

AN ASSESSMENT OF HOUSEHOLD SOLID WASTE RECOVERY AND UTILIZATION IN IBADAN: CASE STUDY OF IBADAN NORTH LOCAL GOVERNMENT AREA

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ABSTRACT

This work aims to assess household solid wastes based on recovery and utilization within three different income groups of Ibadan North local government area and investigate the management system. Ibadan north local government was divided into three groups based on income generation. Household Solid Wastes generated on daily basis were sampled from each section. The average Household Solid Wastes (HSW) generation for the high income group, was 0.62kg/head/day, 0.34kg/head/day for medium income group and 0.24kg/head/day for low income group respectively. While the recoverable wastes were found to consist of 21.5, 38.8, 25.8, and 13.9% respectively for paper, plastic/rubber, nylon and metal/tin wastes. The utilization percentage were, 20% paper wastes, 5.8% plastic/rubber wastes, 1.7% nylon wastes and 6.7% metal/tin wastes among all three income groups. Extent of utilization to that of recoverable wastes was substantially low when compared with the total composition of waste in all the groups that cannot be reused and recovered. Hence, this indicates that a larger quantity of recoverable waste goes directly from household to landfill unrecovered. As a result, efforts should be made to recover all the recyclable wastes which would be made easier through sorting of wastes before disposal, as this will go a long way in reducing the quantity of wastes that goes into landfill.

KEYWORDS: Solid Waste, Recovery, Utilization, Reuse and Landfill

1.0 INTRODUCTION

Household Solid Waste (HSW) constitutes a huge challenge for local government due to its constant increase in quantity and the majority of the municipalities do not keep records on waste generation, recovery and utilization at household level. Waste has been an early problem of mankind, and is still a growing one that is of major concern to every nation of the world (Allende, 2009). Household Waste generation is inevitable since various human activities produces waste. Population explosion has led to prevalence increase in waste generation in Nigerian cities including Ibadan. Ibadan North Local Government is the local government within Ibadan that produces the largest volume of waste due to the large number of people residing in the local government.

As the population increases per household more waste is generated as a result of human activities, and improper disposer could be dangerous to human health. These wastes from household had caused various diseases to human life such as typhus, salmonella, leptospirosis and other diseases (Adewole,

2009). Aidoo (2005) reported that indiscriminate disposal causes the extinction of some plants, birds, and butterfly species, animal, livestock, and the fact that some households in the study area dumped their refuse along the drainage streams which resulted in catastrophes such as flooding. (Ajayi et. al., 2012)

Waste management includes collection, transportation, processing or disposal, managing and monitoring of waste materials. There are several factors that influence the management of solid waste in Nigeria some of which are lack of advance technology, facility for separation at source, environmental education and awareness and income status of individual (Abel 2009). Inadequate provision of solid waste management facilities has been reported in a study carried out by Boadi and Kuitunen (2005) to be the cause of diarrhea due to the presence of housefly in the kitchen from the open dump site. Generation of waste is inevitable in our day to day activities and as long as their intrinsic values and scope of utilization

are not understood, these remain as waste or discarded materials. However, in many cases, these solid wastes contain valuable materials, which can be recovered and recycled. Recycling and utilization of these solid wastes through integrated waste management approach have gained special significance due to several factors such as economic advantages, augmentation of primary resources, better and cleaner environment, conservation of energy and water and compliance with the law (Ghosh and Sinha, 1990).

