RELATIONSHIP BTWEEN SOCIO – CULTURAL FACTORS AND SOLID WASTE GENERATION IN BIDA, NIGER STATE

BY

SAIDU, Muhammad Babasaba

MTech/SET/2018/8597

DEPARTMENT OF URBAN AND REGIONAL PLANNING
FEDERAL UNIVERSITY OF TECHNOLOGY
MINNA

A THESIS SUBMMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY IN URBAN AND REGIONAL PLANNING

JUNE, 2023

ABSTRACT

Urbanization, modernization and rural migration to cities bring about an increase in population which also proliferate the use of needed materials that result into a tremendous urban problem related to waste generation and management. Waste does not only end at creating problem of pollution to environment but also constitute menace that affects human health. Society and culture have a significant impact on waste generation. This study is therefore aimed to analyse the relationship between socio-cultural factors and solid waste generation in Bida. The study employed experimental and quantitative approach. Experimental approach involves the measure of household's solid waste generation, and quantitative approach through structured questionnaire was employed to obtain data on socio cultural factors in the study area. A total of 400 households were selected using a stratified random sampling techniques based on traditional and modern settings to collect information on waste generation. Both descriptive and inferential statistical methods were used to analyse the data. Factor and regression analysis were used to examine factors influencing waste generation and test the effect of socio cultural environment on waste generation. The result found that a total of 1,085 kg of solid wastes was generated at the average generation rate of 0.46 kg/capita/day. The study found that seven (7) socio cultural factors such as Urbanization (0.894), geographical settings (0.757), lack of awareness (0.719), economic (0.791), practice (0.798), beliefs (0.782) and religion (0.715) influenced waste generation in Bida. Also the study found that practice ($\beta = .167$, $t = 2.462$, $p = < .05$), geographical setting ($\beta = -.190$, $t = -2.702$, $p = < .01$) and lack of awareness ($\beta = .251$, $t = 3.552$, $p < .001$) had a statistically significant impact in solid waste generation in Bida. In conclusion the study recommends Government private partnership in issue of waste management and also recommends public enlightenment programme and campaign on waste generation and management. It also recommends establishing a National database that will always carry out researches and updates on waste problems both at the National, State and Local level.

TABLE OF CONTENTS

Content **Page**

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure **Page**

LIST OF PLATES

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Urbanisation, modernisation and rural migration to cities bring about an increase in population thereby creating serious problems in urban areas that are related to waste generation. Waste generation rates are of different kinds from among different countries and cities of the world as they are influenced by different factors (Kolekar *et al.*, 2016). Increase in waste generation according to Pardini *et al*. (2019), is a significant challenge to an enormous urban centres of the world and it means a menace to the fast growing cities with speedy population growth. Waste does not only end at creating problem of pollution to environment but also constitute menace that affects human health. Though, they are greater in highly developed countries than in developing countries.

Report on global assessment of solid waste management in 2019 revealed that the speed at which Municipal Solid waste grows is far ahead of the rate of urbanisation. It further

stated that in the past ten years, urban residents generate about 2.9 billion tons of waste at 0.64 kg per person per day, at present, the amount has tremendously rise to 1.2kg per person per day to about 3 billion urban residents. While it is still expected that by the year 2025, as urban residents increase to 4.3 billion, solid waste generation shall increase by 1.42 kg per capita per day.

Factors affecting waste generation and composition are diverse in separate regions of the world, due to variation in local conditions like climate, standard of living, technology, customs and culture (Darban and Hajilo, 2017). It is then therefore eminent to be guarded in preparing any forecast on the issue of socio cultural factors and solid waste as they have a long term effects.

Society and culture have a momentous effect on solid waste generation than other attributes of economic factors like income and education, due mainly to the difficulties in measuring the real wages of the residents (Yusof *et al.*, 2002). The relationship between socio - cultural factors and the generation of solid waste is being influenced mostly by the household attitude, family size, lifestyle and the indigenous knowledge on the efficient use of materials (Yusof *et al*., 2002; Darban and Hajilo, 2017). While the differences in its composition between and within different nations of the world are due to the differences in geographical locations, economic situation, and waste management guidelines (Abdel-Shafy and Mansour, 2018; Kolekar *et al.*, 2016). Solid waste generation is growing at the rate beyond the reach of the city authorities to control for a sustainable urban environment (Umunna, 2011). It is one of the major environmental problems in Nigeria that is significantly reducing our environment capacity to sustain life. Solid Waste that weighs up to 25 million tons is generated yearly in the cities of Nigeria at the ranges between 0.66kg/capita/day to 0.44kg/capita/day as against 0.7 – 1.8kg/cap/day in developed nations. (Beatrice and Jussi, 2013). This volume increases daily due to the rapid population

increase and modern development, yet there is no proper record on the rate and composition coupled with poor management. Solid waste management could have been the best every city government would like to provides for her residents, if not that it has been traditionally assigned to local authorities with the involvement of stakeholders from both public and private sectors (Massoud *et al*., 2019).

1.2 Statement of the Research Problem

Waste generation rates are profusely increasing all over the world. Cities of the world today generated up to 2.01 billion tons of solid waste and it's expected that with speedy increase in growth and development by the year 2050 the rate will increase by 70% to 3.40 billion tons. (World Bank, 2019).

The largest percentage of municipal solid waste generated from the developing countries are mostly from households (Nabegu, 2017), while its composition varies in cities and nations due to differences in life style, economic situation, waste and management guidelines (Abdel-Shafy and Mansour, 2018). Waste volume is not really the actual problem but the failure of individuals, and waste management agencies to meet up with their responsibilities of maintaining the environment.

Developed nations tend to take a holistic approach in the assemblage, keeping, treatment and disposal of solid waste to make it harmless on environment, human and animal life. The case is different in Nigeria as the issue of waste management is solely channelled to local authorities, and due to the financial burden and the capital intensive nature for the purchase and maintenance of waste management equipment, they were unable to cope with it. The sad side of it is the haphazard disposal of solid waste on the environment due to the negative attitude and inadequate awareness of proper solid waste disposal by the people (Kinyua *et al*., 2016). These problem are however apparent in Bida as one of the

urban centres in Nigeria. The increasing population growth in Bida has proliferated the use of needed materials which have inversely increase the waste generated within the city. The practice (local culture) of open dumping at any nearby pitch "gudu" further pollute the environment, and serve as a breeding ground for disease and scavengers. This study is therefore aimed at investigating the association between socio – cultural factors and the volume of solid waste generation in Bida with view of suggesting ways of improving management strategies of limiting its adverse effects on the environment.

1.3 Research Questions

The study will address the following research questions:

i. What are the socio cultural characteristics of the residents?

ii. What is the rate and volume of solid waste generated by households in the wards?

iii. What is the trend of solid waste generation in Bida?

iv. What are the relationship between socio cultural factors and solid waste generation?

1.4 Aim and Objectives

1.4.1 Aim

The aim of this study is to investigate the association between socio – cultural factors and domestic solid waste generation in Bida.

1.4.2 Objectives

i. Identify social and cultural factors that influence waste generation in Bida. ii. Examine the volume and composition of waste generation among the

household in Bida.

iii. Examine the rate and trend of solid waste generation in Bida.

iv. Examine the association between socio cultural factors and solid waste generation in Bida.

1.5 Scope of the Study

The study covers residential areas in the administrative wards of Bida Local Government Area which include Masaba 'A' and 'B', Masaga 'A' and 'B', Umaru Majigi 'A' and 'B', Kyari, and Mayaki Ndajiya, others are Landzun, Bariki, Cheniyan, Dokodza, Nasarafu, and Wadata wards. The focus is only on the effects of socio cultural factors on the domestic solid wastes apart from all other types of wastes.

1.6 Justification for the Study

This research will throw light on the current situation of waste generation and composition in Bida. It will also look at how society and culture of Bida residents influence the issue of solid waste. These could also help the relevant authorities to manage waste generation in the area.

The study is based on the suggestions that the attitude of the people best explain the engagement in health promoting behaviour. Several studies on the knowledge and attitude of the household waste were mainly descriptive, this study will add to that as it is designed to study the relationship that exist between awareness, culture and well – being of household on domestic waste generation and management. Finally, results from this study shall be a contribution to environmental management planner's verdicts on the active and workable solid waste management system for Bida city.

1.7 The Study Area

1.7.1 Description of location

Bida is a Local Government Headquarters in Niger state. Its located on the A124 highway (a regional road) linked Ilorin to Minna and Abuja at coordinates 9°05'N, 6°01'E, 9.08^{o}N, 6.017^{o}E. A dry, arid town at the South – Western part from Minna (state capital). The major ethnic group found in this city is Nupe. It is the home based of Nupe land with many districts like Agaie, Baddeggi, Enagi, Katcha, Kutigi, Lapai, Lemu, Mokwa, Patigi, and others.

Bida is situated between latitudes and longitudes 4 to 9^{o} North of the equator, and 5 to 59^{o} East of Green Which Mean Time respectively. The scenery of Bida is practically standardised since the lithology and rock constitution are not deeply variable. It is delimited by Pichi, Badeggi, Gbazhi and Doko at the West, East, North and the Southern part respectively.

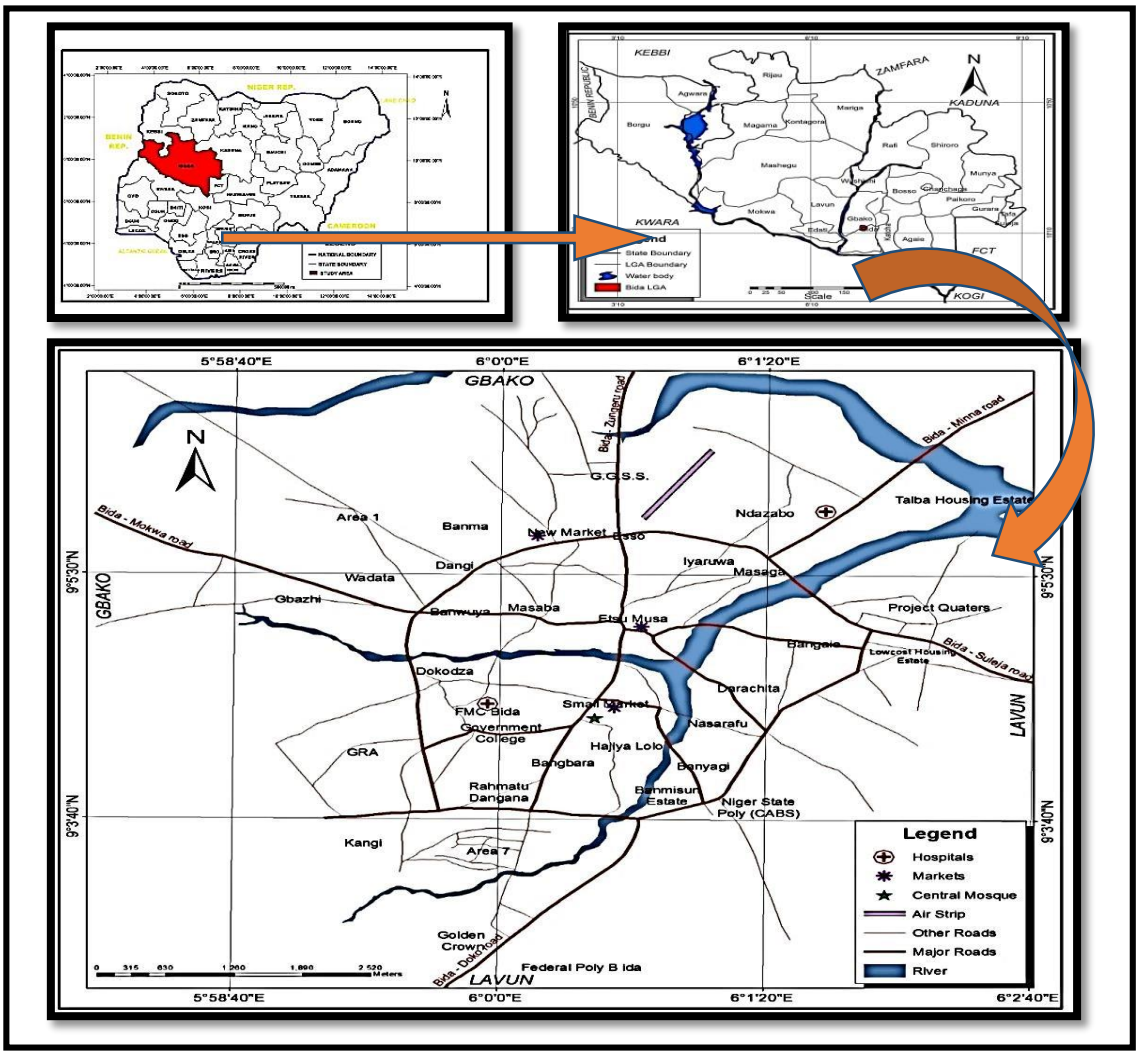
Bida is about 240 kilometres to Abuja (Federal Capital Territory) at the North East direction with overall population of 188,181 people in line with the 2006 census figure. Located to the South western part of Minna (state capital). Bida city is conventional

emirate. It stress along Bako River, which is a minor offset of the River Niger on the vertex of roads from Jebba, Zungeru, and Agaie (Max Lock, 1980).

