Assessment of Challenges Facing Solid Waste Management in Maisandari Neighbourhood of Maiduguri Metropolis, Borno State, Nigeria

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Abstract: **- This study examined the significant causal factors of the challenges the Borno State Environmental Protection Agency (BOSEPA) faces in managing solid waste in the Maisandari neighbourhood in Maiduguri metropolis. The research was motivated by reconnaissance survey to such location which posited that BOSEPA has been unable to evacuate the waste generated on daily basis. This study assessed the key problems BOSEPA faces in managing waste in the neighbourhood. Seventy five residents who have lived in the neighbourhood for at least six years were purposively sampled and interviewed. Officials of BOSEPA were given a questionnaire the information from which was used to validate the data collected from the sampled residents. The data generated from the residents were processed by a Binary Logistic Regression method of estimation. The results revealed that five factors account for the challenge in managing solid waste in the area. The first challenge facing solid waste management is that the residents have a very poor environmental awareness. They do not observe the mandatory monthly Sanitation Day slated for the last Saturday of every month which is meant to tidy the area. Secondly, BOSEPA is inadequately funded by the Borno State Government (Ministry of Environment) thus crippling its capabilities. Thirdly, there is the problem of non-participatory involvement by the community in the planning and execution of policies on waste management. Fourthly, most people do not recycle the waste generated. Moreover, the residents do not sort their solid waste but simply deposit them at dumpsites. Consequently, much solid waste is generated within a short time after BOSEPA's last collection. Lastly, UNEP (2005) recommendations for managing solid wastes in developing countries are suggested as a way out and there should be a conscious and sustained effort to: abandon the present Top-Down approach to waste management and adopt a Bottom-Up alternative so as to make waste management community-based and sustainable; to either prevent the production of waste or reduce the amount generated per time period; the volume of waste prior to disposal must be reduced; material must be recovered for use as direct or indirect inputs to new products; solid waste must be disposed in an environmentally sound manner in landfills.**

Key words: **Solid waste; Neighbourhood; Logistic Regression; BOSEPA**

I. INTRODUCTION

Developing countries have rapid population growth rates and as a result have become incapable of providing efficient urban services such as solid waste management. Reasons for the inefficient urban service delivery are many. Firstly, there are high densities of people living in poorly planned and administered urban centres. Secondly, residents in most cities are unaware of their responsibilities towards solid waste management and hence usually think that refuse collection is the duty of the municipal council or the state environmental protection agency. Thirdly, sanitation workers usually do not have enough equipment in performing their duties (loading and off-loading the waste generated to dumpsites). Lastly, the refuse management authorities are faced with poor funding which undermine their efforts to adequately remunerate refuse workers.

Maiduguri metropolis as a city a developing country, is bound to face these environmental challenges. This study examines the peculiar challenges facing the metropolis with regards to solid waste management in one of the several suburbs: Maisandari neighbourhood where the population is growing very fast. A perusal of available and relevant published literature shows that the challenges with managing solid waste in Maisandari neighbourhood have not been documented. Consequently it constitutes a gap in literature and need research attention.

Relatively, several studies as earlier mentioned have focused on solid waste management in developing nations with Nigeria inclusive. However, it appears that only a single attempt has been made (Dauda's 2007) *Selection of a Suitable Waste Disposal Site in Maiduguri Metropolis using multi Criteria Decision* examines this challenge. This fact elicits more studies into the challenges facing solid waste management in this area. It must be emphasized that the Federal Government has made an attempt to manage solid waste in Nigerian cities vide: Decree 58 promulgated in 1988 established the Federal Environmental Protection agency (FEPA) in order to deal with the problem. All the States in the Federation also inaugurated parallel ministries to cater for

their specific local needs as regards waste. The Borno State Environmental Protection Agency (BOSEPA) thus came into being to manage the solid waste in the state especially Maiduguri metropolis. There is the need therefore, to examine solid waste management in the area and hence the need to conduct this study.