There are several categories of wastes generated on daily basis which are domestic, industrial, commercial, institutional, construction and demolition wastes. Household can make costly waste reduction efforts that affect the volume of waste to be disposed of after consumption. Reuse and composting are examples of household waste reduction effort. Sorting of recyclable wastes materials generated by hand picking are encouraged at household level, such wastes includes; Paper, Cartons, plastics, tins, glass, metals and composting materials such as food wastes and yard wastes which improve soil fertility. Other sorted waste can be reused or recycled (Suttibik and Nitivattananon, 2008). Household waste could contain hazardous and toxic waste such as expired drugs, dried cells, broken glasses, syringes and thus constitute serious environmental health hazards which could be prevented by sorting at household level before disposal. This also will in turn reduce the volume of wastes to be landfilled especially if recyclable wastes are removed before disposal. (Delgado *et al*, 2007). The results of the study of characterization and utilization cannot be generalized towards different regions and seasons of the year because there are many variants such as: eating habits, consumption patterns, population composition, season of the year and income, that can cause dramatic changes in the recovery and utilization of household wastes (Tudor *et al*, 2011).

This study provides information on household waste in Ibadan north where organic and inorganic wastes were highly generated. Even though the fundamental objectives of any solid waste management program embarked upon by local governments is to prevent environmental pollution, these goals become unachievable in the absence of sustainable funding, affordable local technological option and lack of participatory approach to integrated solid waste management at various household levels.

2.0 MATERIALS AND METHODS

2.1 THE STUDY AREA

This study was restricted to Ibadan North Local Government Area, one of the eleven local governments that make up the Ibadan metropolis. It is the biggest local government among the local government within the metropolis. The local government falls between latitude 7°23'00" and 7°27'30" North and longitudes 3°52'45" and 3°56'00"East, it shares boundary with Ibadan North West and North East local Government Area. The population reported for Nigeria shows that it is the most populated local government area with an estimated population of 202,270 inhabitants (NPC 2006).

Ibadan North covers an area of 145.58km, which is approximately 46.6% of the total land area of Ibadan which makes it the largest in terms of land mass. Ibadan North was estimated to have 306,795 inhabitants (Ayinnuola and Adekunle 2008), but should be 432,900 by population projection (NPC, 2016). The local government is characterized by large and small industries (manufacturing and agro allied industries); households; and commercial centers, educational and religious services and medical centers. This area covers wards from Beere roundabout through Oke-Are to Mokola in the South- West and Samonda to New Bodija in the South-East which are shown in the map below.

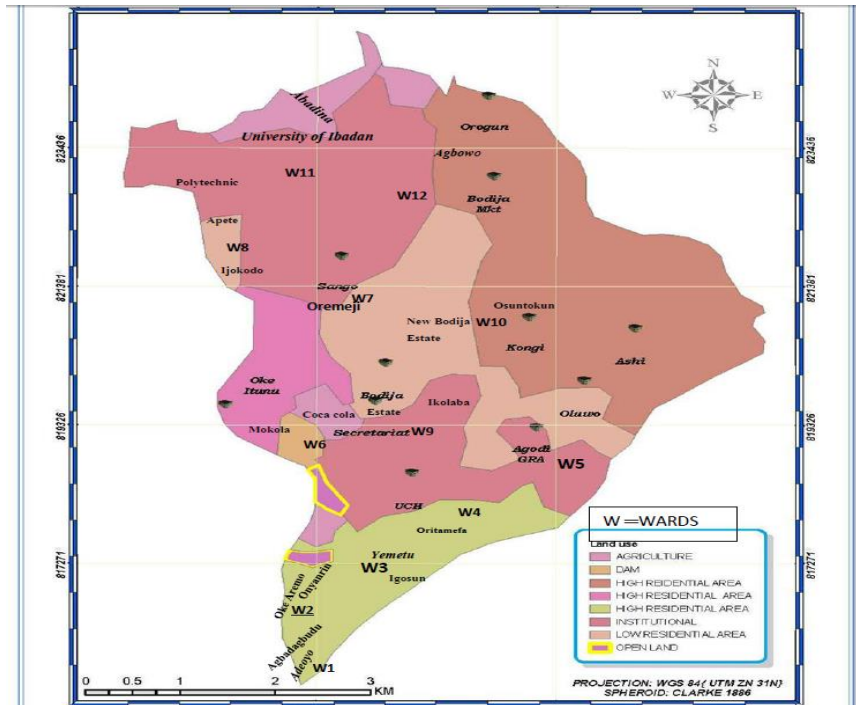


Figure 1: Map of Ibadan North showing Designated wards

Source: Land use map of Ibadan North (Javaheri *et al.*, 2006).

