



**PERCEPTIONS AND ASSESSEMENTS OF HOUSEHOLDS IN
PLANNING FOR A SUSTAINABLE SOLID WASTE MANAGEMENT:
EVIDENCE FROM BAUCHI, NIGERIA**

Haruna, A. U.

Department of Architecture, Faculty of Environmental Technology,
Abubakar Tafawa Balewa University, Bauchi, Nigeria

Corresponding Authors' E-mail: arkiplan.usman8@gmail.com **Tel.:** +234(0)8030850641

ABSTRACT

The paper evaluated the perceptions and assessments of households in planning for sustainable solid waste management in Bauchi, Nigeria. The perceptions of the householders were assessed on households need for transfer stations in their neighbourhoods. The findings showed that 64.5% of the respondents indicated their willingness to have it in their neighbourhoods. On the official responsibility and quality of waste collection, 75% of the respondents held the municipality responsible for solid waste management services. The findings further showed that 82% of the respondents attested that poor health was their major problem and 60% preferred to bring their waste to transfer station for disposal outweighing those that wish to pay for waste evacuation in their neighborhood. These outcomes identify issues and factors to consider when making policy decisions on building and placing a transfer station, planning and designing it, selecting a site, and involving the community. The study concluded that despite the absence of efficient waste collection in most sub-wards and the existence of registered waste contractors in some studied sub-wards most respondents preferred to dispose their waste in the transfer station rather than to pay for waste collection services or consider the nuisance attributed to the transfer stations. It was recommended that, there is the need to know the perceptions and opinions of other stakeholders rendering waste services to the households in the study area so as to create a balance between those served (householders) and those rendering the services (waste contractors). This would assist policy makers in making laws that may create harmony between the major stakeholders and create room for proper implementation of future plans and policies on solid waste management in the study area.

Keywords: Bauchi metropolis, Households, Household perceptions, Solid waste management, Transfer station.

INTRODUCTION

Until recently, solid waste management policies and programs in most African cities were formulated and implemented by government agencies without significant public participation. However, no environmental issue can be solved entirely by the city authority or by the State. Involvement of the end-users is seen as key factor to long-term sustainability since it provides a good way of getting to know and managing the expectation of users. As end-users of solid waste management, the households have a great role to play in solving the particular problems of solid waste (Usman, 2017).

Municipal solid waste management (MSWM) has emerged as one of the greatest challenges facing agencies of both developed and developing countries of the world. This is because waste generation increase with population expansion and economic development, and improperly managed solid waste poses a risk to human health and the environment. In these parts of the world, especially in sub-Saharan Africa, Nigeria inclusive, solid waste management infrastructure has been identified to exhibit features of uncontrolled dumping and improper



waste handling which causes variety of problems. These include co maintaining water, attracting rodents and insects, and increasing flooding due to blocked drainage canals or gullies. Improper MSWM also directly affects environmental sanitation (Mensah, 2006; and Rouse, 2006). As noted in Cuba (Mosler *et al.*, 2006), disease control necessitates special attention in MSWM. Sotamenou *et al.* (2010) in addition reported that it may result in safety hazards from fires. Improper waste management also increases a Greenhouse Gas (GHG) emission which contributes to climate change. United Nations Department of Economic and Social Affairs [UNDESA] (2005), agenda 21 of the Rio declaration on environment and development affirms that environmental sound management of waste is one of the environmental issues of major concern in maintaining the quality of earth's environment especially when it comes to sustainable development in all countries. This emerged facet, called for prioritizing researches in Solid Waste Management (SWM), especially in developing countries, by international organizations; the United Nations, e.g., UNDP, UNEP, HABITAT, ILO, and the World Banks to stem-out a sustainable solution.

However, researches, concentrated on the subject of solid waste management, and sanitation. In Nigeria, and other sub-Sahara Africa, studies concerning solid waste management were tailored towards municipal agencies, use of imported technologies of the industrialized nations, public private partnership (PPP) and other aspects of the secondary phase of solid waste management. However, most of the researches acknowledged the challenged posed by poor solid waste management in Nigerian urban centers (Usman, 2017). However, most of the researches acknowledged the challenged posed by poor solid waste management in Nigerian urban centres and in the study area.

The Study conducted by Bogoro (2012) on solid waste management in Bauchi metropolitan area focused on women contributions in domestic solid waste management with the view of involving women in waste segregation aspects of solid waste management. The findings of the study indicated that about 87% of the respondents showed positive response to participate in solid waste segregation at household level. A related study by Usman and Bawa (2017), characterizes the solid waste generated in Bauchi metropolis. Another study by Usman *et al.* (2016) on household's solid waste management in the study area, appraised the sustainability of solid waste handling practices of waste storage, reduces, re-used and recycles. Considering the three basic role of householders in domestic solid waste management; generators; handlers; and recipients of solid waste services, there is the need to explore more studies on solid waste management at household level especially on solid waste service provisioning in Bauchi metropolis.