II. RESEARCH PROBLEM

Preliminary surveys suggest that BOSEPA has been unable to evacuate all the waste generated in Maiduguri metropolis on daily basis. This indicates that huge backlogs of refuse have piled up in most neighbourhoods (Chiroma, Isa, Usman, Kagu & Ijafiya, 2016), igniting lots of thoughts that demands research attention. Secondly, although Maisandari area is served portable water by the Borno State Water Board, its supply is very irregular. Consequently, several households rely on tube wells and wash boreholes for their water supply. Moreover, some fairly rich residents in the area have sunk boreholes to obtain water. Worrisomely, Dauda (2010), reported that Maiduguri Metropolis is underlay by sedimentary rocks; as a result, leachates from solid waste can easily percolate through these sedimentary rocks and pollute the underground water resources. This calls for the unveiling of factors militating against proper management of waste generated in the neighbourhood so as not to contaminate the subterranean water. Furthermore, the neighbourhoods have been poorly planned and have inadequate drains to carry away rain runoff. The non-collection of solid waste therefore, constitutes a serious hazard during raining season because storm water can be blocked to cause urban flooding (Chiroma, *et al.*, 2016).

In addition, uncollected solid waste constitutes health hazards to the residents with regards to unpleasant odour, dangerous fumes and the spread of diseases by insects and rodents. It is quite important that the challenges facing solid waste management in the neighbourhood is examined at the micro level.

III. AIM AND OBJECTIVE OF THE STUDY

This study aims at documenting the peculiar challenges facing solid waste management in Maisandari neighbourhood of Maiduguri Metropolis. To achieve this aim, the specific objective pursued was to identify the key problems faced by Borno State Environmental Protection Agency (BOSEPA) in managing solid waste in Maisandari neighbourhood.

IV. STUDY AREA

The Maisandari Neighbourhood

Maiduguri metropolis shares boundary with Konduga local government in the west and Jere in the east and north respectively. Maiduguri is roughly circular urban area of 208 km².The area has 11°46'18" N to 11°53'21" N and 13°03'23" E to 13°14'19" E as it latitudinal and longitudinal extension.