2.2 METHODS OF DATA COLLECTION

The method adopted in this study includes field reconnaissance, questionnaire administration, and personal interview. Ibadan North local government has twelve wards and in executing this project, it was divided into three classes namely A, B, and C based on income generation while each division consist of four wards. In class A, areas like University of Ibadan, Polytechnic, Abadina, Agbowo, Orogun, Apete, Ijokodo Sango and Oremoji are classified as medium income group. In class B, areas like new Bodija Estate, Osuntokun, Mokola, Oke itunu, Secretariat, Bodija Estate, Ikolaba, Coca-cola, Agodi G.R.A, and Oluwo are classified as high income group while areas like Adeoyo, Agbadagudu, Oke Aremo, Onyanrin, Yemetu, Igosun, Oritameta in class C are classified as low income group as shown in the map above.

In each of the classes, that contain four wards, five houses were randomly selected from each ward making a total of twenty houses in a class as samples and given a questionnaire in other to access the utilization and recoverable aspect of household solid

waste in Ibadan North local government area as case study.

2.3 FIELD WORK

In order to execute waste generation and composition at household group, twenty houses were randomly selected from each group making a total of sixty houses in all the three classes representing Ibadan North local government area. Each house was allocated with refuse sacks and were instructed to drop their waste in it for twenty four hours (24hrs). The refuse sacks were retrieved thrice per week for each house for the period of March to October.

2.4 DETERMINATION OF THE WASTE COMPOSITION

The wastes from the source of generations were retrieved, weighed in kilogram and spread on the bare floor for sorting into different categories. The wastes were sorted into the following classes; paper which include cardboard, paper, white paper, newspaper; plastics (rubber product, plastic); food (food leftovers, fruits, and peels), metal (ferrous and non- ferrous),

nylon, textile, wood, hazardous, glass and others. Each of the categories of wastes were weighed and recorded for all the groups in the study. The useful and recoverable portion of the sorted waste likewise the overall average compositions of the wastes were generally computed for the whole classes. The portion of the waste that falls under recyclable was paper, plastics, metals and nylon while others were considered as trash.

2.5 DETERMINATION OF HOUSEHOLD SOLID WASTES GENERATION RATE

Weight is generally used for the measurement of solid waste quantities due to the fact that is the only accurate basis for records because weight can be measured directly irrespective of the degree of compaction therefore the use of volume as a unit to measure such waste can be misleading. The rate of waste generated

3.0 RESULTS AND DISCUSSION

The result from the study on waste generation, recovery and utilization are presented in Table 3.1 below.

in all the selected households and the quality and quantity of waste were determined by the number of people, days and rate of consumption.

The household solid waste generated per day was divided by the number of waste depositor per house to obtain the result in Kilogram per head (Kg/per head).

$$\text{Generation Rate (G.R)} = W / (N_d * N_p) \text{ kg/head/day}$$

W = Weight of waste generated in kg

N_d = Number of sacks retrieved for each ward

N_p = Number of people that generate waste for each ward

The data collected were statistically analysed using ANOVA .

The information acquired from the field work, the result from the questionnaire administered and that of personal interview were amalgamated in order to analyze the households waste generation, recovery and utilization in Ibadan north local government area during the periods of March to October. The average household solid waste generation rate was 0.43kg/head/day as shown in Table 1

TABLE 1: HOUSEHOLD SOLID WASTE GENERATION IN VARIOUS INCOME GROUPS

INCOME GROUP	WARDS	WEIGHT (KG) OF WASTE	NUMBER OF DWELLERS PER HOUSE	WASTE GENERATION RATE (AVERAGE) (Kg/Head/Day)
Low	1	13.2	18	0.31
Low	2	12.4	15	
Low	3	11.3	13	
Low	4	14.1	15	
Medium	7	15.7	9	0.33
Medium	8	14.6	10	
Medium	11	13.6	13	
Medium	12	16.2	16	
High	5	19	9	0.65
High	6	20.3	11	
High	9	18.7	9	
High	10	19.5	10	
AVERAGE				0.43

