

## ANALYSIS OF CONVENTIONAL SOLID WASTE MANAGEMENT IN URBAN CENTERS OF DEVELOPING COUNTRIES

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### **ABSTRACT**

*Solid waste management continued to be the biggest threat to the sustainability of urban centers of developing countries. Most streets corners of these urban centers are characterized by heaps of uncollected wastes at drains, public spaces and road sides destroying the aesthetic qualities and environmental ecosystems of these cities, causing health risk to the populace. Thus, posing serious challenge to the municipalities who are in most cases responsible for the solid waste management in these cities. The typical or commonest method adapted by these agencies in dealing with the solid waste management is the conventional approach; focusing mainly on waste collection and disposal (transfer of waste from one destination to another). The resultant consequences being huge budget spending on solid waste management but little collection, compelling residents to resort to various alternative disposals options that are harmful to the environment. This paper attempt to analyze the current waste management strategies in Bauchi metropolis, Nigeria. Observations, focus group discussion, oral interviews, content analysis and questionnaires formed the methodology of the research.*

**Keywords:** conventional Waste Management, Solid Waste, Bauchi Metropolis.

### **INTRODUCTION**

Municipal Solid Waste is defined to include refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments, market waste, yard waste and street sweepings (Schubeler *et al.*, 1996). Municipal solid waste management (MSWM) refers to the collection, transfer, treatment,

recycling, resource recovery and disposal of solid waste in urban areas). Solid waste management is an important facet of sustainable development for any country and global initiatives greatly support the prioritizing of SWM. Cited in Ndum (2013). It is an important environmental health service and an integral part of basic urban services. MSWM aims to promote environmental conditions by controlling pollution ( including air, soil, ground water, surface water, and cross media pollution), protecting environmental health, and ensuring the sustainability of ecosystem in the urban region. (Kaosol, 2009). In most cities of Africa solid waste management is the responsibility of the municipal government (Mugagga 2006, Simon, 2008 & Ogwueleka 2009). The service is non-rival, without diminishing the benefits to anyone else (Cointreau, 1994). Unfortunately, most administration in developing countries failed to provide waste management services to a large section of their population (Cointreau, 1994; Chegail,1996; Bolaane & Ali. 2004 & Simon, 2008). Akinsulire (2005), observed that recent events in major cities of African countries have shown that the problems of waste management has become a monster that has thwarted most efforts by international, federal and states governments as well as city authorities and professional alike.

Also, ( Bovea *et al.*, 2010 & Zurbrugg *et al.*, 2012), cited in Cherian and Jacob (2012), highlighted that waste management is a complex process that requires a lot of information from various sources such as factors on waste generation and waste quantity forecast. Studies by Medina (2002), Ogwueleka, (2009), showed that about 70-90% of these uncollected wastes are generated from households and little fraction from commercial establishments. According to (Onibokun *et al.*, 2000; Mugagga, 2006; Ogwueleka,2009), these wastes are not collected by municipal collection systems largely due to improper management strategies, fiscal irresponsibility, equipment failure, and or lack of adequate waste management budgets. However, good and proper municipal solid waste management is critical to the health and well-being of urban residents (World Bank, 2003). Heaps of refuse garbage which are common sights in most of our urban centers threatens the health of nearby inhabitants, destroying the entire ecosystem and aesthetic qualities of most urban centers. Solid waste management in Bauchi metropolis is characterized by inefficient collection system, inadequate coverage of the collection methods and improper disposal alternatives. Significant portions of the metropolis do not have access to proper solid wastes services. Illegal and

indiscriminate disposal of waste which caused health risk destroyed the aesthetic qualities of the town. Generally, there is the absence of an articulated framework for separation, collection, transportation and disposal of solid waste in the metropolis.

The objectives of this paper are;

- i. To determine the quantity of daily waste generation in Bauchi metropolis
- ii. To determine the current waste handling practices applied by the households in the primary phase of solid waste management.
- iii. To investigate the waste management (collection, transport and disposal) operations by the various stakeholders in the secondary phase of solid waste management.