Figure 1.1: Map of Nigeria Showing Niger State and Bida Local Government Area **Source:** Ministry of Lands and Housing Niger State and modified by Author, 2020.

1.7.2 History of Bida town

Bida was formerly a small colony called Beni (human being) established by Tsoede in the year 1531 before it was later conquered by the Fulani warriors in 1806 and became the central region for the Fulani Empire in the Nupe Kingdom. Etsu Usman Zaki proclaimed himself as the first emir of Nupe land in the year 1835 after defeated Umar Bahushe (a contender Fulani ruler) in the civil war between 1847-1856 at Bida, and then moved the



capital from Raba which is about 67 miles (110 km). Today, Bida is widely recognized under the leadership of Etsu Yahaya Abubakar.

The activities of olden town of Bida are under kingship led by the Etsu Nupe as the head of the town. The municipality is common for its investment of established crafts, the common of which is the glass and brassware. The city is well-known for its Durbar anniversary and the home of Federal Polytechnic Bida. It is also known for its trade, mostly on brass and copper goblets, different steel products, glass beads and bracelets, raffia hats and mats, and domestically dyed cotton and silk material. The craftsmen paintings via hand on their very own premises in extraordinary wards and are prepared into close-knit guilds. Bida is mostly dominated by Nupe people, they live in mud houses that are grouped into a common place compounds. The position of the town at the vertex of River Niger and Kaduna, it is one of the chief producer of swamp rice that are practice in Fadama. In addition, Bida people also trades in yams, millet, shear nuts, tobacco, sorghum, cotton, peanuts (groundnuts), palm oil, palm kernels, onions, indigo, sugarcane, fruits, pottery, sheep and goats.

1.7.3 Settlements

The ethnic group that dominate in the study area is Nupe. The local arrangement of Nupe settlement is constant with bunches of enclosed compounds or houses that form a ward (*efu*). These wards (*efu*) were separated by some sections of open land, road or natural features. Nupe settlement are usually with scattered wards with an enclosed large town wall that protect them from external attack and the remains of which are still be found in many places. Their traditional houses mostly consisted of a several huts, which are mostly round in nature, built of clay and thatched with grass and surrounded by a high mud wall. These type of traditional houses remains till twentieth century, when the western Architecture became common, especially among people living in towns, then the sheets

of corrugated iron are used to replace the thatch roofs, while concrete cements were also used in replacing mud constructions. Then, the individual families that are well to do and earned more salaries built their own houses to quit the extended family homes. While the extended family homes disintegrate gradually due to the inactive contribution to the cost of the repairs as a result of modern western Architectural design.

1.7.4 Topographic and geology

The study area has relatively undulating terrain i.e. gentle slope elevation and depression occurs in some part of the built-up area. It has two wide valleys drainage southward into the landzu running east west some 2km north and south of the town.

1.7.5 Climate

Bida experiences a discrete dry and wet seasons being a town within a middle belt of Nigeria. The wet season usually last for nearly 200 days and start from April through October with the average annual rainfall of about 122.7 mm while the highest record is between July (226 – 300mm) and September (240 – 350mm). (Max Lock, 1980).

The cold hamattan wind ushers in dry season, and become so hot between March and April. The mean monthly temperature is usually at its peak at 31.1c in March and the lowest in August at 26.0c. Bida is blessed with moderate climatic conditions being at the tropic and the sunshine duration last between eight to ten hours daily, ranging between 30^{o}c and 37^{o}c annually with highest temperature in March. The increased in cloud cover in between the months of July and September drop the hours of daily sunshine to an average of about four hours.

1.7.6 Vegetation

Bida area is characterized by a natural green land (natural vegetation) this is known as northern guinea savannah, the area is predominantly a grazed land with trees and grasses, and the predominant trees in generally include mango tree and sheer butter tree.

1.7.7 Population

The population of Bida is heterogeneous type consisting of different tribes from all over the nation. Based on 1991 National Population census, the population of Bida was

107,200. While the 2006 census figure is approximate to 188,181 (National Population Commission, 2006).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

2.1.1 Concept of urbanisation

Urbanisation is the continuous increase in the number of people that live within towns and cities. It transpires due to the movement of people from rural areas to urban areas. Manzoor and Iram (2018) describe urbanisation as a situation where majority of people crowded together in towns and cities, and in the process changing a man's social life. These increases in population at same time transform the city both in land uses, economic and social activities. Urbanisation brings about higher level of literacy, better health, and high access to social services, lower fertility and a longer life expectancy (United Nations Department of Economics and Social Affairs, 2014).

Among the various reasons that brings about urbanisation are industrialization, commercialization, social benefits and services, employment opportunities, and several others, but the common ones among the developing countries could either be natural due to an easy access to better health and social services or movement of people from rural to urban areas searching for a better standard of living.

The continuous rise of the population in the cities however brings about some effects on the cities both positive and the negative ones. Although the negative effects outweigh the positive ones as Michael (2000), related that cities are the centre of technological advancement and economic growth yet they serve as a breeding ground for diseases and environmental pollution.

A reasonable number of the people of the world population today live in cities, this according to the prediction by the United Nations Department of Economics and Social

Affairs (2014), that more than half of the world population shall live in urban centres by year 2050. This continuous agglomeration of people in cities increase the uses of peoples needed materials which in turn pollute the environment and the pollution shall linger on in cities as far as the trend of urbanisation continues till the spread effects on a global dimension (Alirol *et al*., 2011). The major impacts this situation convey to cities are poverty and environmental degradation. This negative impact is common in most of the developing countries with poor technological advancement and limited financial resources than the developed nations. They are not necessarily linear as Barbara (2004), found that the larger urban areas create less of the environmental problem than the small ones as to what determines is the behaviour (consumption and living pattern) of urban population and not just how large.

The impacts of urbanisation are so much that it affects land, water, air and wildlife due to the increase in number of people, increase of their demands on resources and more construction of buildings. These affect the physical environment most especially the issue of solid waste generation and management.

2.1.2 Urbanisation and waste generation

Urbanisation brings about waste generation and inappropriate handling of waste at same time causes degradation in urban environment. Waste generation is at rise all over the world. The world Bank (2019) publicised in the brief of solid waste generation that the cities of the world in the year 2016 generates 2.01 billion tons of Solid Waste at 0.74 kilograms per person per day and it is expected that the rapid increase in population and level of urbanisation will boost the generation by 70% from 2.01 billion tonnes in 2016 to about 3.40 billion tonnes in the year 2050.

Residents in developing countries particularly the upcoming ones are much more affected with the issue of waste than the developed nations. The largest percentage of waste generated are openly burnt or illegally dumped, the situation which creates serious health, safety and environmental consequences and a breeding ground for disease vectors.

2.1.3 Waste generation and management

Wastes are inevitable by – product of most human activity. They are unwanted or unusable materials that are being considered worthless, defective or discarded after primary use. Waste generation can be related to the materials that are not the market products, they are those materials of which its producer has no further use for its own drive of formation, conversion or consumption and which he required to or intends to discard. They are usually grouped according to the activities of their generation which include wastes generated from household, sewage sludge, agriculture, construction, mining and all other industrial wastes. There are two aspects of solid waste generation; the quality (sources, types and composition) and the quantity (generation rates).

The composition of Municipal Solid Waste varies within municipalities and changes significantly with time. They are sorted into six categories which include; food remnant, paper, rags, wood waste, rubber and plastics. (Hui-Zhou *et al*. 2014). The knowledge of waste generation is significant in planning, designing and operation of solid waste management system.

Waste management is the arrangements and actions required to manage waste right from its inception up to the disposal point, which include the collection, transportation, treatment, and disposal of waste in line with the guidelines of the process. Wastes in solid, liquid or gaseous

may likely be a risk to human health, with this it needs to be managed properly so as to reduce its adverse effects on human health, the environment and general global resources.

The processes of waste management practice depend on the advancement in technology among countries and regions of the world. A proper waste management process brings about a sustainable and liveable city, yet it's a challenge mostly for developing countries and cities where municipal waste is mostly generated.

Waste is of different types it could be in solid, liquid or gaseous form depending on the source, economic activity, consumption and population growth of any society. Advanced societies like United States of America do produce larger amount of solid wastes than the less developed Nations. However, waste can generally be classified into four different categories, they are;

1. Municipal solid waste which is generated from houses, shops, offices, hotels, schools, and all other institutions. They consist mainly of food wastes, paper, plastics, metals, rags, discarded bulbs, batteries, medicines, glasses and all debris from demolition, construction site.

2. Industrial Waste comprises all sorts of materials that are harmful to the environment. They consist mainly of paper, packaging materials, wastes from oils, resins, solvents, food processing, paints, sludge, glass, ceramics, metals, plastics, abrasives and several others. The generation of industrial waste varies among different countries at different stages of development.
3. Agricultural Waste are generated as a result of expanding agricultural production and residues. These include livestock wastes, the remains of agricultural crop wastes and by – products of agricultural industries.

4. Hazardous waste which results from the by – product of advance changes in agricultural production, industrial activities, trade, hospital and health – care facilities. The rate and categories of waste generated from this source differ meaningfully among countries subject to the extent and diversity of different countries industrial activity.

2.1.4 Socio – cultural factors and solid waste generation

Socio – cultural factors are some elements guided by the culture and societies like attitudes, values, beliefs, Religion, family structure, kinship structure, education and income level that influence the thought, feelings and behaviours of a person. It is all about knowing people and their background. American Psychological Association (2020) defines socio – cultural factors as the condition that brings about a physical, social and mental transformation or adaptation to an environmental condition. Every society and culture has separate characteristic that make it different from the others.

Waste, as indicated in the Directive 2008/98/EC Article 3(1) 'is any material or item that its owner has discarded, required to or intends to discard. It is an organic and inorganic used materials generated from different sources like residential, commercial, institutional and industrial activities. Solid waste generation is a persistent emergent problem at the world, both at the regional and local levels. The generation rate varies among cities and nations of the world, in the United states according to Nathanson (2020), the generation rate is approximately 2kg per person per day, Japan generates half of this amount, Canada generate more at about 2.7 kg while most of the developing countries generates at the average lower than 0.5kg per person per day. The management and disposal of wastes like landfill or incineration most at times resulted into a serious environmental impact.

Studies (Darban *et al.,* 2017; Yusof *et al*., 2002) on the issue of socio – cultural factors and solid waste generation revealed that household attitude, family size, lifestyle and the local understanding on the management of materials affect the quantity of waste in different houses.

2.2 Theoretical Framework

Waste Generation and Management Theories are founded based on the fact that proper waste management shall avert the detriment that waste caused to health of human and the general environment, condition that bring about reduction in waste generation, reuse of valuable items, as well as to save landfills and to sustain environment (Salanga, 2019). It includes all steps taken to manage waste form generation point to the final disposal either through prevention, reuse, recycling or recovery.

2.2.1 The health belief model

The Health Belief model was developed at the United States Public Health Service in the early 1950s by the Social Scientist to know the reasons behind peoples' negligence in abiding to disease prevention strategies or prompt tests for disease detection. (Rural Health Hub, 2015). The model was based on the two components of health related habit that there is always a wish for a person to circumvent sickness or get well as soon as the sickness comes and also the belief that some certain health action prevents or cure sickness. The Model can be used to guide health promotion and disease prevention programme as it tries to interpret and envisage changes of an individual in respond to some health situation.

2.2.2 Theory of urban ecology

Urban Ecology is a branch of science that studied the relationship within living organisms and their surrounding environment with the aim of achieving a balance between human culture and natural environment (Caves, 2004). It was formulated by

Robert E. Park and Ernest W. Burgess of the Department of Sociology in University of Chicago. The theory assumed that cities were just like a natural environment where some certain forces and competitions brings about the separation of urban space into different ecological places where people with similar social characters were subject to same ecological pressure. (Brown and Nina, 2002).