The paper searched for answers on the opinions and perceptions of the households on the waste service delivery in Bauchi metropolis, as resulting from the relationships they uphold with other stakeholders in the waste management chain. In solid waste management chain, households are the main produces of solid waste. The households are the first responsible actors for dealing with waste in the so called primary phase of the collection, transport and disposal process of flows of (primary collection and short term storage). They are also responsible for linking and coordinating their waste activities with the activities of the (system) actors operating in the secondary phase of collection, transport and disposal, through what is termed as the interface, waste junction, communal bin or transfer station (Usman, 2017). In the current study, the word "transfer station" will be used as shown in Figure 1.

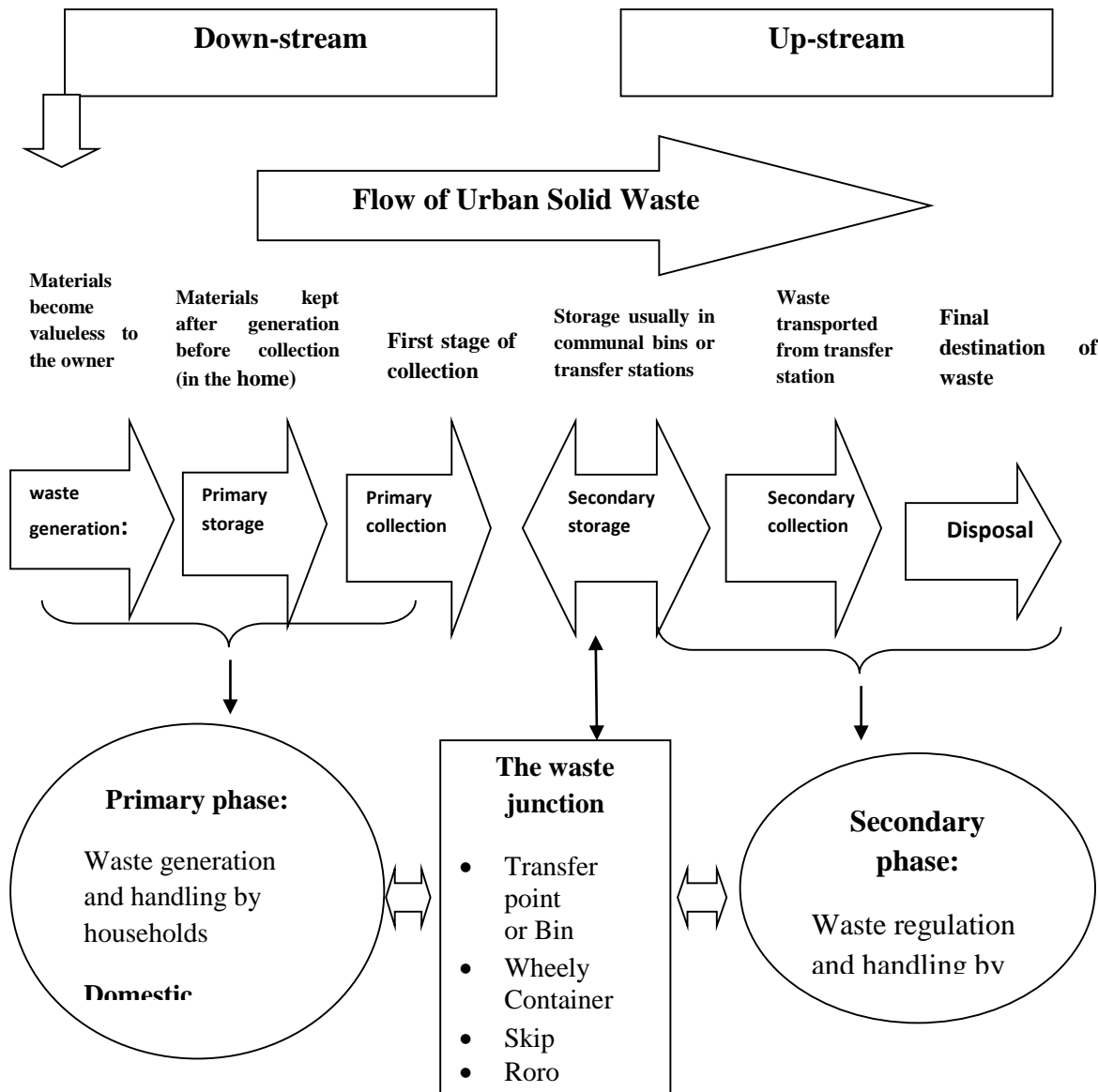


Figure 1: *Flows of urban solid waste through primary and secondary phase in SWM chain*