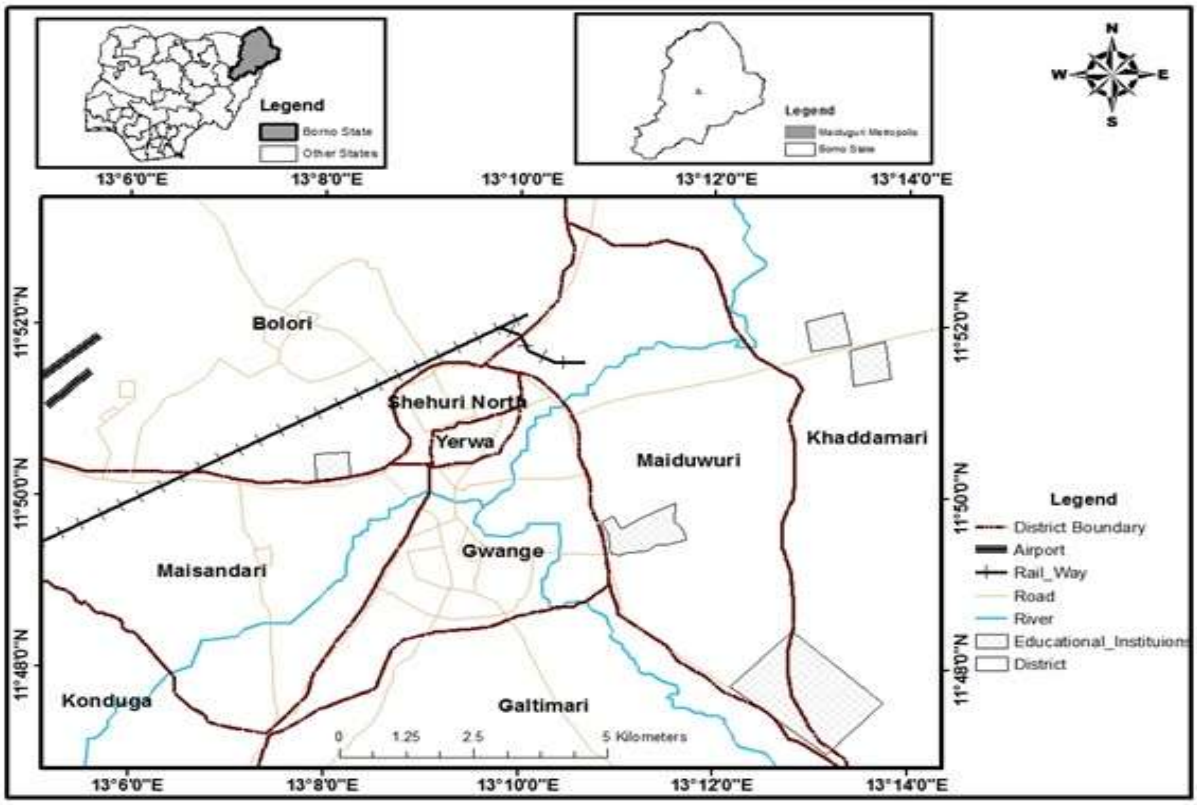


Fig.1. Borno State showing Maiduguri. Source: University of Maiduguri Spatial Database (2017)

Maisandari neighbourhood is located in Maiduguri Metropolitan Council. It is bounded to the north by Bolori District, to the south by the much recent Galtimari District, to the west by parts of Jere Local Government and to the east by Gwange District. Several subsectors bear different names specifically: Moduganari, Tsallake, Ngomari Old airport and Unguwan Doki, Shuwari, Suleimanti among others. Thus, Maisandari is the agglomeration of the areas outlined. Isolated and unoccupied areas however, lie within this delineation. The area may also be loosely described as the peripheral area in Maiduguri city.

The study examines the challenges facing waste management in Maisandari, one of the several large neighbourhoods in Maiduguri metropolis. The metropolis evolved from the historical city of *Yerwa* founded in 1907 and started to function as the Seat of power to the Kanem Borno Empire (Waziri *et al* 2009). The city was built coincidentally at a very strategic hitherto fairly occupied area of Maiduwuri and has been occupying the crossroads of several savannah kingdoms and thus has served and continues to serve as the marshalling point of trans-Saharan trade between the Maghreb and the lands alongside the Gulf of Guinea. In view of its status a marshalling point, waves of migrations and assorted merchandise have always ended in this city. This historic feature of Maiduguri has never waned not even under European colonisation. It is conclusive to say that Maiduguri has been a city that has always welcomed migrants and waste (Waziri *et al* 2009).

Apart from her historically envious position as a collection and distribution centre of merchandise, the strategic location of Maiduguri close to the confluence of two permanent rivers (Ngadda and Ngaddabul)have factored in the rapid growth of population (i.e. through natural increase and immigration) of the city (Chiroma, *et al*., 2016). Participants' observations suggest that large amounts of waste are generated by large heterogeneous population. The siting of Maiduguri at the meandering point of Ngadda and Ngaddabul confluence has always guaranteed regular water supply for irrigation agriculture and other domestic utilization. It is easy to allude that the city has always attracted migrants from far and near again resulting in a rapidly growing city that is habited by people with diverse cultures and from different ecological zones. It is human, any area with high density population activities to generate waste and therefore, Maiduguri as a city has always, through different neighbourhoods facilitated in generating large quantities of waste as other cities do (Richard &Mollie, 2006; Hamnett, 2011).

Since its inception in 1907, the city of Maiduguri has always enjoyed an urban supremacy status in the region and has performed varied functions including religious, commercial, administrative, judiciary and education as NE administrative seat. Specifically, Maiduguri was the Provincial Headquarters during the colonial rule (1907-1960) and has always remained as an administrative capital of a new state bearing its name for all the five State creation exercises in Nigeria's political history (i.e. in 1967, 1976, 1987, 1991 and 1996). Series of state creation exercises added to the Maiduguri's primacy in terms of infrastructure and functions and made it always unrivalled among its neighbours. The varied functions which the city has played over the years have inculcated the feeling of aristocracy among its indigenous people and have made them rely on migrant labour to perform menial services thus always pulling migrants especially artisans and traders. Historical evidence seems to support this assertion since the traditional role Gwoza people played *Oshara* -here is waste managers, has been in existence since the city was inaugurated (Waziri,2009)

Relief of Maiduguri and Solid Waste Management

Evidence from the topographical sheet, 'Maiduguri SW Sheet 10', reveals that the central part of Maiduguri metropolis (including the study area) is about 280 metres above sea level. Thus in terms of relief, the central part of the city is undulating lowland with some areas having flat plains. The vast and almost noticeable flat plain of the landscape stretches for several kilometres. In sum, the relief of Maisandari neighbourhood resembles the bridge and windscreen of the front side of a conventional car (Waziri,2009).