2.2.3 Triple bottom line concept

Triple Bottom Line is a business oriented theory formulated by the founder of a British consultancy John Elkington. His argument was on the support of the people and planet in which he stated that the companies should at least over a period of time measure their financial, social and environmental performance through three different bottom lines

(profit, people and planet) rather that concentrating solely on profit generation (Kelsey, 2020).

2.3 Global Solid Waste Generation

The World Bank (2019) report of September 2019 predicted the increase in global waste generation by 70% in the year 2050. Another report on global review of solid waste management in 2019 also stated that, years before now precisely ten years back, 2.9 billion urban residents do generates 0.64 kg of Municipal Solid Waste per person per day (0.68 billion tons per day), but today, the amount has increased where about 3 billion urban residents generates1.2 kg per person per day (1.3 billion tons per year), and it is expected that by the year 2025, with likely increase of urban residents to 4.3 billion, solid waste generation will increase to 1.42 kg/capita/day amount to 2.2 billion tons per year. That report ranked United States as the largest generator of solid waste in the world where each citizen generates an average of 808 kilograms per year.

The report also predicted future of solid waste management as an issue of universal commitment that concern every person in the world. It has it that more than 90% of wastes in the low income countries were not properly managed in an environmentally safe manner, which make it vulnerable and contaminate the world's ocean, transmit disease and affect the economic development. It further stated that waste generation is anticipated to rise due to the increase in population and economic growth in the year 2050 particularly in Sub – Saharan and North Africa, Middle East and South Asia that are major among the fast growing regions of the world.

Findings from these reports shows that the waste generation and composition at the global level depends solely on economic development, population growth, cultural norms and geographical location of a country while the waste management strategy is linked to the income level of a nation where the low income countries generate and manage less waste than the high income countries.

Pardini *et al.* (2019), having considered the increase in waste generation and management as a challenge to large urban centres of the world, suggested the use of Internet of Things (IOT) which envisages a world where physical, digital and virtual objects are unified in a network to modify the performance of solid waste management. The study reviewed analysis on the requirements of the existing literature on waste management models based on internet of Things with that of infrastructure for a wellorganized waste management in an urban setting with the focus on the interaction that exist among the agents that are responsible for waste collection and the waste generators from the viewpoint of time, costs, and citizenship promotion. It was discovered from the study that it is possible to track points of waste containers, thereby monitoring their level of usages, detect collection points with highest usage, recommends the shortest way of waste collection and the

possibility of being in line with the citizens to inspire them to disposed their waste as at times containers are emptied to reduce the problems of indiscriminate dumping of waste on the streets.

David *et al*. (2020), investigated the effects of continuous increase in trends of world's municipal solid waste generation, in the analysis, a global dataset of generated waste for 217 countries and regions were collated aside their management, the evaluation shows that there is going to be a continuous increase in waste production with land filling as the only prior method of disposing. Thus, pollution from waste will increase and many of the valuable and recyclable wastes will gradually vanish from the global economy. As such there is a need to implement policies that will reduce waste generation and probably increase the share of the treated waste sustain ably.

Zhnag (2020), examined how well countries managed waste generated with the two indices created by Verisk Maplecroft on Today's World waste statistics by country in Act environ noted that the highly developed Europeans and North America countries produced a reasonably high amount of waste with the highest risk at Australia, Canada, Germany, Austria, France, Netherlands, United States of America and Switzerland. It was discovered that United States produces more waste than all other countries on the list and lags behind all others as it recycles only few of the waste generated.

2.4 Solid Waste Generation in Developed Nations

Trang *et al*. (2017) uses ordinary least square to study the effects of socio – economic factors on household solid waste generation and composition in Vietnam. He stratified some selected households to be investigated based on income to determine the factors that influence household solid waste generation and composition. It was discovered in the findings that the average waste generation in the city was 0.76 kg/household/day and

comprised of six categories of wastes but the largest component in organic waste that is up to 67%. The study emphasis on income as the basis for investigation even when discoveries shows that it is insignificant on waste generation rather than looking at the role of householders daily activities and other variables like household size that are expectedly positively related with household waste generation.

Hilles (2011), studied the society and household behaviour, culture and attitudes of people towards solid waste management in order to mitigate the environmental problems that are related to global solid waste generation. The study focuses on the role of cultures and behaviours of people which is believed to control their attitudes towards solid waste management process. In relating these to developed countries, Hilles found out that the usage of any solid waste management programme like recycling scheme is always influenced by demographic factors (age, education, income and household size) and attitudinal change of the site usage. In the findings, it was suggested that householders most especially the older people are willing to participate in solid waste management programme (recycling) than the younger households while the reasons were given as due to specific and individual information on the effects of solid waste management, method used and the billing system. Three municipalities that were used as a case study in Sweden discovered a number of contradicting strength and weakness of waste – based billing system which makes it difficult to conclude that the waste billed collection system can actually reduce waste generation.

Most of the Europeans countries adopted the use of separate waste collection system as a policy to control waste generation. Agovino *et al.* (2019) investigated this policy on how it has affected the municipal solid waste generation in the study of the effects of neighbour influence and cultural consumption on separate waste collection system.

Focusing of twin events, Agovino first on the theoretical framework outline the essential things that motivate the pro – environmental behaviours of people towards separate waste collection and then testing the results by implementing a quartile regression on Italian municipal data for 2012. The findings show that cultural policy could possibly play an important role in addressing the issue of environmental sanitation. Separate waste collection system is only achievable and could be successful in the developed nations and not like developing nation's most especially African nations.

2.5 Solid Waste Generation in Developing Nations

Okot-Okumu (2012), studied the trends of solid waste management in East African countries of Kenya, Tanzania and Uganda as they were managed from the source up to the final disposal. The study showed that waste management at the past have been a central control system monopolized by the urban authorities before it is then moved to the mixture of both public and private service providers in different urban communities. It further stated that waste management is a very good indicator in the performance of a municipality. It was stated in the study that residential areas are the major source of waste generation in these countries on the average of between 0.26 – 0.78 kg/cap/day for low and high income earners respectively. This translate that the low income urban centres in the developing countries of the world tend to generate lower volume of waste than the higher income urban centres. The total waste generation was tied to the countries national GDP per capita that the developing countries like countries in Africa and Asia generates less waste (less than 1.0 kg/cap/day) than the developed economic countries that is more than 1.5 kg/cap/day.

An overview of different literature approaches on the issue of waste management were studied by Mihai (2012) in Geography of waste as a new approach in waste management. Mihai uses two procedural tools concerning waste management assessment studies enlisted in the scientific specific literature i.e. the Life Cycle Assessment studies which is concerned with the environmental engineering approach and the Cost Benefit Analysis studies that is concerned with the comparing and modelling the cost for various waste

management options for an effective management of public and private expenditure. The studies were analysed from a systemic perspective with other assessment tools used in waste management like Management Information System (MIS), Strategic Environmental Assessment (SEA), and Environmental Impact Assessment (EIA) among others to compare their relative distribution between the groups of models and tools for system analysis. It was concluded that geography as a science of the interface between natural and social systems may contribute to the improvement of waste management systems considering the natural, socio – economic and demographic features of the territory concerned.

The report on the International Seminar organized by the Council of Scientific and Industrial Research – National Environmental Engineering Research Institute and Royal Safety by Kumar *et al*. (2017) on the challenges, barriers and opportunities associated with improving waste management in South Asian Association for Regional Cooperation (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka and Afghanistan) focus on the diversion from waste dump to waste management system that will retain useful resources within the economy, using waste segregation at source and a specialized waste processing facilities to separate recyclable materials.

Yiougo *et al.* (2013) uses Geographical Information System (GIS) to evaluate the waste generation of two cities in Burkina Faso with focus on some selected variables like urban fabric, grey water outlets and household garbage dump sites. Findings show that the most dominant urban fabric is low standard of living characterized by the existence of open spaces. While the solid waste dump site dominates the density of grey water discharge points.

Rapid urbanisation and economic growth in developing countries increase the amount of solid waste generation, while inadequate financial resources and deficiency of data on the amount and its composition make it difficult for the regulatory bodies in preparing a proper planning management system. Ilyas *et al*. (2017) in his study collect information on the average waste generation rate of four groups of residential areas in Gujranwala city of Pakistan for record and discover that the generation rate ranges of between 0.33kg per capita per day for low income areas to 0.46 kg for high income areas, while the composition is of 15 categories of waste products with kitchen waste as the largest components of between 43 – 68%.

Apart from solid waste generation, the behavioural attitude of household on solid waste management is another serious factor that influence solid waste in developing countries, Wegedie (2018) examines these factors in Bahir Dar city. Stratifying the city into core, outer and the middle zones, it was discovered that households do not enjoy sufficient solid waste management services. Though, the per capita waste generation was 0.22kg/person/day in all zones with the highest generation in the core zone due to the household waste sorting that is more intensive in outer zone than the other zones.

The failing services on urban waste management in developing countries was traced to the lack of resources, infrastructures, awareness and institutional strength by Breukelman *et al*. (2019). Though, these were addressed as the signs, indications, and facts that can be observed, measured or calculated from the review of the past literatures on the factors that restrain Centres for Disease Control (CDC) from offering all of their citizens, companies and institutions access to good solid waste management services.

The increase in the amount of solid waste generation in most of the developing countries was traced to the lack of arrangement and resources to establish an active waste

mangement plan. Mohammad *et al.* (2020) considered socioeconomic factors as the key factors in behavioural studies with focus on household, it was discovered that family size, monthly income, educational level, gender and the age of household head are the best predictor of solid waste generation and composition trends in Syrian cities.

2.6 Factors Influencing Solid Waste Generation

The quantity and rate of solid waste generation are influenced by different factors. The quantity generation are influenced by geographical location, season of the year, collection frequency, use of kitchen waste grinders, characteristics of populace, extent of salvaging and recycling, public attitudes, and legislation. While the rate of generation is influenced by source reduction, reuse and recycling.

A Study carried out in China by Liu *et al.* (2011) listed twelve items (GDP, per capita GDP, urban population, the proportion of urban population, the area of urban construction, the area of paved roads, the area of urban gardens and green areas, the number of the large cities, annual per capita disposable income of urban households, annual per capita consumption expenditure of urban households, total energy consumption and annual per capita consumption for households) to investigate the factors that influence solid waste generation with two methodologies (Principal Components Analysis and Cluster Analysis) from multiple statistical analysis on three components which accounted for 99.1% of the initial variance. The result indicated that economy and urban development are important items influencing Municipal Solid Waste generation.

Solid waste characterization study done by Senzige *et al.* (2014) in three municipalities of Dar-es-Salam showed that solid waste generation and composition is highly dependent on population and socio – economic status of the population. It was revealed from the study that solid waste generation and composition can best be calculated when the population and the weighted average socio economic status of a city is known, indicating that peoples' socioeconomic status (education, income and occupation) is a determining factor for solid waste generation rates and composition. The multiple regression technique used found it that there is a positive correlation between solid waste generation, GDP and population growth, meaning that once population ad GDP is known, the amount of solid waste can be computed without stress.

The study carried out by Herianto *et al*. (2019) uses linear regression to analyse the factors that affect household waste generation in Palangka Raya City. The factors identified are the income, concern for the environment, household size, and level of education, recycling knowledge and installed electric power. It was the discovered that a total of 0.33 kg of solid waste were generated per person per day in the city, while the substantial factors that affects the generation among the identified ones are the income, concern for the environment and the household size at 95% and 99% confidence level respectively. The study therefore recommends a plan to control waste generation from the settlements by socialization activities through media or by improving on the organization of garbage banks formed by Palagka Raya City Environmental Agency (PRCEA).

2.7 Summary of Literature Review

The review covered issues on how Urbanisation and Socio – Cultural factors relate to Municipal Solid Waste Generation and Management in cities of the world. Several literatures on waste generation and management strategies as well as the socio – cultural factors that influence Solid waste were explored in conjunction with the theories evolved

to explain their concept. It was noted from the review that the issues of waste generation are diverse in different regions of the world, due to the variances in local conditions like climate, standard of living, technology, customs and culture (Darban and Hajilo, 2017). Trang *et al.* (2017) and Herianto *et al.* (2019) identified economic condition as the major influencing factor while Hilles (2011), Senzige *et al.* (2014) and

Mohammed *et al.* (2020) recognizes GDP and population of the country. Others like Yusof *et al*. (2002), Darban *et al*. (2017), Wegedie (2018) and Agovino *et al.* (2019) relate the issues to the behavioural attitude of the people.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

This chapter explains the research methodology adopted in achieving the objectives of the study. It is structured on how the research has been treated with justification at every stage. These stages are outlined in the research design. This study uses a sampling procedure that is quantified to gather knowledge. The study focuses on studying situation in the research area in order to explain the relationship between the variables. Both the qualitative and the quantitative data collected through the use of questionnaire were analyzed while conclusion and recommendations was made from the result of findings.