Waste transfer stations play an important role in a community’s waste management system, serving as the link between a community’s solid waste collection program and a final waste disposal facility (USEPA, 2012). In nearly every developing country, the capital city has grown to the extent that transfer stations need to be considered. Transfer stations are an integral part of present-day in municipal solid waste management systems. The main criteria used to decide on the location of a transfer station has traditionally been the minimization of transport costs, since it is cheaper to transport great amounts of waste over long distances in large loads than in small ones as reported by Bovea *et al.* (2007) cited in Abd Manaf *et al.* (2008). Not only distance to disposal, but travel times (due largely to traffic congestion) have dramatically increased in the past decade. As a general rule of thumb, if the one-way travel distance to disposal is over 20 km and the one-way travel time is over 30 minutes, implementation of transfer stations should be assessed (Cointreau, 2005). A transfer station is a building or processing site for the temporary deposition of waste (Zemanek *et al.*, 2011). Transfer stations



are often used as places where local waste collection vehicles or households will deposit their waste cargo prior to loading it into larger vehicles. It is regarded as the points connecting the primary and secondary actors and dynamics in handling domestic waste. It is termed as “waste junction”. Transfer stations make solid waste collection more efficient and reduce overall transportation costs, air emissions, energy use, truck traffic, and road wear and tear (Indiana Department of Environmental Management [IDEM], 2014).

Anschutz (1996) in Solomon (2011) stated that the transfer station is one of the most visible aspects of solid waste management (SWM) since it provides an interface between primary and secondary collection. For households to carry their own waste to the transfer station, it needs to be located within easy walking distance. Only in this way indiscriminate dumping can be discouraged. Furthermore, Anschutz pointed out that when households often behave contrary to schedules and rules of effective solid waste management this can be sometimes be shown to be caused by lack of facilities. If a transfer point, communal bin or dumping site is more than 100 meters away from their house, people tend to throw their waste much more often in streets, open spaces and rivers. The transfer station should be “acceptable” to householders in terms of location, visual impact and method of disposing of waste. The availability of transfer stations is an important factor to be studied when trying to understand the disposition behaviors of household. Because household are crucial for the ways in which waste flows can be shown (not) to move between household and skips, the strong emphasis on households at the primary phase of SWM seem to be justified (Solomon, 2011).

This coordination and integration of households (downstream actors) and the secondary waste collectors (upstream actors), is of critical importance for more effective and successful organization of the domestic solid waste systems. When this coordination is established, it creates a stronger socio-technical network or chain for handling waste. Oosterveer and Spaargaren (2010) expressed that by doing so, it facilitate services in ways as suggested by the theory of Modernize mixture approach (MMA).

The Sub-wards study on the household’s waste flows travelling from the household to the transfer station in Bauchi metropolis of Nigeria reveals the following types:

(1) 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 Government Reserved Area [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 (Figure 2).

(2) 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 Limited) 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.

(a) 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.

(b) 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 fortnightly 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.