## **MATERIALS AND METHOD**

### **Study Area**

Metropolis, the headquarters of Bauchi state, is located between latitude 9° 00' and 9° 30' North of the equator and longitude 10° 25' and 11° 20' east of the Greenwich meridian. It occupies a total land area of 3,604.0 hectares. It is about 128km north-east of Jos and 150km west of Gombe town. Bauchi is one of the towns in northern Nigeria within Sudan savannah vegetation zone. It is generally less uniform and grasses are shorter than what is obtainable further south. The topography of Bauchi metropolis is relatively flat in the center. There are ranges of disjointed hills on the north-eastern part of the metropolis. There are two major types of climate in Bauchi namely the rainy (wet) season and the dry season. The wet season starts from May to October while the dry season covers the remaining part of the year. According to the National Population Commission, (NPC, 2014) Bauchi metropolis is a home to over 421,187 residents of the 653,596 and 6,159, 689 populations of Bauchi local government area and Bauchi state respectively. The Bauchi Emirate was sub-divided into eight new districts comprising of over forty wards and one hundred and five sub-wards. Most of these districts are fully or partly within the metropolitan area. (Bauchi LGA, 2013; Ministry of Lands and Housing Bauchi, 2013)

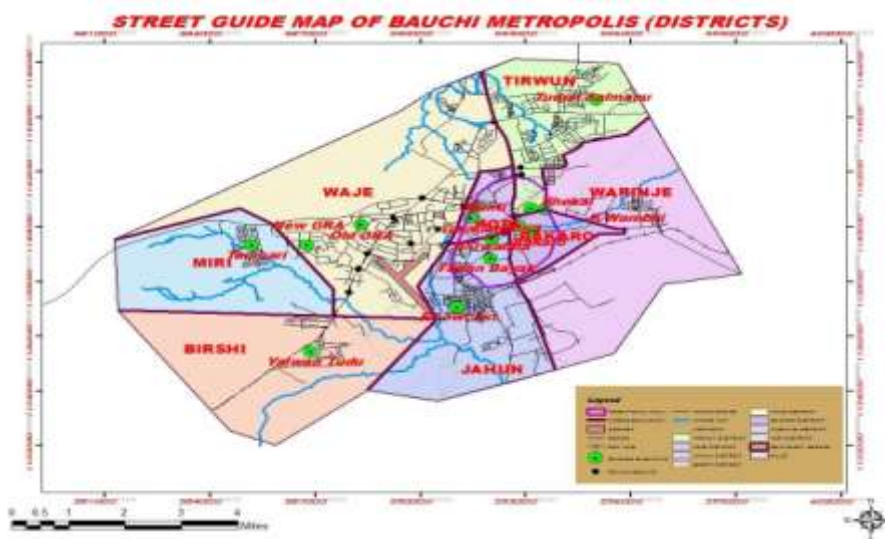


Figure 1; Map of Bauchi metropolis

## METHODOLOGY

According to Jos Electricity Distribution Company (JEDC Plc,) the number of households in the metropolis using both prepared and Billing methods is 33,339 (JEDC, 2014). This form the sampling frame of the study. Four (4) out of the Eight (8) districts that made Bauchi metropolis; Bakaro, Warinje, Kobi and Jahun were within the old Bauchi city, surrounded by the old town wall (Ganuwa). All these are characterized as areas of high density population and low income areas of the metropolis. The three (3) other districts at the outskirts are:

- i. Birshi: at the south, comprising of Yelwa, and Gwallameji
- ii. Miri: at the west comprising of Wuntin Dada and Tambari
- iii. Tirwun at the north comprising of Tudun Salmanu, Tirwun and Rafin Makaranta.

Yelwan Tudu sub-ward in Yelwa ward is also high density area while Tambari and Tudun Salmanu sub-wards are medium density areas. Purposive sampling was applied in selecting wards within the district and sub-wards within the wards. Wards and sub-ward that are by the streets or along the streets. , The sampling frame of 33,339 would be represented by 378 households, purposely selected from the study area. A close format approach questionnaire was adopted combined with some open format questions and direct sampling and analysis method of waste characterization study. It is time consuming and labour intensive but provides reliable data that is detailed, accurate and

informative when combined with factors affecting the waste generation.

## RESULT AND DISCUSSION

### Solid Waste Generation and Composition

This study found that per capita waste generation in the selected sample varies from 0.22 kg/capita/day to about 0.48 kg/capita/day, obtained at the sub-ward of Kofar Wambai and federal low-cost respectively. While 0.30 kg/capita/day was obtained for Bauchi metropolis when not specified for socio-economic categories. When socio-economic differences are included in the analysis, the per capita waste generation varies, in the high density (city proper) low income areas, this was 0.27 kg/capita/day and in the medium density (middle income) 0.37 kg/capita/day while the low density high income (sub-wards generates 0.32 kg/capita/day. The implication is that about 126.5 metric tonnes of household solid waste is generated daily in Bauchi metropolis which need to be disposed safely in a controlled manner that may not be harmful to the environment. In Bauchi metropolis, domestic wastes constitute 61 % organic (biodegradable, or kitchen waste). This is typical of most wastes from cities of the developing countries. The percentage of organic component is usually higher. The high percentage of organic constituents in the domestic solid waste in Bauchi indicates high presence of food wastes which reflects the eating habit and nature of income generating activities of households which influences the composition of household waste.