3.1 Research Design

Research design is an outline that a researcher uses to derive solutions to an identified problem and guide through all stages of the research work (Uloko, 2016). This study is aimed at investigating the relationship between socio cultural factors and domestic solid waste generation in Bida which was achieved through the data collected from the field, analyzed and made inferences in order to make recommendations for a sustainable environment.

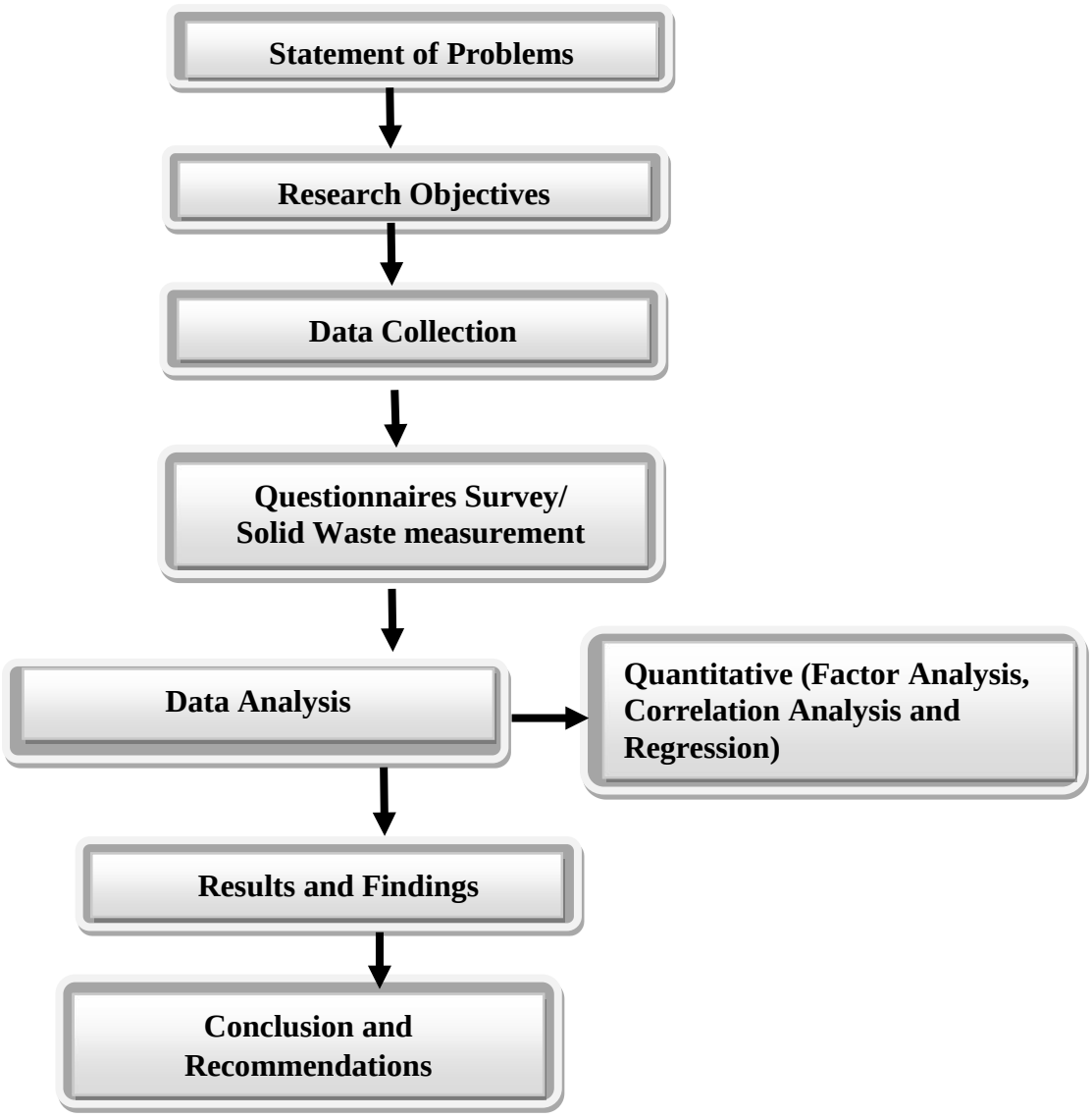


Figure 3.1: Research Design flowchart

3.2 Population of the Study

There are fourteen (14) administrative wards in Bida (figure 3.2), targeted population of the study was the total number of households form the selected eight out of these fourteen wards (figure 3.3). Since the 2006 population census figure is not available at the ward level, the study uses an average population figure by first projecting the 2006 population figure at 2.47% growth rate (exponential model) to year 2021 and then dividing the result with the total number of wards in Bida to acquire the targeted population for the study.

The 2006 population figure = 188,181

Formula for geometric projection method is pt = po $\left(\frac{1+r}{100}\right)^{t}$

Where pt = population at a time

Po = Initial population t = Time

r = Rate of population growth

To Substitute into formula = pt = po $\left(\frac{1+r}{100}\right)^{15}$

po =188,181 t = 2021 – 2006 = 15 r = 2.47%

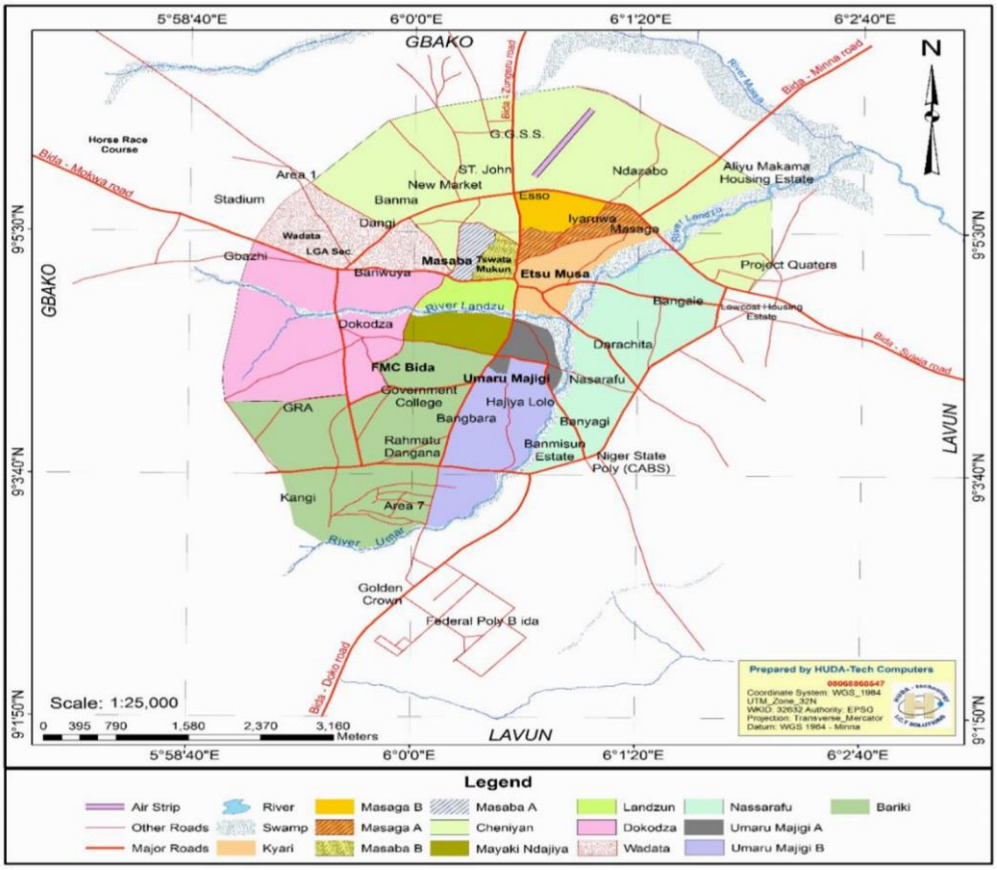


Figure 3.2: Administrative wards in Bida Local Government

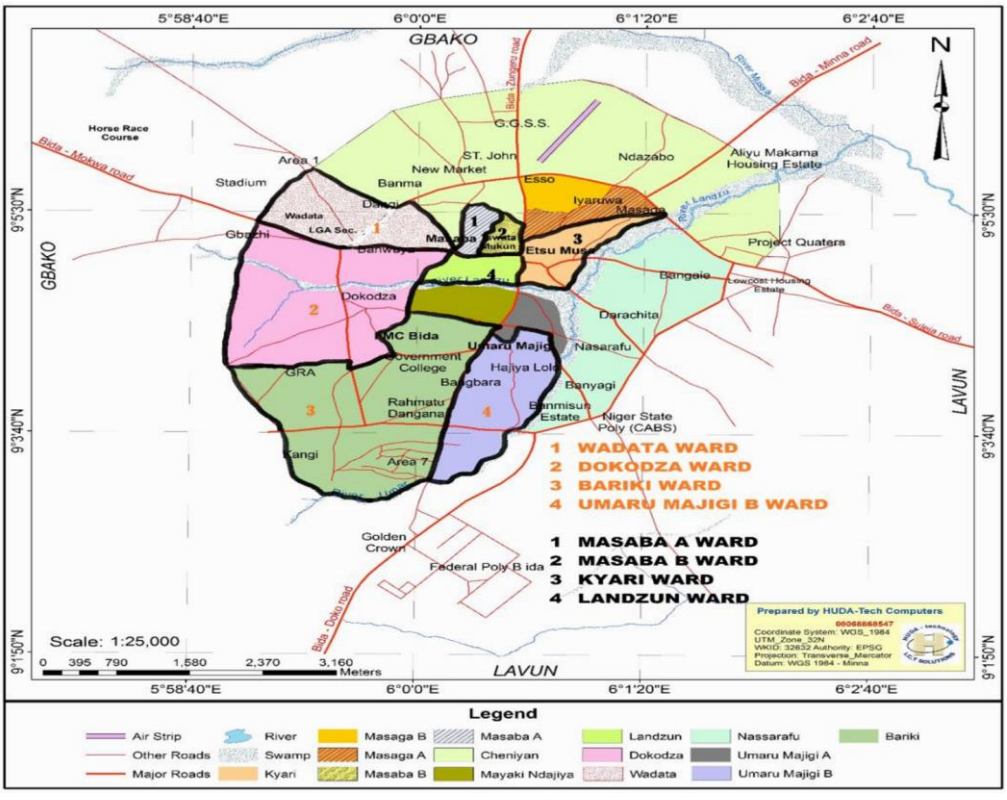


Figure 3.3: Eight Selected wards

3.3 Sample Frame

The study uses a random number selection to pick four (4) each from both the traditional core and modern areas in Bida Local Government. Total number of households from the selected wards forms the sample frame where respondents were drawn to obtain required data for investigation. The 2021 average population figure for each ward was divided by 6 which is the estimated number of person that is expected to live per household this gives the estimated households in the study area. The sample frame for the study is 25,840 from both the selected wards in Bida.

3.4 Sample Size and Sample Techniques

3.4.1 Sample size

The sample size for the study is determined using Taro Yemane Formula as enlighten by Agrasuta (2013) with 95% confidence level and the total number of household as 30,

496. Where; n =

N / (1+Ne^2)

Where N = Population of study

1 = Constant

e = percentage of error expected

n = sample size

Substituting into the formula which is n = N/(1+Ne^2) = 400

3.4.2 Sampling technique

Multistage sampling method was adopted for the process of administering the questionnaire for this study. It is the sampling method where sample is drawn from a population using smaller and smaller groups (units) at each stage. It is used to collect data from a large group of people. The first stage in this sampling method, eight wards that

consist of four each from both traditional core and new emerging wards were selected as the Primary Sampling Unit, then five areas named *'efu'* within these wards were selected as the Secondary Sampling Unit, while the final stage make the selection of houses of which questionnaires are to be administered together with the weight measurement.

3.5 Methods of Data Collection

The data used for this study were obtained through the administration of a structured questionnaire and the record of solid waste weight measured at the site with the measuring scale.

3.6 Instrument of Data Collection

A set of well – structured questionnaire that covers the socio – economic characteristics of the residents, household size, educational attainment, income level, residential area types, and the distance to the permitted dump site was administered to all wards selected for interview. It was prepared using a closed – ended type of questions administered through the use of Open Data Kit (ODK).

Twelve (12) socio cultural factors that are related to solid waste generation were identified for measurement. These include Economic status, Value, Awareness, Public cooperation, Urbanisation, Geographical location, lifestyle, Perception, Norms, Beliefs, Practices and religion. They were separately measured from the response of the investigated households with different items using a five point Likert scale that ranges from one (1) as strongly disagree to five (5) as Strongly agree. (Appendix A).

