecting sustainable MSW management

ANOVA was also used to carry out a between subjects multiple comparison analysis of success factors affecting MSW management in Abuja. A breakdown of responses received on this question indicates that households, businesses and policy makers had 1153, 190 and 150 responses respectively. Table 2 is an SPSS analysis output showing three key descriptive statistical parameters: mean, standard deviation and number of responses (N) for the listed success factors affecting sustainable management of MSW in the City.

Analysis of Variance between the three respondent groups on the success factors affecting sustainable management of MSW in the case study area was also carried out. Each item in the model was tested for its ability to account for variation on the dependent variables. Sample size is represented by N, degree of freedom; df is

![Fig. 2. Graphical plot of the barriers affecting sustainable MSW management.](image)

dependent variables. From Fig. 2 the most important barrier constraining sustainable waste management in Abuja, is the very low level of public education on MSW management. Equally, the least important barrier constraining sustainable MSW management is the character of waste samples (high density and moisture content).

![Table 2 Descriptive statistical analysis.](image)

<table>
<thead>
<tr>
<th>Type of respondent</th>
<th>Mean</th>
<th>Std. deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture of informal recycling already exist</td>
<td>Household</td>
<td>3.05</td>
<td>2.002</td>
</tr>
<tr>
<td></td>
<td>Business</td>
<td>3.00</td>
<td>2.225</td>
</tr>
<tr>
<td></td>
<td>Policymakers</td>
<td>2.83</td>
<td>1.864</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.02</td>
<td>2.018</td>
</tr>
<tr>
<td>Waste stream is compostable</td>
<td>Household</td>
<td>3.08</td>
<td>1.959</td>
</tr>
<tr>
<td></td>
<td>Business</td>
<td>3.40</td>
<td>2.170</td>
</tr>
<tr>
<td></td>
<td>Policymakers</td>
<td>2.79</td>
<td>1.762</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.09</td>
<td>1.973</td>
</tr>
<tr>
<td>City population offers potential market</td>
<td>Household</td>
<td>3.79</td>
<td>2.038</td>
</tr>
<tr>
<td></td>
<td>Business</td>
<td>3.56</td>
<td>2.271</td>
</tr>
<tr>
<td></td>
<td>Policymakers</td>
<td>3.71</td>
<td>2.160</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.75</td>
<td>2.081</td>
</tr>
<tr>
<td>Emergence of small scale industries</td>
<td>Household</td>
<td>3.35</td>
<td>2.041</td>
</tr>
<tr>
<td></td>
<td>Business</td>
<td>3.68</td>
<td>2.067</td>
</tr>
<tr>
<td></td>
<td>Policymakers</td>
<td>2.87</td>
<td>2.197</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>3.34</td>
<td>2.068</td>
</tr>
</tbody>
</table>

![Fig. 3. Graphical plot of success factors affecting sustainable MSW management.](image)

4. Discussion and recommendations

Fig. 3 is a graphical plot of calculated grand mean values against the dependent variables (success factor). From Fig. 3 the most important success factor affecting sustainable waste management in Abuja is the perceived bourgeoning City population, which has a huge potential for uptake of recycled products.
Barriers affecting sustainable MSW management in Abuja, Nigeria (Ezeah et al., 2009).

Fig. 4. Barriers affecting sustainable MSW management in Abuja, Nigeria (Ezeah et al., 2009).

Operational constraints are the bane of MSW management in Abuja. In certain instances, even basic materials for waste collection such as black bin bags and plastic receptacles are unavailable. Waste handling vehicles are limited to a few obsolete imports from more advanced countries of the world. Such equipment purchased at high costs are in turn easily scrapped because, usually, spare parts for their maintenance would normally have been off production lines, hence no longer available for purchase. Training opportunities in sustainable methods of MSW management are not easily available for operational staff. The effect is that at times, waste management responsibilities in the City are manned by less skilled staff. Such staff have no place at decision-making levels in Abuja Environmental Protection Board. Ultimately, therefore, waste issues are decided mostly by political expediency rather than sound science.