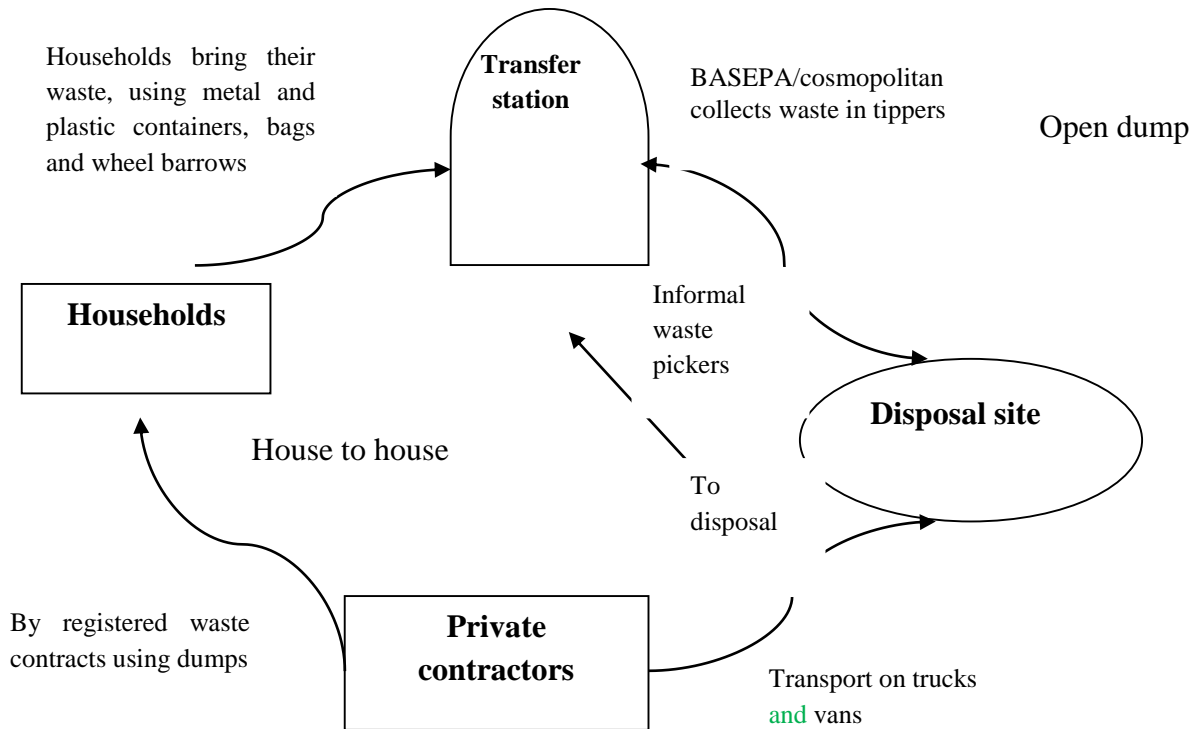


Figure 2: Waste transportation from the households to the transfer station in the studied sub-wards in Bauchi metropolis of Nigeria

MATERIALS AND METHODS

The Study Area

The study area 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 (Figure 3). Bauchi metropolis occupies a total land area of 3,604.0 hectares. 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 and Bauchi State, respectively.

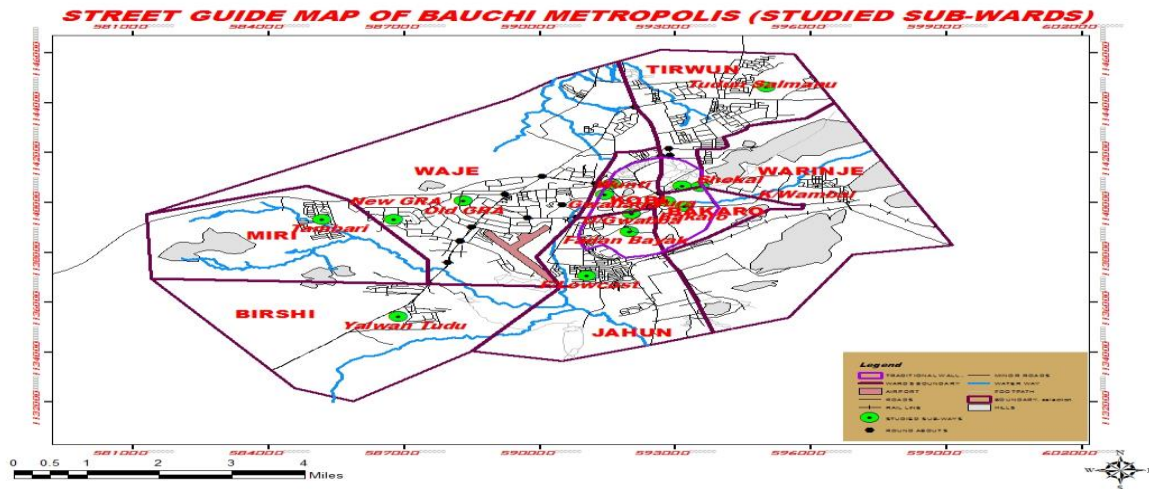


Figure 3: Map of Bauchi metropolis

Analytical Techniques

Quantitative method used was the household survey questionnaire and waste characterization study. A structured household survey questionnaire with the objectives of collecting information about households’ knowledge on waste flow from households to transfer station and to obtain households’ perceptions towards solid waste management provisioning was used for the study in 378 households purposely selected from 33,339 households in 14 sub-wards of the Bauchi metropolitan area as presented in Table 1. The selection of the study areas was based on population density, income level and distances to communal bins, or waste disposal points. Sub-wards along the streets and sub-wards at the inner core of the wards. Sub-wards within the old wall city are characterized as high density areas while Sub-wards outside the old wall city are characterized as medium and low density areas.

Method of Data Collection

In the study, a combination of quantitative and qualitative methods of data collection was employed in order to deepen the understanding of household solid waste management in its current State in Bauchi metropolis. Information was obtained from the level of federal government represented by the official of National Environmental Standard Regulation and Enforcement Agency (NESREA), from officials of Bauchi State Environmental Protection Agency (BASEPA) Bauchi State Commission for Women and Youth Development and rehabilitation and the household level. Other government agencies like the National Population Commission (NPC) and federal office of statistics were interviewed to obtained demographic data. At local government level, officials of the department of local government and chieftaincy affairs were interviewed to obtained data on the newly created districts, wards, and sub-wards of Bauchi emirate. While the health and sanitation department of the local government assisted with information concerning their roles and responsibilities. Waste contractors, operating in the Bauchi metropolis area were also interviewed to obtained information on their operation as service providers. The district and wards heads were also interviewed as stakeholders on the part of the community. They are usually the link between the municipal authorities and their communities. A total of 22 key informants were interviewed to obtain information that would assist in obtaining the current state of affairs of sanitation and waste management in Bauchi metropolis.