This was alongside with a 50kg measuring scale (Plate 1) used in measuring the waste collected for the investigated houses.

Plate 1: 50kg measuring scale

3.7 Method of Data Analysis

Data collected for this study were analysed using statistical methods that include descriptive and inferential statistical method. It was prepared using a closed – ended type of questions administered through the use of Open Data Kit (ODK).

The descriptive methods (frequency, percentage and mean score) were used in analyzing the socio – economic characteristics of the residents, household size, income level and the distance to the permitted dump site. The inferential statistics on the other hand adopted include factor analysis, correlation analysis and regression analysis.They were separately measured from the respond of the investigated households with different items using a five point Likert scale that ranges from one (1) as strongly disagree to five (5) as Strongly agree. (Appendix A).

3.7.1 Exploratory factor analysis

This is a method of building a factor structure by bringing together interrelated underlying variables using an inductive approach. It is mostly used to reduce data by extracting a

minor number of uncorrelated variables from the major correlated variables and identifying those that converge or measure the same factor. This method was chosen as it has been frequently used in explaining a large number of variables (items) with a small number of underlying factors.

To start with this process, Kaiser-Meyer Olkin (KMO) and Bartlett's Test of Sphericity was first of all measured in order to determine the sample adequacy of each item, their strength of relationships and the significant level required in performing further analysis with the factors (the appropriateness of data for EFA). The KMO returns values of between 0 to 1 (Hair *et al.* 2012) which was assessed based on the recommended acceptable value by Tabachnick and Fidell (2012), that it must have a minimum value of 0.5 to indicate the sample is adequate and that the bartlett's test of sphericity is significant at ($p<0.005$).

Factor extraction, which according to Field, (2013) is the process of discovering potential factors within the data and deciding on numbers to maintain begins. In this process, variables that have a significant impact on the factors are identified, maintained and then proceed with exploratory factor analysis using likelihood extraction and promax rotation methods. Factors with the Eigenvalues ≥1 are retained while those with eigenvalue <1 were ignored.

3.7.2 Correlation analysis

Correlation analysis is a statistical technique that determines the strength of a relationship between two quantitative variables which could ether be positive, negative, or have no relationship (Hair *et al*. 2011). The correlation coefficient is between +1 and -1. Where +1 is an ideal positive relationship, 0 signifies no relationship, while -1 is an ideal negative relationship. The relationship between socio cultural factors and solid waste generation in Bida was investigated with the use of correlation analysis.

Spearman correlation analysis was used in determining strength or meaningfulness and either positive or negative direction that was met.The most accepted view about Spearman coefficient is when rho = 0.10 is small, that is, it accounts for 1% of the total variance, rho = 0.30 as medium, accounts for 9% of the total variance and rho = 0.50 as large, accounts for 25% of the variance (Field, 2000). Table 4 shows the Correlation Coefficients (rho) interpretation used in this study.

Table 3.1:Spearman correlation coefficients interpretation

Spearman rho	**Correlation strength**
0.50- above	Large
0.30-0.49	Moderate
0.10-0.29	Small
0.00-0.09	No or Negligible

Note: This description applied to both positive and negative association.

3.7.3 Regression analysis

Regression analysis is a form of inferential statistics that estimates the relationship between one dependent variable and one or more independent variables. It allows the estimate of how a dependent variable changes as the independent variables changes. The p – values decide if there is relationship between an observed sample and the entire population. It considers the effect of more than one independent variable on some outcome of interest.

3.8 Method of Data Presentation

Data collected were presented with the aid of statistical method that that involves the use of tables and charts, in order to present accurate information and easy explanation about the facts of the figures.

3.9 Summary of Data Requirements, Sources and Analysis

A summary of data required for this study, their sources and methods of analysis in relation to the objectives were itemized in table 3.2.

Table 3.2: Summary of data requirements, sources and analysis

	Objectives	Data Type	Sampling Method	Method Of Data Collection	Method Of Data Analysis
1	To identify socio cultural factors that are related to waste generation in Bida	Quantitative (Primary data)	Multi stage Random sampling	Close-ended questionnaires administered to the selected wards	Factor analysis (Exploratory Factor Analysis)
2	To analyze the rate, composition and expected future generation of waste among the households in Bida.	Quantitative (primary data)	Multi stage Random sampling	Measurement of solid waste weight collected daily for three (3) days.	Descriptive Statistics
3	To examine the relationship between socio cultural factors and solid waste generation in Bida.	Quantitative (primary data)	Multi stage Random sampling	Close-ended questionnaires administered to the selected wards	Correlation analysis (spearman's correlation)

4	To examine the effects size of socio cultural factors on household waste generation in Bida.	Quantitative (Primary data)	Multi stage Random sampling	Close-ended questionnaires administered to the selected wards	Multiple Regression analysis

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socioeconomic Characteristics of the Responding Households

A total of 400 sample size was taken from the study area to collect information based on personal and socio – cultural background. The analysis depicted in table 4.1 has it that the gender distribution of the household head was 63.6% (255) males and 146 (36.4%) women. Regarding the age of the household head, 170 (42.4%) participants aged between 36 and 45 years, while 90 (22.4%) were between 26 and 35 years, 52 (13.0%) were between 46 and 55 years, less than 10% were not up to 25 years and the remaining 13.5% were above 55 years old. Concerning the family size, 60 (15%) households consisted of 2 – 4 people, 168 (41.9%) consisted of 5 – 7 people, the remaining 228 (43.1%) households included more than 8 people. Educational level of the household head has it that 175 (43.6%) obtained a secondary school certificate, 147 (36.7%) attain a tertiary education, 48 (12%) only had a primary school leaving certificate and the remaining 31 (7.7%) had no educational background. The household monthly income from the table also depicted that 19.7% (79) household earned less than ₦20,000, 27.7% (111) earned between ₦20,000 and ₦40,000, while 36.4% (146) earned between ₦40 and ₦80,000 and the remaining 16.2% (65) earned more than ₦80,000. On the period of stay in the area, 35 (8.7%) respondents reside in the area less than 3 years, 124 (30.9%) between 4 and 8 years,

125 (31.2%) were between 9 and 13 years, while 56 (14%) were between 14 and 18 years and the remaining 61 (15.2%) have stayed in the study area for more than 18 years. Regarding to the distance to permitted dumpsite, 190 (47.4%) respondents stroll more than 200 meters to dispose their waste at the approved dumpsite, while only 46 (11.5%) are closed to 50 meters and the remaining 165 (41.1%) move between 50 - 100 meters to evacuate their used materials.

Table 4.1: Socio-economic characteristics of the responding households.

Variables	Frequency	(%)	Variables	Frequency	(%)
Gender of the household head			Average Monthly Income less than N20,001		
	255	63.6		79	19.7
Male					
Female	146	36.4	₦20,001-₦40,000	111	27.7
Age			₦40,000 - ₦80,000	146	36.4
< 18	2	0.5			
18 – 25	33	8.2	Above ₦80,000	65	16.2
26 – 35	90	22.4	Duration of stay in the area		
			Less than 3 years	35	8.7
36 – 45	170	42.4	4-8 years	124	30.9
46 -55	52	13.0	9-13 years	125	31.2
Above 55	54	13.5	14-18 years	56	14.0
Average Household Size			Above 18 years	61	15.2
2 – 4	60	15.0			
5 – 7	168	41.9	Distance to the permitted Dump site less than 50 meters	46	11.5
8 – 10	119	29.7	Between 50 to 100 meters	165	41.1
11 – 13	33	8.2	over 200 meters	190	47.4

14+	21	5.2
Education level		
None	31	7.7
Primary	48	12.0
Secondary	175	43.6
Tertiary	147	36.7

4.2 Social and Cultural Factors Influencing Solid Waste Generation in Bida 4.2.1 KMO and Bartlett's test for social and cultural factor influencing waste generation

Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were first conducted to verify the sampling adequacy and the significant level required for the EFA. The result on table 4.2A and 4.2B shows that KMO value of 0.843 were set for social and Cultural factors at 0.843 and 0.773 respectively, both above the minimum acceptable value of

0.50 (Tabachnick and Fidell, 2014). Bartlett's test on the other hand was significant at p = 0.000 for both factors which also confirmed that sampling is adequate and can be considered for further analysis.

Table 4.2 KMO and Bartlett's test for social factor influencing waste generation

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.843
Bartlett's Test of Sphericity	Approx. Chi-Square	3162.916
df		120
	Sig.	0.000

Table 4.3 KMO and Bartlett's test for cultural factor influencing waste generation		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.773
Bartlett's Test of Sphericity	Approx. Chi-Square	1883.130
	df	78
	Sig.	0.000

4.2.2 Social factors that influence solid waste generation

Table 4.4 shows that four (4) factors were extracted that had eigenvalue > 1 for social factor that influence waste generation after the eliminating five items (My purchase decisions contribute to the amount of waste generated in my house, Income determine the type and rate of waste generation, Value attached to a waste determine the manner in which its being generated and managed, Public enlightenment programmes controls the volume of waste generation and Size of the family determines the rate of waste generation)for having loadings < 0.3 and for double cross loading on other factors. The process was re-run repeatedly after eliminating each item.

The first extracted factor had eigenvalue of 6.101, seven (7) items with loadings from 0.769 to 0.706 and accounted for 38.129% of the variance. The second factor had eigenvalue of 2.375, four (4) items with loadings from 0.762 to 0.647 and accounted for 14.842% of the variance. The Eigen value for the third factor is 1.184, three (3) items with loadings from 0.747 to 0.709 and accounted for 7.397% of the variance. Finally, the fourth factor had eigenvalue of 1.004, two (2) items with factor loading of 0.837 and 0.722, accounted for 6.274% of the variance. The factors all combined together contributed (66.643%) above the 50% acceptable threshold for cumulative variance

(Hair *et al.*, 2012). The factors are therefore labelled; Urbanisation, Geographical Location, Awareness, and Economic Status as factor 1, 2, 3 and factor 4 respectively.

Table 4.4: Rotated component matrix for social factor influencing waste generation

	Factor			
Indicators	1	2	3	4
Urbanisation is a rival to healthy environment	0.769			
in term of waste generation				
The more people urbanize the more waste they	0.764			
Generate				
Distance to the municipal permitted dump site	0.754			
determine the rate of waste generation Awareness campaign on radio and television controls the rate of waste generation than that	0.750			
social media only				
Household participation in community development	0.729			
activities influence the amount of waste generation				
A waste today might be a future treasure	0.727			
My expenditures on groceries contribute to the	0.706			
amount of waste generated in my household				
As the city increase in size, changes occur that influence waste generation		0.762		
Change in seasons influence waste generation		0.731		
Public cooperation with government on the issue				

of waste management influence the rate of waste generation	0.680			
More wastes are generated during dry season than the rainy season		0.647		
Limited time of sweeping has effect on amount of waste generation			0.747	
Waste recycling minimize waste generation			0.737	
Educated people generate less waste			0.709	
Family that dine out generate less wastes than the ones that cook at home				0.837
The aged abide to the rules of waste management than the young ones				0.722
Eigenvalue	**6.101**	**2.375**	**1.184**	**1.004**
% of Variance	**38.129**	**14.842**	**7.397**	**6.274**
Cumulative Variance	**38.129**	**52.971**	**60.369**	**66.643**

4.2.3 Cultural factors that influence solid waste generation

Table 4.4 shows that three (3) factors were extracted that had eigenvalue > 1 for cultural factor that influence waste generation and management after eliminating six items (I do prefer dinning out with my family to reduce the rate of waste generated in my household, The volume of waste generated when I buy food do less than when I cook at home, I do keep some of my used properties to minimize waste generation, Believing in the norms of "no night sweeping" minimize the volume of waste generation, Waste separation from the source before disposal minimize its generation and Indiscriminate dumping of refuse controls waste management) for having loadings < 0.3 and for double cross loading on other factors. The process was re-run repeatedly after eliminating each item.

The first extracted factor had eigenvalue of 4.485, five (5) items with loadings from 0.788 to 0.634 and accounted for 34.497% of the variance. The second factor had eigen value of 1.850, four (4) items with loadings from 0.810 to 0.647 and accounted for 14.228% of the

variance. Lastly, the third factor had Eigenvalue of 1.184, four (4) items with loadings from 0.807 to 0.565 and accounted for 9.404% of the variance. The factors all together contributed (58.129%) above 50% acceptable threshold for cumulative variance (Hair *et al.*, 2012). Therefore, the factors are then labelled; Practice, Beliefs, and Religion as factor 1, 2 and 3 respectively.