From the result of household solid waste generated it was observed that there was variation between the three groups. The generation rate for Ibadan as a whole revealed by Ibadan Solid Waste Management Authority (ISWMA, 2001) was 0.5kg/head/day and thus the rate has been increased to 0.71kg/head/day as reported by Adewumi *et. al.* (2005). Since this project was restricted to household in Ibadan North only, field test was conducted to get an estimate and present generation rate in the study. The generation for previous studies ranges from 0.5kg/head/day to 0.71kg/head/day however the values obtained by this study are 0.31kg/head/day which was recorded for low income group, that of medium group was 0.33kg/head/day and 0.65kg/head/day for high income group, respectively, as shown in Table 1 above. The values obtained in the study are lower than the one stated by ISWMA (2001) and that of Adewumi *et. al.*(2005) in the same local government.

The reason for variation in generation rate may be due to the fact that the value obtained by the study was strictly for household in Ibadan North while the value gotten by ISWMA (2001) and Adewumi *et.al* (2005) was for the whole of Ibadan city which includes waste from institutional and commercial centers. These centers they would generate more waste per person compared to households in Ibadan- North.

3.1 Waste Generation at High, Medium and

Low Income Groups

It was observed from the result of solid wastes generation and computation that solid waste generation rate in kilogram per capital per day at high income group was 0.65kg/head/day. Table 2 revealed that ward 6 generated more waste in high income area with 20.30kg compared to ward 5 with total waste of 19.0kg and ward 10 which contain 19.50kg also ward 9 has the least weight of waste with 18.70kg.

The finding in this study is in line with a report by Alfered and Sangodoyin (2011) which reported that

quantity of waste generated at high income is greater than what produced by low income earner, because of higher purchasing power, taste and high standard of living.

The variation in waste generation rate in medium, high and low income group earner are shown in Figure 2 The reason for the differences was that at household level, the occupants in medium income earn less than those in high income and more than those in low income group. Those in medium income can afford to feed averagely to some extent compared to those in low income group, their consumption and standard of living is higher than those in low income group. This account for why solid waste generation rate in kilogram per head per day in medium group estimated to be 0.33kg/head/day. The quantity or volume of waste generated varies according to standard of living, customs and food habit of individual, the categories of people living in low income group and structures of their houses. However, because of their income which is very low compared to those in high and medium income they cannot afford to buy foods in bulk though they will likely eat more, having leftover food as it was applicable to those in high income group does not arise.

The term composition itself refers to the percentage by weight of the various components that makes up a waste. The results of total solid waste generation by household in the case study shown in the chat above indicated that there was variation in the composition of waste generated in the mediums, among the waste food waste (organic waste) has the highest percentage of waste in the entire mediums with 33.8%. Follow by plastic/rubber with 20.4%. These simple trends indicate that concentrations in terms of waste management should be more at wards than generated high quantity of waste.