Socio-economic realities in the country constitute a major block of barriers affecting sustainable MSW management. As most people struggle for economic survival, environmental considerations are often consigned to the background of individual priority lists. The very limited funding available to waste management authorities are not always applied judiciously. Sometimes, politically expedient but ad-hoc solutions are adopted at the expense of well articulated programmes aimed at waste minimization. Since the private sector is profit driven, present economic circumstances in Nigeria as a whole have tended to negatively influence the inflow of private capital for MSW management.

4.1 Multivariate analysis

Section 3 above outlines ANOVA on the main barriers affecting sustainable MSW management in Abuja. Interaction effects between these dependent variables (barriers) and respondent groups have been explored. From Fig. 3, we see that the most important barrier constraining sustainable waste management in Abuja is the very low level of public education on MSW management. Though the Abuja Environmental Protection Board, AEPB, has recently embarked on sensitization campaigns to educate residents of the City on the need to recycle some of their household waste, there is hardly any evidence of a well structured and sustainable public waste education strategy. This situation reflects of the low levels of public awareness on sustainable solid waste management in other Nigerian cities.

On the other hand, multivariate analysis also indicated that the least important barrier affecting sustainable waste management by order of calculated mean values is the physico-chemical characteristics of waste samples from the City. This indicates that though the character of waste sample from Abuja, differ significantly from samples from more industrialized and temperate parts of the world, this factor is the least likely to affect sustainable waste management in the City. Other important barriers identified from the analysis by order of importance include: operational equipment are obsolete and insufficient, waste workers are poorly trained and poorly paid, funding limitations, unplanned city aspects makes waste collection difficult, waste institutions are weak and sometimes, overlap in their functions as roles are not clearly defined, legislative and policy framework is weak, policies lack clear strategies for action, availability of dumping grounds encourages waste dumping.

Section 3.1 above outlines ANOVA on the main success factors affecting MSW management in Abuja. Interaction effects between these dependent variables (success factors) and respondent groups were also explored. From the analysis, this research found that the most important success factor affecting sustainable waste management in Abuja is the bourgeoning City population, which has a huge potential for uptake of recycled products.

4.2. Recommendations

Based on the findings of this research, the following recommendations have been advanced as a panacea for overcoming identified barriers affecting sustainable MSW management in Abuja:

- A key finding of this research is that the legal framework supporting waste management is weak. A comprehensive review of all legislative aspects relating to MSW management in Nigeria is therefore recommended, to harmonize and align them to the objectives of the Waste Hierarchy and Integrated Waste Management (IWM) models.
- Another finding from this investigation is that waste policies lacked clear strategies for realization. A new National Waste Strategy document is recommended in line with the expectations of Section 3(b) of FEPA Decree 59 (1992). This plan should explicitly specify realistic targets for waste prevention, re-use, recycling, composting and energy generation in Nigeria.
- Given the federal structure of governance in Nigeria, a rebalancing of the relationship between local, state and other federal agencies/organizations with oversight for waste management is required so as to create new synergies and empower local government councils to discharge their waste management responsibilities more efficiently. This will minimize waste and avoidable role conflicts between various tiers of government as well as between institutions. As part of this plan, a sustained public education programme on waste prevention and reuse targeted at schools, churches, community groups and third sector organizations should be designed.
- Following the review of prevailing legal frameworks for waste management, a short-term plan to train specialized manpower...
in waste management is recommended. Experts so trained will help drive and sustain the public waste education programme. This programme can be implemented drawing on existing training capacities in Nigerian Universities and institutions with waste management oversight at various levels of government.

- Further liberalization of waste management in Nigeria is recommended by re-modelling it to be largely private sector driven. This will address to a large extent identified funding and other operational barriers currently impeding sectoral efficiency.

References