Table 4.5: Rotated component matrix for cultural factor influencing waste generation

	Factor		
Indicators	1	2	3
Sweeping only at some specific periods reduces the rate of waste generation	0.788		
I do separate waste generated from my household so as to manage the rate of waste generation	0.749		
All religion preach cleanliness, yet we need to minimize the volume of waste generation	0.703		
I sweep homes during the day times only, to reduce the volume of waste generated in my house	0.699		
Culture provides the context within which human activities takes place that include management of wastes	0.634		
What you "see" or "feel" is a dirt determine the way you manage it		0.810	
The way people manage their waste depend mostly on what their culture classify as a dirt		0.786	
Waste is a dirt, so sweeping always generate more waste		0.706	

The much more time used in cleaning the more waste generated		0.647	
Though cleanliness is next to Godliness, but to minimize the volume of waste generation, one need to sweep less			0.807
No religion support waste of materials, to abide by this one should always keep aside used materials to control the volume of waste generation			0.733
Waste separation before disposal minimize waste generation			0.569
Waste generated each time I buy processed(sachet) food stuff do less than when I buy to processed at home			0.565
Eigenvalue	**4.485**	**1.850**	**1.223**
% of Variance	**34.497**	**14.228**	**9.404**
Cumulative Variance	**34.497**	**48.725**	**58.129**

Table 4.5 shows the reliability test for both social and cultural factors influencing waste generation and management. The Cronbach's alpha was used to provide a reliability estimate/test to the items of corresponding factors. The degree of reliability was considered to be acceptable when Cronbach's alpha value is > 0.70 (Field, 2000). From the table, it could be noted that all factors had Cronbach's alpha values above the acceptable threshold, suggesting that the items measure it corresponding factors perfectly.

Table 4.6: Reliability test (Cronbach's Alpha) for the extracted factors

Social Factors Influencing waste generation	**Cronbach's Alpha**	**Remarks**
Factor 1	0.894	Acceptable
Factor 2	0.757	Acceptable
Factor 3	0.719	Acceptable

Factor 4	0.791	Acceptable

Cultural factors influencing waste generation	**Cronbach's Alpha**	**Remarks**
Factor 1	0.798	Acceptable
Factor 2	0.782	Acceptable
Factor 3	0.715	Acceptable

The social factors reviewed in the literature that mostly influence solid waste generation in the study area include the economic condition of the residents, value attached to waste, public enlightenment / awareness campaign on waste management, public cooperation, urbanisation and geographical factors. Findings from the respondents revealed that the value attached to waste by the residents is the strong and effective social factor that influences solid waste generation in the study area followed by the geographical location and the public cooperation. Cultural factors on the other hand reviewed include the lifestyle of the people, people's perception on the issue of waste, their norms, beliefs, practices and religion. The study revealed that the lifestyle of people is the strongest and most effective cultural factor that influences solid waste in the study area before people's perception and their norms.

The result of KMO and Bartlett's Test that was first conducted for both factors confirmed that the sampling is adequate and can be considered for further analysis. Four Social factors (Urbanisation, Geographical Location, Awareness and Economic status) and three Cultural Factors (Practice, Beliefs, and Religion) that were finally extracted after several reruns were all in line with the previous studies.

Factor extraction (principal component) method was further adopted in order to reduce the multidimensional datasets while varimax rotation method was used to extract and retain factors with eigenvalue ≥ 1 and ignore factors with eigenvalue < 1. Four factors from the list of items on social factors were finally extracted with different eigenvalues, different loading items and variances after several reruns. These factors combined together contributed to 66.643 which is above 50% acceptable threshold for cumulative variance. The factors were then labelled as Urbanisation, Geographical, Awareness, and Economic for factors 1, 2, 3 and factor 4 respectively for social factors that influence solid waste in the study area. While repeating same on culture, three factors with different eigenvalues, different loading items and variances were extracted from among the items listed after several reruns of the process. These factors all together again contributed to 58.129% which is above 50% of acceptable threshold for cumulative variance and were labelled as Practice, Beliefs, and Religion as factor 1,2 and 3 respectively for cultural factors that influence solid waste generation and management in the study area.

Studies reviewed on Urbanisation according to the prediction by the United Nations Department of Economics and Social Affairs (2014) has it that more than half of the people of the world shall live in urban areas. Similarly, the World Bank (2019) brief on Solid Waste Management further concluded that the rapid increase in population and urbanisation shall increase the annual waste generated by cities of the world from 2.01 billion tons in 2016 to 3.40 billion tons in the year 2050.

On Geographical Location, Natanson (2020) revealed that solid waste generation varies among the cities and Nations of the world, the generation rate of different Nations varies gradually according to the level of their development, the developed Nations like United States generate 2kg per person per day, Japan generate half of that, while Canada generate

2.7kg and most of the developing countries generates at the average little above 0.5kg per person per day.

Hilles (2011) on the awareness of people towards waste mangement focuses on the role of Culture and behaviours which is believed to control their attitudes towards solid waste management process. Relating these to developed countries, Hilles found out that the usage of ay solid waste management programme like recycling schemes is always influenced by demographic factors and attitudinal change of the site usage with the reason given as due to the specific and individual information on the effects of solid waste mangement and the billing system.

Socio Economic status (education, income and occupation) of the population is a determining factor for solid waste generation rates and composition, as this was revealed in the study by Senziege *et al*. (2014) in the municipalities of Dar-es-salam that the solid waste generation and composition can best be calculated when the population and the weighted average socio economic status of a city is known.

The degree of reliability was tested to check the acceptability of the items of corresponding factors using Cronbach's Alpha value (> 0.70) and this is noted from table 4.6 that all factors had Cronbach's alpha values above the acceptable threshold of greater than 0.7 indicating that the items measure their corresponding factors perfectly.

4.3 The Rate, Composition and Trend of Waste Generation among Households in Bida.

4.3.1 Average daily generation rate and composition

Samples of waste generations were taken in 401 households from different wards in Bida, a total of 1,085kg of solid wastes generated was recorded and the average for each ward

was calculated in table 4.7 as depicted in figure 3. The per capita waste generation is then calculated by dividing the total waste generated with the number of people living in that same household for that day. (Dangi *et al*., 2011).The result of this calculation indicated that 0.46 kg/person/day was generated for the study area, which is in line with the study carry out by Ogwueleka in 2009 on solid waste Management in Nigeria that

0.48kg was observed in Makurdi, 0.44kg in Nsuka, 0.51kg in Ibadan and 0.56kg in Kano. The literature on daily waste generation studies for some cities in the developing world has it that East African countries of Kenya, Tanzania and Uganda generates between 0.26 – 0.78 kg /per/day (Okot-Okunu, 2012), Vietnam generates 0.76 kg/per/day (Trang *et al*., 2017), Pakistan generates between 0.33 and 0.46 kg/per/day for low and high income respectively (Ilyas *et al*., 2017), Bahir Dar City generates

0.22kg/per/day (Wegedie, 2018) while that of the United State has 2 kg/per/day and Canada is above 2.7 kg/per/day (Nathanson, 2020).

The highest solid waste generation rate was observed within the core areas (Umaru Majigi 'A' and 'B') with average household size of 5 and 6 respectively while the highest average household size was in Cheniyan and Kyari wards with 0.34 and 0.39 generation rate, this indicated that number of person does not really determine the rate of waste generation and that the people in the modern areas uses more of the processed food materials than those in the core areas thereby produced less of the food waste but more of other waste products.

Table 4.7: Average daily generation rate and composition

Wards Setting	**Waste Components (%)**				**Averag e**	**Average**	**Average**
	Food	**Polythene**	**paper**	**Others**		**Total**	**Generati**

			/ cellophane		(ash/sand)	household size (person)	weight (kg)	on rate (kg)
Bariki	MA	50	20	15	15	5.0	2.2	0.44
Cheniyan	MA	40	25	15	20	7.0	2.4	0.34
Kyari	MA	45	20	15	20	7.0	2.7	0.39
Wadata	MA	40	20	25	15	5.0	2.6	0.52
Masaba 'A'	TCA	55	10	10	25	6.0	2.7	0.45
Masaba 'B'	TCA	60	10	10	20	6.0	2.9	0.48
Umaru Majigi A'	TCA	65	10	10	15	5.0	2.8	0.56
Umaru Majigi 'B'	TCA	60	10	10	20	6.0	3.3	0.55
Grand Total		**415**	**125**	**110**	**150**	**47**	**21.6**	**3.73**

Note: (MA) Modern Areas, (TCA) Traditional Core Areas.

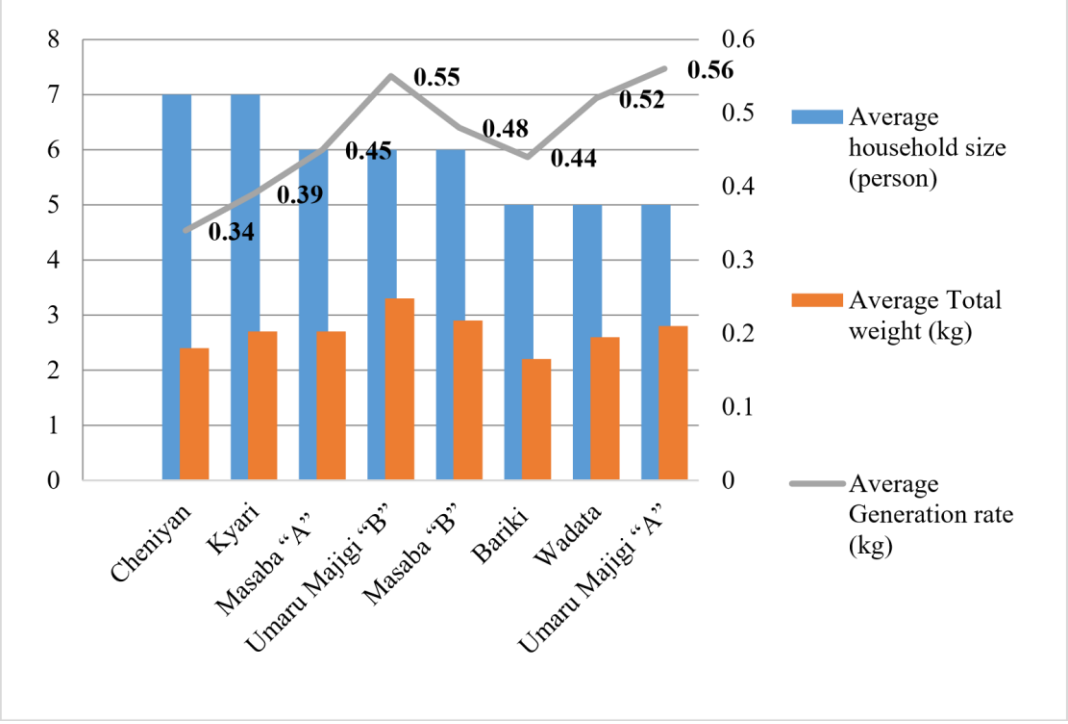


Figure 4.1: The sum of Average Solid waste generation

Plate II: Sorting of solid waste collected

Plate III: Weighing of solid waste collected

Plate IV: Evacuation of solid waste collected

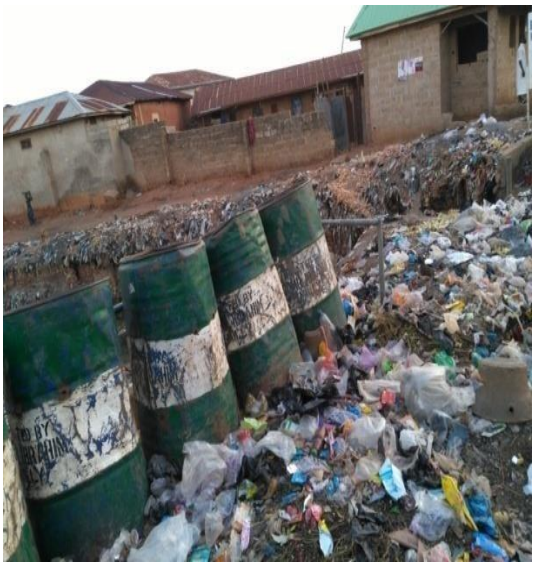


Plate V: Government Approved Dumpsite

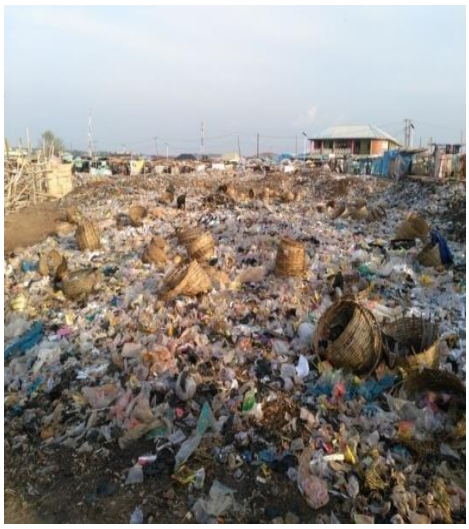


Plate VI: Open Dumping

Plate VII: Open Dumping near public primary School

4.3.2 The trend of solid waste generation in Bida

The trend of waste generated in Bida was further predicted based on the information collected from the analysis in order to plan for its management. The Average daily generation rate calculated from the analysis was 0.46kg/person/day while the projected total population of Bida is 320,212 with the growth rate of 2.47%, the rate of increase in domestic solid waste generation is 1.87%. The future waste generation is therefore calculated by multiplying the Average Generation rate by the total population and then divide by 1,000 as shown on table 4.8

Table 4.8: Future trend of solid waste generation in Bida.