The relief of Maisandari neighbourhood might affect management of waste in the area through several ways. Solid waste might pile up at the crest of the hill because the terrain is flat and waste might remain immobile. On the other hand, on the account that the area experiences high intensity rainfall between June and September, storm water will definitely drift any accumulated solid waste downhill from the centre. Similarly, sewage may easily accumulate in areas. It is obvious that both solid and liquid waste will be pushed along the steep slopes only to accumulate at the valleys fringing the neighbourhood. From the foregoing, it is easy to assert that the relief of Maisandari neighbourhood has potential implications for waste management.

V. DATA REQUIREMENTS OF THE STUDY

The objectives of the study required that the variables contained in the Interview schedule are collected and analyzed quantitatively**.** The pre-coded Interview schedule contained basic socio-economic information on respondents, the possible causes of the challenges facing waste management and the official reaction from BOSEPA.

VI. TOOLS OF DATA COLLECTION

A pre-coded 26-question structured interview schedule was used to collect data from purposively sampled respondents. There are some reasons to explain why the structured interview was used. Most of the respondents were deemed to be illiterate and as such, the pre-coded interview schedule was the most appropriate tool for eliciting responses from them. Secondly, since a combination of diverse factors can lead to waste management challenges, oral interview was used to allow further in-depth probing of responses as Adamu *et al*

(2006:139) have advocated. Thirdly, oral interviewing easily permits the researcher to explore further the contextual nature of an individual's perception of the problem under study.

VII. SAMPLING METHOD; SAMPLING FRAME AND SAMPLING SIZE

The study area comprises: Moduganari, Bulumkutu, Ngomari old airport, Unguwan Doki, Shuwari and Suleimanti which all together is referred to as Maisandari. The reconnaissance survey conducted showed that Bulumkutu was the largest among the six followed by Moduganari, Ngomari Old Airport, Suleimanti, Shuwari and Unguwan Doki in that order. This factor was considered in choosing the sampling size and sampling frame. All the residences in each subunit constituted the sampling frame. Notably, the neighbourhood is poorly planned and as a result it is difficult to assess the total number of full unit houses. Consequently, systematic sampling was adopted to sort out the houses for survey. It was estimated that at least 750 units of houses can be found in the study area based on the number of houses aligning the main streets in the area. So 10% of this number was chosen as the sampling frame with the following distribution.

Sampling Frame and Sampling Size

Name of District in Maisandari	№ of Respondent
Bulumkutu	20
Moduganari	15
Ngomari Old airport	13
Suleimanti	13
Shuwari	07
Unguwan Doki	07
Total	75

Source: Field Survey, 2017.

VIII. METHOD OF DATA ANALYSIS

The study applied the Binary Logistic Regression model to analyse the collected data. Several scholars including Findley (1994:539), Bilsborrow (1998:56), Zhu (1998:157) and Ezra (2001:2) demonstrate that the most appropriate way to analyse the determinants of social challenges in an area is to apply a multilevel model which simultaneously considers individual, household and community level contextual factors. The reasoning is that 'the multilevel approach to social problems isolates the net effects of crucial contextual independent variables (Liang and White 1996:33) (see also Zhu 1998:157). In addition, several studies which applied this approach like those by Ezra (2001:2), Fox and Stark (1987:16),Stark and Bloom (1985:175) were able to take advantage of the varied software on Logistic Regression and thus were able to quantify and analyse quantitative data.

IX. SOLID WASTE MANAGEMENT

There is no efficient formal arrangement in place involving the private sector in waste management in Nigeria; as a result, managing solid waste has been the responsibility of government agencies (Abdullah, 2013).Therefore, solid waste management programme have existed in major municipalities where governmental functions are mostly carried out but not common in all settlements. It is arguable to say that most developing countries do not have efficient ways of managing their waste, in most cases this is done only in major municipalities (Thompson, 2010). Ogwueleka (2009) attest that solid waste is not managed properly; there is inefficient collection, insufficient coverage of the collection and improper disposal of the waste. Similarly, Sanusi's (2010), study on solid waste management in Minna shows that 82% of the households get rid of their solid waste using wheel barrows, burning the waste and dumping them indiscriminately in a place they deem fit or consider convenient.