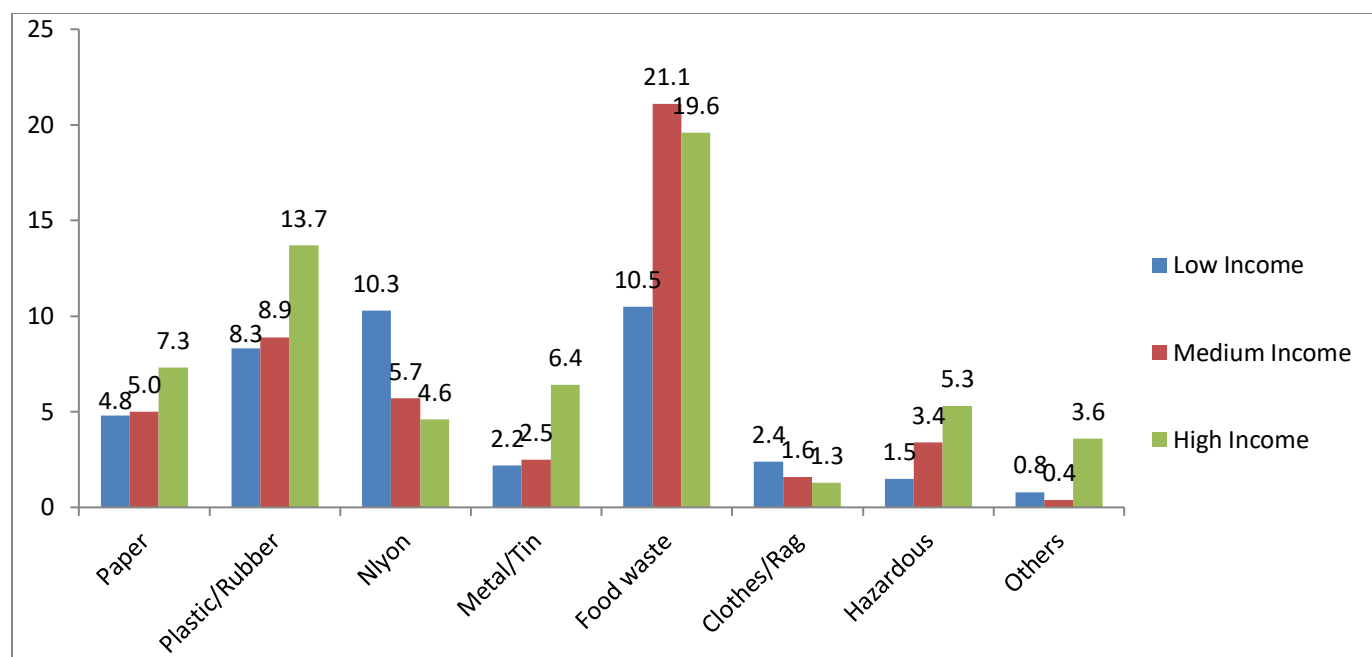


Figure 2: Total Percentage Composition Analysis of Solid Waste Generation by Household in Ibadan North L.G.A

This corroborates an earlier finding of Okeniyi and Anwan (2012) about food waste constituting the highest waste component generated. However food waste is relatively wet and slurry in nature and

decomposes rapidly thus bio-chemical conversion process can be used to recover energy from it through anaerobic digestion.

TABLE 2: HOUSEHOLD SOLID WASTE RECOVERY

Waste Component	Low Income	Medium Income	High Income	Sum of Component	%
Paper	4.8	5.0	7.3	17.1	21.5
Plastic/Rubber	8.3	8.9	13.7	30.9	38.8
Nylon	10.3	5.7	4.6	20.6	25.8
Metal/Tin	2.2	2.5	6.4	11.1	13.9
Total	25.6	22.1	32.0	79.7	100.0

From the result of solid waste a recovery Analysis in Table 2, plastic/rubber wastes were the most recovered wastes component based on the waste sorting after collection, with 38.8% generation in the case study

area. This is followed by Nylon waste with 25.8% then paper waste with 21.5% and Metal/tin waste with 13.9% was the least recoverable coming from the household waste in the studied area .