Year	Population	Generation rate	Total waste generated/day (Metric Ton)	Total waste generated/year (Million Ton)
2020	320,212	0.47	150.49	0.55
2021	332,604	0.48	159.60	0.58
2022	345,475	0.49	169.23	0.61

2023	358,844	0.51	183.01	0.66
2024	372,731	0.52	193.82	0.70
2025	387,155	0.54	209.06	0.76
2026	402,137	0.56	225.19	0.82
2027	417,700	0.58	242.26	0.88
2028	433,865	0.60	260.32	0.95
2029	450,656	0.61	274.90	0.100
2030	468,096	0.64	299.58	0.109

The trend of waste generation as depicted on figure 4 shows that at the end of year 2020, with the total population of 320,212 in Bida, 150.49 metric tons of solid waste was generated per day at the rate of 0.46kg/capita, equivalent to 55million tons in that same year. The projected population predicted an increase of 468,096 in year 2030 with 299.58 metric tons per day at an average generation rate of 0.64kg/capita and 1.09 billion tons for year 2030.

4.4 Relationship between Socio-Cultural Factors and Solid Waste Generation in Bida

The relationship between waste generation and socio – cultural factors in Bida is best explained with the use of correlation coefficient. As it provides the techniques for measuring the linear relationship between two variables and produce a single summary statistic that describes the strength of association between them. As such, variables of solid waste generation were used as dependent variables while that of socio – cultural factors such as urbanisation, Geographical location, Awareness, economic situation, local practice, beliefs, and religion were independent variables.

Table 4.9: Correlation between socio - cultural factors and waste generation rate in Bida

Attributes	Waste Generation Rate		
	Pearson (r)	Correlation Sig. 2-tailed (p)	Significant Test
(A) Social Factors			
Urbanisation	.124*	.013	Significant
Geographical	.030	.546	Not Significant
Awareness	.197**	.000	Significant
Economic	.064	.198	Not Significant
(B) Cultural Factors			
Practice	.195**	.000	Significant
Beliefs	.065	.193	Not Significant
Religion	.095	.057	Not Significant

**. Correlation is significant at the 0.01 level (2-tailed) *.
Correlation is significant at the 0.05 level (2-tailed).
n = 400

The result of Pearson's correlation coefficient tested on the relationship between social and cultural factors with waste generation in Bida indicated that the factors such as geographical location, economic situation, beliefs and religion have little or weak correlation with solid waste generation in the study area as revealed in the table 4.9. This indicated that Urbanisation, Awareness and local practice are significant factors that influence the type and quantity of solid waste generated in Bida. This means that despite the level of Urbanisation, lack of awareness of the residents on waste handling could not change the local practice of landfill adopted as the system of waste evacuation.

This result is consistence with the results of most studies, such as that of Darban and Hajilo, (2017) carried out in Iran to evaluate the quality and quantity of the rural domestic

waste using multiple regression analysis in evaluating the factors affecting the generation of domestic waste. The result indicated that the households' attitude and indigenous knowledge on efficient use of materials are the key factors that influence waste generation.

4.5 Effects of Socio-cultural Factors on Household Waste Generation

A multiple regression was performed to investigate whether social and cultural factors could significantly predict waste generation. The results of the regression as revealed on table 4.10 indicated that the Practice, beliefs, religion, urbanisation, geographical, lack of awareness and economic status all contributed significantly to the regression model ($F(7, 393) = 5.146$, $p < .000$). The relationship between variables were moderate ($R = .290$) and accounted for 8.4% ($R^2 = .084$) of the variance in waste generation rate. The table shows that practice had a statistically significant impact $\beta = .167$, $t = 2.462$, $p = < .05$, geographical had a statistically significant impact $\beta = -.190$, $t = -2.702$, $p = < .01$ and lack of awareness had a statistically significant impact $\beta = .251$, $t = 3.552$, $p < .001$.

Whereas the remaining 4 variables did not, beliefs $\beta = -.79$, $t = -1.033$, $p = .302$, religion $\beta = .001$, $t = .022$, $p = .983$, urbanisation $\beta = .139$, $t = 1.866$, $p = .063$, and economic $\beta = -.073$, $t = -1.135$, $p = .257$.

Table 5.0: **Result of the regression analysis between socio cultural factors and waste generation rate**

Waste Generation Rate				
Variables	**B**	**Beta (β)**	**t**	**Sig**
Practice	.097	.167	2.462	.014*
Beliefs	-.046	-.079	-1.033	.302
Religion	.001	.001	.022	.983
Urbanisation	.077	.139	1.866	.063
Geographical	-.109	-.190	-2.702	.007**

Awareness	.129	.251	3.552	.000***
Economic	-.033	-.073	-1.135	.257

R	R^2	Adjusted R^2	Std. Error of the Estimate
.290	.084	.068	.41265

Note: Waste generation rate as dependent variable, * p < .05, ** p < .01, *** p< .001

4.7 Summary of Findings

i. Seven Socio – Cultural Factors (Urbanisation, Geographical location, Lack of Awareness, Economic Status, Practice, Beliefs and Religion) were identified that influence solid waste generation in Bida.

ii. The Average Generation Rate is 0.46kg/person/day and compost major of the organic materials iii. Number of person does not really determine the rate of waste generation rather the awareness and attitude of people towards waste handling.

iv. The future increase of 299.58 metric tons of Solid Waste per day at an Average of 0.64kg/capita was predicted for year 2030 as against 150.49 metric tons with an Average 0.46kg/capita in the year 2020.

v. Urbanisation, Lack of Awareness, and practice of indiscriminate dumping of refuse are the main factors that are related to the increase in waste generation.

vi. The practice of waste dumping, geographical location and Lack of Awareness all impacted significantly on waste generation.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study attempted an analysis of the relationship that exists between Socio Cultural Factors and Solid Waste Generation in Bida. Seven Socio – Cultural Factors that were identified to relate with the rate and weight of waste generation in order to determine the association that exist between them. The outcome of the study could be of help to decision makers and environmental planners in the strategies for dealing with the issues on solid waste generation and management in Bida. Like other cities in developing countries, Bida is experiencing an increase in the amount of waste generation with inadequate infrastructure, information and resource to establish an effective waste management strategy. The study focus on household waste generation as it contributes more than half

of the entire municipal waste generation. It was therefore concluded that Geographical location, Urbanisation, lack of residents' awareness on waste handling and the practice of indiscriminate dumping of refuse are the significant factors that predict the rates and composition of solid waste generated in the city. It was based on these findings that the following recommendations were suggested.

5.2 Recommendations

The following recommendations were made based on the findings;

i. The level of Urbanisation in Bida is increasing alongside the rate of waste generation, Economic status of the resident is not improving, yet there is inadequate awareness on the issue of waste handling due to their practice of uncontrolled dumping of refuse. It is therefore recommended that there should be a sensitization on waste minimization and management strategies through social media.

ii. It is recommended that the residents should be enlightened on the assets that can be achieved from waste through the method of waste reduction, reuse, and recycling. This could be achieved through Public private partnership with government to serve as a source of income to Local Authority to curb the expenses on waste management. It could also control the indiscriminate dumping of refuse on the

street.

iii. The dominance of organic fraction and recyclable materials on waste mixture in Bida city showed that composting and recycling would be a preferred method in waste handling as such some parts of the waste management cost may be recovered by selling recyclables and compost, and likewise the challenges of uncontrolled dumping may be moderated by decreasing the amount of waste transferred to the

final disposal site. iv. Residents' awareness and attitude towards waste handling is another significant factor that influence waste generation in the study area, it is therefore recommended that there should be an enlightenment programmes on media to educate people on waste generation and mangement.

v. Government at the national and local level should establish a national database that will always carry out researches and update data on waste problem both at the national, state and local authorities.

5.3 Contribution to Knowledge

This study contributes to the knowledge of the residents' awareness and attitude towards waste handling in Bida and its environs. It was established that the number of people in most cases does not determine the quantity of waste generated. Factors that influence solid waste generation were investigated with the use of correlation analysis and the result indicated that urbanization, awareness and practice were the factors that contributed significantly to the issue of waste generation in Bida. The outcome of the study could be of help to decision makers and environmental planners in the strategies for dealing with the issues of solid waste generation and management in Bida Like other cities in developing countries,

5.4 Proposition for Further Research

There is a need for further research to explore more on the issue of waste generation. This research has shown that there is a significant relationship between socio cultural factors and solid waste generation in Bida, effort for further research should be on how access to waste management infrastructure and services affect the relationship between socio cultural factors and solid waste generation, so that it could provide a valuable insights that

can inform policy making and waste reduction initiatives and as well contribute to the sustainable development of Bida.

REFERENCES

Abdel-Shafy, H. I., & Mansour, M. S. M. (2018). Solid waste issue: sources, composition, disposal, recycling, and valorization. Egypt J Pet 27: 1275–1290.

Agovino, M., Cerciello, M., & Musella, G. (2019). The effects of neighbour influence and cultural consumption on separate waste collection. Theoretical framework and empirical investigation. *Ecological economics*, *166*, 106440.

Agrasuta, V., & Nelson, A. (2013). The adoption of green dentistry among dentists in Thailand. *An Unpublished PhD Thesis*.

Alirol, E., Getaz, L., Stoll, B., Chappuis, F., & Loutan, L. (2011). Urbanisation and infectious diseases in a globalised world. *The Lancet infectious diseases*, *11*(2), 131-141.

American Psychological Association (2020). American Psychological Association writing format https://www.apa.org/about 22 November, 2020.

Barbara B. T. (2004). Urbanisation: An Environment Force to be Reckoned with Social and Environmental Dimension of Health and World. Population Trends.

Beatrice A. & Jussi K. (2013). Municipal Solid Waste Management problems in Nigeria: Evolving Knowledge Management Solution. *International Journal of Environmental, Chemical, Ecological and Geophysical Engineering*, 7(6),15-22.

Breukelman, H., Krikke, H., & Löhr, A. (2019). Failing services on urban waste management in developing countries: a review on symptoms, diagnoses, and interventions. *Sustainability*, *11*(24), 6977.

Brown, N. (2002). Robert Park and Ernest Burgess, Urban Ecology Studies, 1925. CSISS Classics.

Caves, R. W. (Ed.). (2005). *Encyclopedia of the City*. Taylor & Francis.

Dangi, M. B., Pretz, C. R., Urynowicz, M. A., Gerow, K. G., & Reddy, J. M. (2011). Municipal solid waste generation in Kathmandu, Nepal. *Journal of environmental management*, *92*(1), 240-249.

Dangi, Mohan B., Christopher R. Pretz, Michael A. Urynowicz, Kenneth G. Gerow, and J. M. Reddy. "Municipal solid waste generation in Kathmandu, Nepal." *Journal of environmental management* 92, no. 1 (2011): 240-249.

David. M. C., Bodirsky, B. L., Krueger, T., Mishra, A., & Popp, A. (2020). The world's growing municipal solid waste: Trends and impacts. *Environmental Research Letters*, *15*(7), 074021.

Darban Astane, A. R., & Hajilo, M. (2017). Factors affecting the rural domestic waste generation. *Global Journal of Environmental Science and Management*, *3*(4), 417-426.

Directive 2008/98/EC of European Parliament and the Council of 19 November 2008 on Waste and repealing certain directives (Text with EEA relevance) *OJL 312,22.11.2008, p 3 – 30 Chapter 15 Volume 034 P. 99 – 126* http://data.europa.eu/eli/dir/2008/98/oj

Field, A.(2005). Discovering Statistics Using SPSS. London: SAGE Publications. *Anuario de psicología/The UB Journal of psychology*, 195-196.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. sage.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. An analysis of mental wellbeing and mental psychopathology of gifted students by an emotional and social developmental process perspective.