**Table 1: Per Capita Solid Waste Generation in Bauchi Metropolis**

District	Ward	Sub-ward	Waste generation rate (kg/capita/day)	Average household size
Bakaro	Bakaro	Bakaro	0.30	10.7
	Tura	Tura	0.29	11.2
Warinje	Kofar wambai	Kofar Wambai	0.22	10.1
	Shekal	Shekal	0.24	12
Kobi	Wunti	Wunti Street	0.34	9.9
	Gwallaga	Gwallaga	0.26	9.8
Jahun	Jaja	Fadan Bayak	0.23	11
	Gwabba	Unguar Gwabba	0.31	10.2
Waje	Gidan gona	Federal low cost	0.48	8.2
	Tudun	Old GRA and	0.39	9.6
	dan-Iya	New GRA	0.24	7.6

Birshi	Yelwa	Yelwan Tudu	0.28	9.3
Miri	Wuntin dada	Tambari	0.36	7.2
Tirwun	Tirwun	Tudun Salmanu	0.27	8.9

## CURRENT WASTE MANAGEMENT PRACTICE

### Solid Waste Storage

The type of waste storage containers is significant in waste management as it changes waste generation and variation in waste composition. This study found that 93 % of the respondents have various types of waste storage containers. 42 % uses metallic containers mostly in form of old metal containers, 48 % uses plastics buckets usually old empty (used) paint bucket of 25 liters capacity, 5 % uses polythene bags and 5 % uses other containers as empty boxes and cartons which are eventually disposed off together with the waste. However, the municipal agency (BASEPA) required that each household should use a container which is non-rust, plastics, alloy or galvanized. The residents might not be aware or are not ready to adhere to these recommendations and instead used containers that suit their choices and environment. According to (Solomon, 2011), a good bylaw might exist in waste management, but if not applicable to the situation on the ground becomes irrelevant and would not guarantee the proper waste management practices by the residents.

### Waste Flows Travelling From the Households to the Transfer Station or Communal Bin

Communal bin or transfer station made the distinction between the primary and the secondary phase of the solid waste management chain. (Solomon, 2011). The function of transfer stations is twofold. First it received wastes from households and secondly it function as the point of connection between the primary and secondary phase of waste chain and its main actors. One challenging issue that this study found was the placement or location of a communal bin or transfer station. Open/vacant plots, uncompleted building sites, public building like schools, public drains, road junctions and so on were used as transfer stations, communal bins, or dumping sites. These transfer stations or open dumps are usually child of circumstances. Their distances from the households were not the determinant factors in their location as they are just located on any available spaces accessible by the waste collectors. Observations showed that the state agency in most sub-wards found an open-dump, sometimes earlier used by the households in the study area, usually by road sides, road junctions and

public spaces and made it a transfer station by keeping a (roro) - wheel container or build a masonry waste disposal facility called designated dumping site, (DDS). Therefore, it can be concluded that the placement and location of transfer stations in the study area were decided by both the households, which may be out of necessity, and the municipal authority (BASEPA) in its quest to satisfy the disposal requirement of the households. This situation compounds the problems of waste disposal in the metropolis. Solomon, (2011), reported that (Shubeler et al, 1996) stated that for households to carry their own waste to a transfer station, it needs to be located within easy walking distance of 100 meters.

### **Alternative Waste Disposal by the Households**

Households in the study area resorted to various available alternatives to discard their waste when not collected by the municipal agency or private contractors. This study found out that about 58 % of the household's burn their waste if it remained uncollected. This is usually the case in the sub-wards of Old GRA, new GRA, and medium density areas as Tambari. Observations revealed that, it's easy for the households to burn their waste because of the availability of spaces as setbacks yards and lawns in their compounds accorded to them by the architecture and planning of their areas. 34 % mostly in the high density sub-wards within the old city who enjoyed the daily collection service of BASEPA/cosmopolitan cleaners claimed that they throw their waste by the road sides as was required them to do by the municipal authority.