Table 1: Distance of Sub-wards in Meters (m) to Communal Bin

Ward	Sub-ward	Population density income category	Distance in (m) to communal bin or open dump
Bakaro	Bakaro	(HD) (LI)	10-50m
	Tura		50-150m
Warinje	Kofar Wambai	(High density low income)	10-50m
	Shekal		50-150m
Kobi	Wunti	(High density)	5-50m
	Gwallaga	(low income)	50-150m
Jahun	Jahun	(High density)	5-50m
	Gwabba	(low income)	50-150m
Waje	GidanGona Tudun wadan dan-iya	Federal low- cost	Medium density 5-50m
		Old GRA	Middle income 50-150m
		New GRA	Low density
		west	High income
Birshi	Yelwa	Yelwan Tudu	High density 10-150m
Miri	Wuntin Dada	Tambari	Medium density Middle income 10-150m
Tirwun	Tirwun	Kura,	Medium density
		Tudun	Middle income
		Salmanu	

RESULTS AND DISCUSSION

The Need for Transfer Station or Communal Bin in the Studied Sub-wards

As reported in Figure 4, the perceptions of the householders were obtained on four (4) sets of variables need for transfer station. Transfer stations are important facility in household solid waste management, as it integrates households and secondary waste collectors. Official responsibility of waste collection variable was also included because households play an important role in promoting public private partnerships with other stakeholders in waste management. Households were asked on the most severe problem with regard solid wastes at household level. This was included because there is a public health implication of household waste management. Households were also asked the role they would like to play in solid waste management.

The need for transfer station or communal bin in the studied sub-wards cannot be overemphasized because transfer stations are crucial facility in solid waste management as it links the activities of the downstream actors (Households) and upstream actors (secondary waste collectors). Stationary wheel-containers (*roro*), masonry bins (designated dumping site), open space (open dumps) public drains and road junctions served as transfer stations in the study area.

The perception of the households with regard to the need for transfer station in their neighborhood is an important factors when assessing the household solid waste service provisioning as it integrates the downstream actors (households) and the upstream actors (formal and informal stakeholders providing solid waste services). The study shows that 64.5%

of the respondents indicated that they knew its importance in effective solid waste management and are willing to have it despite all other negative attributes associated with it, like bad odour and health implications. Also, 17.5% indicated that transfer stations produced unpleasant smells and for that reason are not to be welcomed in their neighborhood. With regard to these category, similar observations was made by Odewumi (2013) who reported that *Aatan* transfer stations are not welcome by some residence due to the popular belief that it is the food basket of pets, like chicken, dogs, pigs and so on. Although they claimed that these pets reduced the volume of waste before collection. While the first category that needs a transfer station in their neighborhood might be due to indiscriminate disposal in drains and road sides that cause environmental degradation, such as flooding and defacing of aesthetic qualities of their neighborhood.

The implication of households perceptions (Figure 4) towards the location of the transfer station is that, their perceptions and opinions should influence the decision making process about the location of transfer station. Essentially the decision on the location of transfer station should take into consideration the extent of resistance by households against the location of the transfer station in their neighborhood in addition to the factors such as health impact and accessibility (Solomon, 2011). It is in line with the above that BASEPA collaborates with ward heads and leaders to find a suitable location for placement of transfer station in the study area. According to Solomon (2011), the transfer station services as an important object in the efforts of the householders to claim more decision-making powers and to increase level of participation.

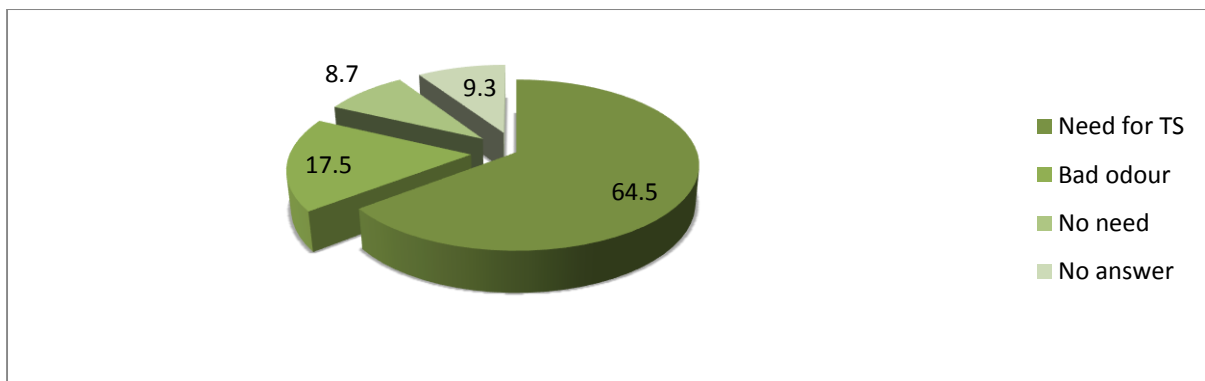


Figure 4: *Households perceptions on the need for transfer stations in their neighbourhood*