In addition, the study highlights non-governmental organizations participating in solid waste management having weak capacity. With respect to these findings, data suggest that solid waste management in Maisandari neighbourhood of Maiduguri Metropolis (the study area) faces similar challenges. Furthermore, Abdullah (2013) demonstrates that in both Kebbi and Niger States similar problems exist. Alexander *et al* (2012) verify that Nigerians have not been particularly concerned about waste management; open dumping as well as open burning in unapproved locations, has been the norm. Equally, Ogwueleka (2009) explains that indiscriminate dumping of wastes contaminates surface land ground water supplies. Fervez and Kafeel (2010) expressed that municipal solid waste obstructs the drainage system as a result creating stagnant water for insect breeding and flooding during the rainy season. In like manner, Agwu (2002) establishes that solid waste in Port-Harcourt is so haphazard that it is either dumped on the road sides, unapproved dumpsites and into the drainage system which consequently affects environmental friendliness. To date, there is paucity of study carried out to examine which of the challenges facing urban areas in Nigeria is facing Maisandari Neighbourhood of Borno State.

In view of the review above, the challenges facing solid waste management in developing countries can be summarized as follows; firstly, there is direct disposal at wrong places. Moreover, solid waste is burnt openly which pollute the environment. Thirdly, there is a delay in the periodic collection by the responsible bodies/agencies. Fourthly, there is limited awareness/environmental education of the health hazards resulting by poor waste handling. In addition, there is the negligence and lukewarm attitude on the part of waste handlers. Similarly, corruption affects the smooth operation of waste management, through misappropriation of funds meant for waste management.

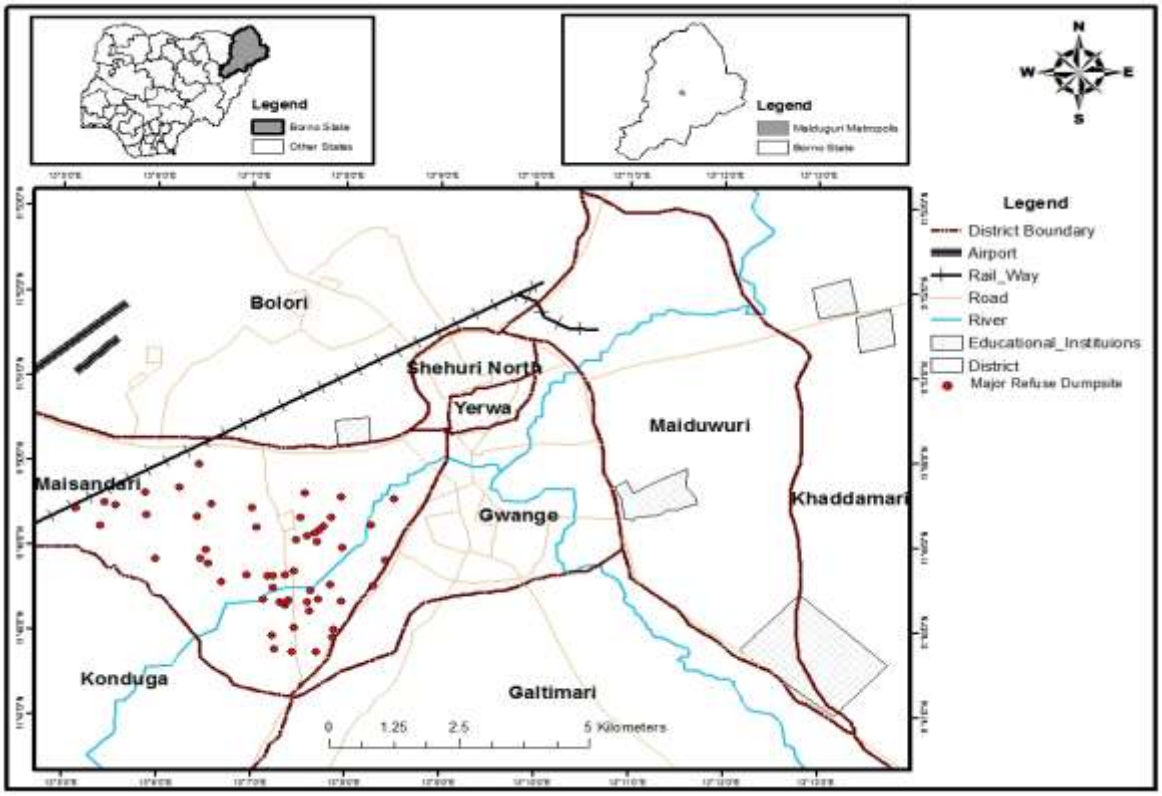
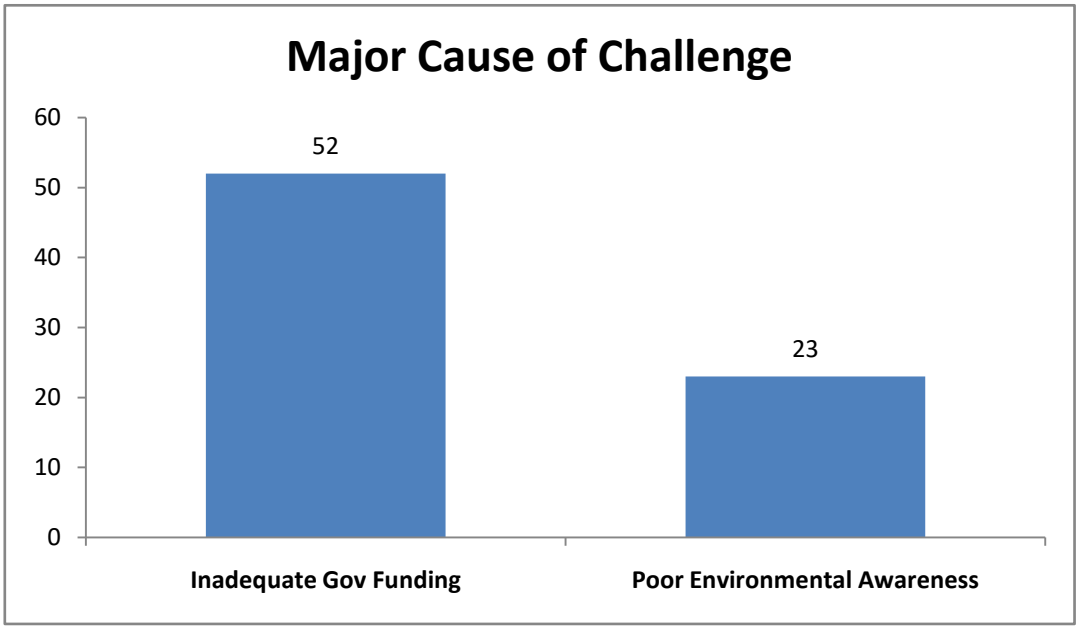