TABLE 3: SOLID WASTE UTILIZATION

Response	Frequency	Percentage
No response	69	57.5
Paper use for packaging of goods, food such as groundnut, fried fish and also to keep other things.	24	20.0
broken bottles used to construct fence for security	3	2.5
plastic used to store drinkable water in the refrigerator	6	5.0
Tins can serve as container to store liquids, engine oils. Detergent, palm oil, and groundnut.	3	2.5
Tin used as measurement for food items such as beans and rice.	5	4.2
Nylon can be used for wrapping domestic soap and detergent	2	1.7
wood as firewood to make fire	3	2.5
use clothes as rag to clean the floor	4	3.3
plastic as funnel	1	.8
Total	120	100.0

Table 3 above was based on questionnaire responses. It reveals the possible methods of utilisation of wastes composition by the respondents, larger proportion of those who responded 24(47.1%) declared they use paper for packaging of goods, 3 (5.9%) admitted that broken bottles has found utilization in construction of fences for security purpose, a reasonable number of them 6 (11.8%) asserted that they use plastic to store water in the refrigerator for drinking purpose, 3(5.9%) of them inveterated that they use tins as container to store liquids, engine oils, detergent, palm oil and groundnut oil, 5(9.8%) affirmed that they use tin as measurement for food such as rice and beans, 2(3.9%)

confirmed that they use nylon for wrapping domestic soap and detergent, 3(5.9%) of them reported they use wood as firewood to cook, 4(7.8%) established that they use cloth as rag, and 1(2%) declared he used plastic as funnel.

There are few firms who are involved in recovery and recycling of the waste, an example of this is established firms existing in the neighboring local government around Ring road in Omoleye area of Ibadan North East Local Government area. It was observed that these firms are established in area where high tension power passes through because most

machines used require high power to operate. The firm recovers wastes such as nylon of different forms, lumps and plastics of different form

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Table 4: WASTE COMPOSTION UTILISATION

WASTE COMPOSITION	RECOVERY	REUSE	SELL	UNRECOVERED
Nylon	26(21.7%)	32(26.7%)	4(3.3%)	58(48.3%)
Bottles	26(21.7%)	58(48.3%)	12(10%)	24(20%)
Bags	13(10.8%)	24(20%)	31(25.8%)	52(43.3%)
Tin/ Cans	12(10%)	29(24.2%)	30(25%)	49(40.8%)
Metal	7(10.8%)	18(15%)	54(45%)	41(43.3%)
Shoe	9(7.5%)	29(24.2%)	42(35%)	40(33.3%)
Clothes	13(10.8%)	57(47.5%)	10(8.3%)	40(33.3%)
Tyres	8(6.7%)	37(30.8%)	24(20%)	51(42.5%)
Wood	19(15.8%)	51(42.5%)	8(6.7%)	42(35%)
Broken bottles/ glass	12(10%)	24(20%)	11(9.2%)	3(60.8%)
Paper	9(7.5%)	36(30%)	16(13.3%)	59(49.2%)
Plastic	12(10%)	56(46.7%)	21(17.5%)	31(25.8%)

Table 4 shows the method of utilisation of waste in household, 21.7, 26.7, 3.3% of nylon are recovered, reused and sold respectively while 48.3% were unrecovered . For bottles, larger proportion 48.3% were been reused, while 20% were unrecovered.

Conclusions

From HSW stream in Ibadan North Local Government Area, the recoverable waste was found to consist 21.5% Paper wastes, 38.8% Plastic/Rubber wastes, 25.8% Nylon wastes and 13.9% Metal/Tin wastes, while Utilization percentage are: 20% paper wastes, 5.8% Plastic/Rubber wastes,1.7% Nylon wastes and 6.7% Metal/Tin wastes respectively.

Similar trend of reused was observed in paper, plastics, wood, clothes and tyres. The most unrecovered waste was broken bottles/glass 60.8% followed by paper 49.2%, and tin/can 40.8%

From the study conducted, it is hereby concluded that utilization in percentage to that of recoverable waste in percentage was substantially low when compared. Hence, this informed that lager percentage of recoverable waste goes directly from household to landfill unrecovered.

The composition and generation rate vary among the three income group, sorting of waste at household level should be encouraged, Attempts must be made

by Government at all levels to improve waste separation, through awareness campaigns about consequences of waste mishandling and benefits of solid waste separation.

Finally Government should put machinery in place to ensure utilization of waste product which includes recycling, composting and reuse by industries and adequate support program for those involved.

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