Responsibility for Waste Collection at the Households

When assessing households' with respect to the quality and nature for waste service provisioning in their neighborhoods, 75% of the respondents hold the municipality (BASEPA) responsible for the waste service delivery (Figure 5). That is to say household thought that solid waste management services (SWM) are the sole or at least the prime obligatory responsibility of the municipal authorities (BASEPA). A study by Stanley *et al.* (2012) in Sabon Gari, Zaria, 37.84% of the respondents felt that waste collection services is a government responsibility alone. In trying to establish that current waste management scenario in Bauchi metropolis, it has been captured that major part of the city population received little or no waste management services from the municipal authority (BASEPA) which made those that can afford to opt for stronger role of private sectors. Although the involvement of the private sectors does not change the situation as the percentage of those paying for the waste service is very small and no proper institutional capacities to set up the public private partnership in the systems.

The implication of these findings is that the majority of the households hold the municipal authorities responsible for inadequate service provision. In this case, household tend to blame the municipal authorities and do not consider themselves to be first or primary responsible for improper, unsafe and unsustainable forms of domestic solid waste management. In a study by Stanley *et al.* (2012) in Sabon Gari, Zaria, 37.84% of the respondents felt that waste collection services are a government responsibility alone.

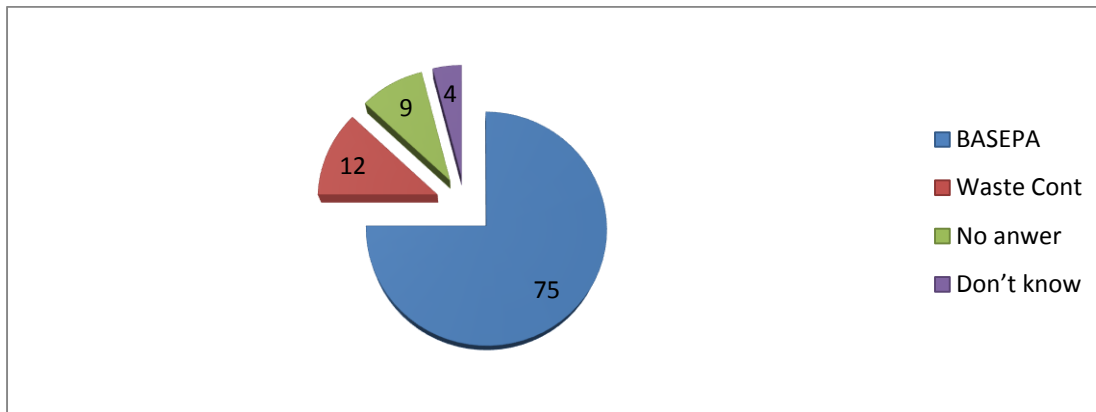


Figure 5: *Households perceptions on the official responsibility for waste collection*

Household’s role in Solid Waste Management in the Studied Sub-wards

With regard to the perception of householders on their own roles in solid waste management, 60% of the respondents preferred to bring their waste to transfer station for disposal outweighing those that wish to pay for waste evacuation in their neighborhood which was 30% (Figure 6). The implication of these findings are that households knows the importance of transfer station and are willing to cooperate with the municipal agency as the sole provider of solid waste services by bringing their waste to the transfer station for secondary collection by BASEPA. This result can also be interpreted that majority of the households cannot afford to pay for waste collection services. In this case, it became very important for the municipal agency (BASEPA, 2013) to consider this in planning future solid waste management. According to an interview with the municipal official, the agency is considering the introduction of 'fees' for waste collection in the nearby future in Bauchi metropolis.