Figure 1. Maiduguri Metropolitan showing Major Dump site in Maisandari Neighbourhood.

Source: Field Survey, 2017.

X. MAJOR CAUSE OF CHALLENGE

Emphatically, 69% (52) of the 75 (100%) stressed that the major cause of solid waste challenge in Maisandari neighbourhood is inadequate funding to BOSEPA to manage waste.



Major Cause of Waste Challenge in Maisandari

Source: Field Survey, 2017.

Basic Statistics on Respondents ($X_{19} \rightarrow X_{26}$)

Variable	**Frequency**	**Percentage**
Rating of BOSEPA's collection of Waste (X_{19})		
Daily/Weekly	5	6.7
Bi-weekly/Monthly	70	93.3
Total	75	100
BOSEPA's Efficiency in collecting Waste (X_{20})		
Yes	19	25.3
No	56	74.7
Total	75	100
Official Method of Disposing Waste (X_{21})		
Burnt/Land fill/Manuring	27	36.0
Do not Know	48	64.0
Total	75	100
Effects of Waste Disposal on Residents (X_{22})		
No	46	61.3
Yes	29	38.7
Total	75	100
Consequences of Waste Disposal Method (X_{23})		
No	29	38.7
Yes	46	61.3
Total	75	100
Communal Efforts in Waste Management (X_{24})		
No	18	24.0
Yes	57	76.0
Total	75	100
Profitability of Waste Management (X_{25})		
No/Do not Know	33	44.0
Yes	42	56.0
Total	75	100
Private involvement in Waste Management (X_{26})		
No	18	24.0
Yes	57	76.0
Total	75	100
Major Cause of Solid Waste Challenge (Y_1)		
Poor Environmental Awareness of Residents	21	28.0
Inadequate Government Funding	54	72.0
Total	75	100

Source: Field Survey, 2017.