## **CURRENT WASTE COLLECTION, TRANSPORT AND DISPOSAL BY RELEVANT STAKEHOLDERS**

### **The Bring System of Waste Collection**

The bring system in this study refers to the type of waste collection usually being used by the major waste contractors (COSMOPOLITAN CLEANERS) and the municipal agency (BASEPA) in Bauchi metropolis. The process involved householders to bring and dump their wastes at designated sometimes unauthorized spaces. Observations revealed the system to be of two forms. Sub- wards within the old- walled city; Wunti, Kofar Wambai, Shekal, Gwallaga, and Unguwar Gwabba which were along the dual- carriage ways dumped their waste every day at any available spaces by the road sides for collection by the municipality. Sub – wards of Federal Low- cost, Tambari, Yelwan Tudu, Old GRA, New GRA and Tudun Salmanu brings their waste to a designated transfer station or unauthorized public spaces. That is those households

who received the waste services by the municipal agency. The collection is usually forth rightly or monthly. However, respondents interviewed complained of non- or delay of the waste collection by the municipality. This threw the health of the nearby inhabitants' into risks of diseases caused by mosquitoes and rodents. The challenges in this process identified by this study is the non adherence to time schedules of disposal by the residence and the spread of the waste by animals and birds on the road before collection. This type of waste collection also creates traffic jams on the street in the day time. While collection on single lane roads and streets is done weekly or fortnightly. The residence dumped their waste on either a designated dump site or illegally in public area by the road sides or uncompleted building structures. In this process, the collection involved the use pay loaders and tipping trucks. In areas where the agency (BASEPA) kept a stationary wheel-container (RORO), the process involved towing of the roro with tractors to final disposal sites (open dump). This research found that the collection in these part of the town is grossly inadequate. The waste dumps were washed away by rain during rainy days or blown away by winds into drains thereby clogging the drains which result to flooding. The dumps usually became the breeding ground for rodents, rats, mosquitoes and flies which spread diseases.

### **House to House Services**

These types of wastes collection are only executed by the formal waste contractors with legal registration in the medium and low density areas. Sub- wards of Federal Low- cost, Tambari, Tudun Salmanu, Old GRA and New GRA (West) are the areas where the formal private waste contractors operate. Most of those contractors uses pick- up vans and open trucks and side-loaders to transport the waste to disposal points (open dump) usually at the outskirts of the town. Collection is usually done manually by emptying the waste container in the trucks. Open – metal drum without lids and painted green were the common waste storage containers used by the waste contractors. The crew members which their number varies from 3-6, emptied the drums into side loader trucks, pick up vans or compactor trucks.



**Table 2; Available Equipment at the Municipal Agency and the Major Waste Contractors in Bauchi**

Waste collector	Types of waste collection equipment (functional)			
	Compactor trucks	Open tipper	Pay loader	Tractor
BASEPA	2 nos	5 nos (6.5m <sup>3</sup> )	1 no	2nos
Cosmopolitan cleaners	4 nos	1 no (12m <sup>3</sup> )	1 no	Nil
<b>Total</b>	<b>6nos</b>	<b>6nos</b>	<b>2nos</b>	<b>2nos</b>

## RECOMENDATIONS

In this research, a wide range of documentation was made on the waste generation and composition, household solid waste management practices and solid waste management service provisioning in Bauchi metropolis. However, limitation can be identified with these findings which can be turn into suggestions for further research. Further study is needed to find out the relationship or impact of the physical built environment on the household waste management. As emphasized by (United Nation Habitat, 2011), failure to consider parameters of each particular location has led to many failed systems and wastages of huge sum of money on solid waste management in developing countries. In Bauchi metropolis, further studies on these aspects will benefit policy makers. The UNDP/UNCHS (Habitat) 1996, identified Municipal Solid Waste Management (MSWM) as a complex task which depends as much upon organization and cooperation between households, communities, private enterprises and municipal authorities, as it does upon the selection and application of appropriate technical solution for waste collection, transfer, recycling and disposal. Therefore, there is the need to develop a sustainable household solid waste management framework for Bauchi metropolis.

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**Reference** to this paper should be made as follows Haruna Abdu Usman. (2017). Analysis of Conventional Solid Waste Management in Urban Centers of Developing Countries *J. of Environmental Science and Resources Management* Vol. 9, No. 2, Pp. 1-12

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