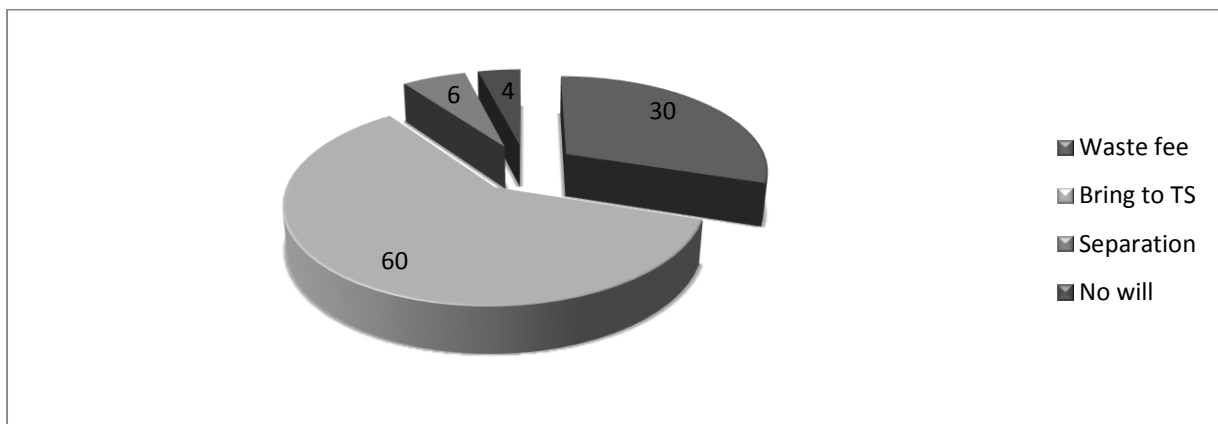


Figure 6: *Roles and responsibility opinions of the households in waste management*

Most Severe Problem Related to Solid Waste Management in the Studied Sub-wards

When respondents were asked, what is the most severe problem relating to solid wastes at the household level, about 82% of the respondents showed that poor health is their major problem while 4.5% claimed that nothing is wrong (Figure 7). This variable is vital because these are a public health implication of household waste management, especially in areas where waste collection service is insufficient. Essentially the decision on the location of transfer station should take in to consideration the extent of resistance by households against the location of the transfer station in their neighborhood in addition to the factors such as health impact and accessibility (Solomon, 2011).

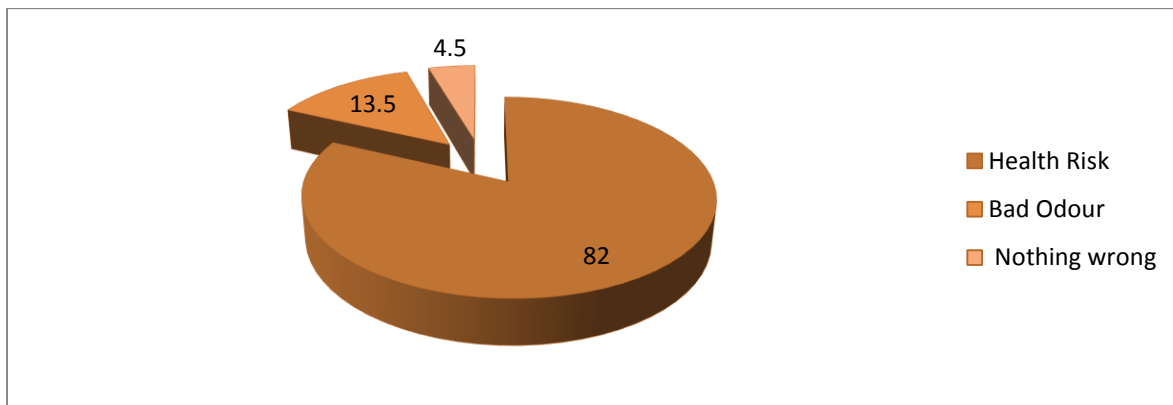


Figure 7: *Opinion of Households on most severe problem related to location of transfer station*

CONCLUSION AND RECOMMENDATIONS

Bauchi metropolis, the capital of Bauchi State Nigeria, is a town comprising of different categories of social class of families living in the old city (surrounded by the town wall-Ganuwa), the GRA's and sub-urban areas. These families (households) generate waste as a result of various domestic social and economic activities. Once generated, the wastes have to be stored somehow and somewhere until the moment the wastes can be handed over to a third party that will take care of the wastes.

The study has demonstrated the importance of transfer stations in the studied sub-wards. The findings indicated that despite the absence of efficient waste collection in most sub-wards and the existence of registered waste contractors in some studied sub-wards most respondents preferred to dispose their waste in the transfer station rather than to pay for waste collection services or consider the nuisance attributed to the transfer stations. As the municipal authority is planning to introduce waste management fee in the future because it is an externality that must be paid for, either as a separate fee or part of the general tax.

The study therefore, recommended as follows:

1. There is the need to investigate the willingness to participate in and pay (WTP) for improve waste services in relation to householders opinions about the lack of performance of the other stakeholders.
2. Finally there is the need to know the perceptions and opinions of other stakeholders rendering waste services to the households. This would create a balance between those served (householders) and those rendering the services (waste contractors). This would assist policy makers in making laws that may create harmony between the major



stakeholders and create room for proper implementation of future plans and policies on solid waste management.