XI. SUMMARY OF LOGISTIC REGRESSION ANALYSIS

Variable	B	S.E	Wald	Df	Sig	Exp (B)
InX18 Frequency of BOSEPA's Collection of Waste	2.519	1.146	4.834	1	.028	12.412
X20 BOSEPA's Efficiency in collecting Waste	-1.926	.977	3.881	1	.049	.146
X24 Communal Efforts in Waste Management	3.369	1.607	4.395	1	.036	29.048
Constant	1.136	.454	6.248	1	.012	3.114

The Logistic Regression analysis of the variable $\mathbf{X_{14}}$**(**non-observation of Sanitation Days) shows a **Logistic Regression Coefficient of + 6.394 at .011 significance level at 1 degree of freedom.**

This suggests residents in Maisandari neighbourhood have a carefree attitude towards waste and disposal. They do not observe the mandatory *Monthly Sanitation Day* slated for the last Saturday of every month which is meant to tidy the area. In simple terms, this statistic indicates that this finding 99% are not subject to change. This factor can thus, be deemed the major cause of the challenge of managing solid waste in the area. This finding corroborates the observation by earlier studies that average Nigerian views solid waste management as the duty of either Local, State or Federal Government and not the communities that generate them. It is in this view that managing Solid waste in Maisandari neighbourhood has become the burden of government alone. Secondly, residents do not retain any part of the waste they have generated for recycling or reuse ***(Logistic Regression Coefficient of + 5.054 at .025 significance level at 1 degree of freedom).*** Consequently, the rate of dumping of wastes at dumpsites should be expected to be higher than BOSEPA can evacuate.

Thirdly, BOSEPA the formal governmental agency designated to manage solid waste in Borno State especially the metropolis, does not collect the waste piled up at dumpsites regularly (***Logistic Regression coefficient = + 4.834 at .028 significance level at 1 degree of freedom***). So waste is infrequently collected in the study area. Interviews with Key Informants BOSEPA officials attributed this problem to the possession of inadequate refuse collection vehicles and other necessary equipment and staff. Another, problem is the long delays in the payment of overtime fees and risk allowances to staff.

The fourth challenge to managing waste in the study area is linked to the fact that the Maisandari community is not involved in any way in handling waste in the area ***(Logistic Regression coefficient = + 4.395 at .036 significance level at 1 degree of freedom***). So, paradoxically, the people who generate waste in the area have been indirectly conditioned to think that managing the waste is not part of their responsibilities. The populace have taken this view because after all, they have elected people into governments (Federal, State and Local) to cater for their common needs. This revelation underscores their 'anyway, anyhow and anywhere' attitude towards disposing waste', as observed by earlier studies. The last major causal factor of the waste problem in Maisandari neighbourhood is connected to the varied problems bedevilling BOSEPA as a public institution in Nigeria ***(Logistic Regression coefficient = + 3.881 at .0.049 significance level at 1 degree of freedom***). Expectedly, BOSEPA as government agency established to manage solid waste generated in Maiduguri Metropolis faces several challenges including inadequate funding, corruption, and bureaucratic red-tapeism among others.

XII. CONCLUSION

Solid Waste Management encompasses generation, collection, transportation and disposal. It is a major challenge in Maisandari neighbourhood (Maiduguri Metropolis) due to rapid urbanisation, inadequate funding of agencies handling waste management and poor environmental awareness of the consequences of mismanaging waste.

XIII. RECOMMENDATIONS

The following recommendation culled from UNEP (2005), sources serve as solutions to the conclusion drawn above. At both the individual, corporate, institutional and governmental levels, there should be a conscious and sustained effort to:

- Either prevent the production of waste or reduce the amount generated. This will reduce the waste generated per time period.
- Reduce the toxicity or negative impacts of the waste generated.
- Recycle compost or recover material for use as direct or indirect inputs to new products.
- Reduce the volume of waste prior to disposal.
- Dispose residual solid waste in an environmentally sound manner generally in land fills.

It is not easy to muster the political will and the financial resources to plan and execute the recommendations outlined. However, lessons from several developed countries indicate that the recommendations cited above are implementable with minimal resources

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