REFERENCES

- Abd Manaf, L., Pei Pei, G., Mohd Zukki, N. I. and Abu Samah, M. A. (2008). TSA: An Expert System for Solid Waste Transfer Station. *Journal of Sustainable Development*, **1**(3):82-90. www.ccsenet.org/Journal.html. Nov, 2008.
- Anschutz, J. (1996). *Community Based Solid Waste Management and Water Supply Projects. Problems and Solutions Compared*. A survey of the literature. Gouda, the Netherlands, WASTE.
- BASEPA (2013). *Bauchi State Environmental Protection Agency Waste management strategy 2013*.
- Bogoro, A. G. (2012). *The Role of Women in Household Solid Waste Management in Bauchi Metropolitan Area, Bauchi*. Unpublished Ph.D Thesis Abubakar Tafawa Balewa University, Bauchi.
- Bovea, M. D., Powell, J. C., Gallardo, A. and Capuz-Rizo S. F. (2007). The role played by environmental factors in the integration of a transfer station in a municipal solid waste management system. *Waste Management*, **27**(4): 545-553.
- Cointreau, S. (2005). *Transfer Station Design Concepts for Developing Countries*. Washington DC, USA .
- Mensah, A. (2006). People and their waste in an emergency context: The case of Monrovia, Liberia. *Habitat International*, **30**(4): 754-768.
- Mosler, H. J., Drescher, S., Zurbrügg, C., Rodriguez, T. C. and Miranda, O. G. (2006). Formulating waste management strategies based on waste management practices of households in Santiago de Cuba, Cuba. *Habitat International*, **30**(4): 849-862.
- Indiana Department of Environmental Management. [IDEM] (2014). *Solid Waste Transfer Stations Office of Land Quality*. IDEM Fact Sheet, 2014. (317) 232-8871 • (800) 451-6027 www.idem.IN.gov.
- NPC (2014). *National population census 2006*. National population commission, Nigeria.
- Odewumi, S. G. (2013). Appraisal of Storage and Collection Strategies of Municipal Solid Waste in Lagos State *IOSR Journal of Humanities and Social Science*, **10**(5): 61-67.
- Oosterveer, P. and Spaargaren, G. (2010). *Meeting Social Challenges In Developing Sustainable Environmental Infrastructure*. East Africa Cities: Environmental Policy Group, Wageningen University Hollandseweg, Chapter 2. Pp.11-29.
- Rouse, J. R. (2006). Seeking common ground for people: Livelihoods, governance and waste. *Habitat International*, **30**(4): 741-753.
- Solomon, A. (2011). *The role of Households In Solid waste Management* (Vol. 4). East Africa: The Netherlands; Wageningen University.
- Sotamenou, J., Ganry, F., Montange. D., Parrot, L. and Simon, S. (2010). Transfer stations for Sustainable municipal solid waste management in Africa: Evidence from Cameroon. *Solid Waste Management and Environmental Remediation*. Chapter 5, Pp. 1-26. ISBN: 978-1-60741-761-3: <https://www.researchgate.net/publication/286146989>.
- Stanley, A. M., Andrew, S. S., Dania, A. A. and Sani, F. I. (2012). An Assessment of Household Solid Waste Disposal Practices in Sabon Gari Zaria. *Journal of Environmental Technology, Abubakar Tafawa Balewa University, Bauchi*, **5**(1): 8-12.
- UNDESA (2005). *United Nations Department of Economic and Social Affairs*.
- United States Environmental Protection Agency USEPA. (2014): *Waste Transfer Stations: A Manual for Decision-Making*. Pp. 1-2.



- Usman, H. A. and Bawa, H. S. (2017). Characterization of Households Solid Waste in Bauchi Metropolis. *International Journal of Innovative Research and Development* 6(6): 158 – 162. ISSN: 2278 - 0211.
- Usman, H. A., Abubakar, S. K., Aminu, M. A. and Mohammed, U. J. (2016). *Sustainability Appraisal of Residential Households Solid Waste Handling Practices in Bauchi Metropolis, Nigeria*. Proceedings of the 2nd conference on Management Technology and Development ATBU (2016). Pp. 193 - 198. ISBN: 978-1-922069-18-4.
- Usman, H. A. (2017). *Framework for Sustainable Households Solid Waste Management for Bauchi Metropolis*. Unpublished Ph.D. Thesis, Abubakar Tafawa Balewa University Bauchi.
- Zemanek, J., Wo niak, A. and Malinowski, M. (2011). *The role and place of solid Waste Transfer Station in the waste management system*. Infrastructure and ecology of rural areas. Commission of Technical Rural Infrastructure, Polish Academy of Sciences, Cracow Branch. Pp. 5-12.