Hair, J. F., Sarstedt, M., Pieper, T. M., & Ringle, C. M. (2012). The use of partial least squares structural equation modeling in strategic management research: a review of past practices and recommendations for future applications. *Long range planning*, *45*(5-6), 320-340.

Herianto, H., Maryono, M., & Budihardjo, M. A. (2019). Factors affecting waste generation: household study in Palangka Raya City, Central Kalimantan. In *E3S Web of Conferences* (Vol. 125, p. 07007). EDP Sciences.

Hilles, A. H., & Abushbak, T. (2011). Society and Household Behavior, Culture and Attitudes & Their Role in Solid Waste Management. *Institute of Water and Environment, Al-Azhar University PO Box*, *1277*.

Hui-Zhou, Aihong, M. Yanqiu, L. Qinghai, Li & Yauo, Z. (2014). Classification and Comparison of Municipal Solid Waste based on thermochemical

characteristics, *Journal of the Air & Waste Management Association,* 64(55), 597 – 626, Doi: 10.1080/10962247.2013.873

Ilyas, H., Rashid A.S., & Nawaz C. M., (2017). Waste Generation Rate and Comparison of Municipal Solid Waste based on thermo chemical characteristics, *Journal of Waste Resources,* 07(03), 15-29.https://doi.org/10.4172/2252-5211,1000297

Kelsey, M. (2020). *The Triple Bottom Line: What it is and Why it's important. Retrieved* from http://online.hbs.edu/blog/post/what-is-the-triple-bottom-line.

Kinyua, L., Pertet, A. M., & Ogwayo, I. O. (2016). Social-Cultural Factors Associated with Household Solid Waste Management in a Kenyan Informal Settlement. *Journal of Environmental Science, Toxicology and Food Technology*, *10*, 63-68.

Kolekar, K. A., Hazra, T., & Chakrabarty, S. N. (2016). A review on prediction of municipal solid waste generation models. *Procedia Environmental Sciences*, *35*, 238-244.

Kumar, S., Smith, S. R., Fowler, G., Velis, C., Kumar, S. J., Arya, S., Rena, N., Kumar, R. & Cheeseman, C, (2017). Challenges and opportunities associated with waste management in India. *Royal Society Open Science,* 4(3), 160764. https://doi.org/10.1098/rsos.160764

Liu, C., & Wu, X. W. (2011). Factors influencing municipal solid waste generation in China: A multiple statistical analysis study. *Waste Management & Research*, *29*(4), 371-378.

Manzoor, H., Iram, I. (2018). Urbanisation Concepts, Dimensions and Factors. *International Journal of Recent Scientific Research* 9(1), 23513 – 23523, January 2018. Doi: 10.24327/IJRSR. http://www.recentscientific.com

Massoud, May A., Michel Mokbel, Suheir Alawieh, and Nasser Yassin. "Towards improved governance for sustainable solid waste management in Lebanon: Centralised vs decentralised approaches." *Waste Management & Research* 37, no. 7 (2019): 686-697.

Max Lock (1980) Master Plan of Bida Nigeria.

Michael A. J. (2000). The Urban Environment and Health in a world of Increasing Globalization: Issues from Developing Countries. *Bulletin of the World Health Organization*, 78, 1117 – 26.

Mihai, F. (2012). Geography of waste as a new approach in waste mangement study. *Papers of the Geographic Seminar "Dimitrie Cantemir",* 33, 39 – 46 https://doi.org/10.5281/senodo.19110

Ministry of Land., (2013). Research Gate. Retrieved November 3, 2019, from https://www.reserachgate.net/figure/Location-of-Nigeria- Source-Ministry-ofLand-and-Housing-Minna-2013_fi2_315941330

Mohammad N, Liu-Yuanyuan, Zena, M & Sylvia, A. (2020). "Determinants of Household Solid Waste Generation and Composition in Hons City". *Journal of Environmental and Public Health,* 2020, 7460356. 15 pages. http://doi.org/10.1155/2020/7460356

Nabegu, A. B. (2017). An Analysis of Municipal Solid Waste in Kano Metropolis, Nigeria. *Journal of Human Ecology,* 3(2), 17-
https://www.tandfonline.com/doi/doi/pdf/10.1080/09709274.2010.11906301?ne
ed Access=true

Nathanson, J. A. (2020). November 10). *Solid – waste management*. *Encyclopedia Britannica*.https://www.britannica.com/technology/solid-waste-management

National Population Commission (2006). Population and Housing Census Population Distribution by Sex, State, LGA and Senatorial Distribution, NPC, Abuja, Nigeria, April

Nigeria – General Household Survey – Panel Wave 3 (Post Planning) 2015 – 2016,
Third round – Overview. (n.d.). Retrieved March 8, 2020, from https://www.nigerianstat.gov.ng/index.php/catalog/51

Ogwueleka, T. C. (2013). Survey of Household waste composition and quantities in Abuja, Nigeria. *RESOUR CONSERV RCY*, 77, 52 – 60.

Okot – Okumu, J. (2012). Solid Waste Management in African Cities – East Africa. In L. F. Marmolejo Rebellon (ED.), *Waste Management – An Integrated Vision.*
InTech. http://doi.org/10.5772/50241

Pardini, K., Rodrigues, J, J, P,C., Kozlov, S.A., Kumar, N., & Furtado, V. (2019). IoT – Based Solid Waste Management Solutions: A Survey. *Journal of Sensor and Actuator Networks*, 8(1), 5-16. https://doi.org/10.3390/jsan80100005

Salanga, R. (2019), Why is Waste Management Important? The Science Park Blog. http://sciencepaek.com.ph/blog/waste-management-important/

Senzige J.P, Nkansh-Gyeke. Y, Makinde D.O & Njau K.N. (2014). Factors Influencing Solid Waste Generation and Composition in Urban Areas of Tanzania. The case of Dar –es – salam. *American Journal of Environmental Protection*. 3(4), 172 –
178. Doi: 10.11648/j.ajep.20140304.11

Ruralhealthhub, (2015). Retrieved from https://www.ruralhealthinfo.org/toolkits/healthpromotio/2/theories-and-models/health-belief

Tabachnick, B.G. & Fidell, L.S. (2012) *Using Multivariate Statistics*. 6th edn. Harlow: Pearson.

Tabachnick, B.G. & Fidell, L.S. (2014) *Using Multivariate Statistics*. 6th edn. Harlow: Pearson.

Trang, P. T. T., Dong, H. Q., Toan, D. Q., Hanh, N. T. X., & Thu, N. T. (2017). The Effects of Socio – economic Factors on Household Solid Waste Generation and Composition: A case Study in Thu Dau Mot, Vietnam. *Energy Procedia, 107*, 253-258. https://doi.org/10.1016/j.egypro.2016.12.144

Uloko, C.E. (2016). Research Methodology: A practical Approach. Advance Publishers Nigeria Limited.

Umunna, M. (2011). *Solid Waste Generation and Disposal in a Nigerian City: An Empirical Analysis in Onitsha Metropolis*. 13.

United Nations Department of Economic and Social Affairs (2014, July). Revision of the World Urbanisation Prospects. http://www.un.org.publications.

Wegedie, K.T. (2018). Household Solid Waste Generation and Management Behavior in case of Bahir Dar City, Amhara National Regional State, Ethiopia. *Cogent EnvironmentalScience*, 4(1),147-154 https://doi.org/10.1080/23311843.2018.1471025

World Bank (2019). Solid Waste Management, Retrieved on June 10, 2020, from https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-wastemanagement.

Yiougo, L.S.A., Oyedotun, T. D.T, Some, C.Y. Da-Evariste C.D (2013) Urban Cities and Waste Generation in Developing Countries: A GIS Evaluation of two Cites in Burkina Faso. *Journal of Urban and Environmental Engineering.* 7(2), 280 – 285 http://www.redalye.org/articulo.oa?id=283230157010

Yusof, M.B., Othman, F., Hasim, N., & Ali, N. (2002). The Role of Socio – Economic and Cultural Factors in Municipal Solid Waste Generation: A case Study in Taman Perling, Johor Bahru. *Jurnal Teknologi*, 37, 551-557. https://doi.or/10.11113/jt.v37.551

Zhang, T. (2020). Landfill earth: A global perspective on the waste problem.

APPENDIX "A"

Survey Instrument (Questionnaire)

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE

SCHOOL OF POSTGRADUATE STUDIES,

DEPARTMENT OF URBAN AND REGIONAL PLANNING

RELATIONSHIP BTWEEN SOCIO – CULTURAL FACTORS AND SOLID WASTE GENERATION IN BIDA, NIGER STATE

Dear respondent,

I am currently undertaking M.TECH research thesis and this questionnaire is designed to obtain information on **Relationship Between Socio-Cultural Factors and Solid Waste Generation in Bida, Niger State.** All information given in this questionnaire shall be strictly for academic purpose and will be treated privately. Please Tick (√) where appropriate.

Thank you.

SECTION A: SOCIO ECONOMIC / DEMOGRAPHIC CHARACTERISTIC OF THE RESPONDENT

i. Name of the ward ……..

ii. Age group (a) 18 - 25 (b) 26 - 35 (c) 36 - 45 (d) 46 -55 (e) Above 55

iii. Sex of the respondent (a) Male (b) Female iv. Marital Status: (a) Single (b) Married (c) Divorce (d) Widow

i. Average household size (a) 2 – 4 (b) 5 – 7 (c) 8 – 10 (d) 11 – 13 (e) 14+

v. Education attainment (a) Non (b) Primary (c) Secondary (d) Tertiary vi. Employment status of respondents (a) civil servant (b) self-employed

(c) farming (d) family business (e) retired (f) Unemployed vii. Average monthly income of respondent (a) less than ₦20,001 (b) between ₦20,001 and ₦40,000 (c) Between ₦40,000 and ₦80,000 (d) Above ₦80,000

viii. How long have you been in this area? (a) Less than 3 years (b) 4-8 years (c) 9-13 years (d) 14-18 years (e) Above 18 years ix. Type of residential area (a) Planned residential area (b) Unplanned residential area

x. Distance to the permitted dumpsite (a) less than 50 meters (b) Between 50 to 100 meters (c) over 200 meters

SECTION B: SOCIAL FACTORS THAT INFLUENCE SOLID WASTE GENERATION

Rate the following Social factors as they influence solid waste generation in your ward.

Please tick (✓) as appropriate

	Social Factors	Strongly disagree	Disagree	Neither agree /disagree	Agree	Strongly Agree
	Economic					
1	Income determine the type and rate of waste generation					

2	My purchase decisions contribute to the amount of waste generated in my house.					
3	Educated people generate less waste					
4	Family that dine out generate less wastes than the ones that cook at home					
5	Size of the family determines the rate of waste generation					
6	The aged abide to the rules of waste management than the young ones					
	Value					
1	Value attached to a waste determine the					
	manner in which its being generated and managed					
2	A waste today might be a future treasure					
3	Waste recycling minimize waste generation					
	Awareness					
1	My expenditures on groceries contribute to the amount of waste generated in my household.					
2	Limited time of sweeping has effect on amount of waste generation					
3	Awareness campaign on radio and television controls the rate of waste generation than that social media only.					

	Public Cooperation					
1	Public enlightenment programmes controls the volume of waste generation					
2	Household participation in community development activities influence the amount of waste generation					
3	Public cooperation with government on the issue of waste management influence the rate of waste generation					
	Urbanisation					
1	The more people urbanize the more waste they generate					
2	As the city increase in					
	size, changes occur that influence waste generation					
3	Urbanisation is a rival to healthy environment in term of waste generation					
	Geographical factors					
1	Change in seasons influence waste generation					
2	Distance to the municipal permitted dump site determine the rate of waste generation					
3	More wastes are generated during dry season than the rainy season					

SECTION C: CULTURAL FACTORS THAT INFLUENCE SOLID WASTE GENERATION AND MANAGEMENT

Rate the following factors that influence solid waste generation in your ward. Please tick (✓) as appropriate

	Cultural Factors	Strongly disagree	Disagree	Neither agree /disagree	Agree	Strongly Agree
	Lifestyle					
1	The volume of waste generated when I buy food do less than when I cook at home					
2	Waste generated each time I buy processed (sachet) food stuff do less than when I buy to processed at home					
3	I do keep some of my used properties to minimize waste generation					
4	Waste separation before disposal minimize waste generation					
	Perception					
1	Waste separation from the source before disposal minimize its generation					
2	Indiscriminate dumping of refuse controls waste management					
3	The much more time used in cleaning the more waste generated					
	Norms					
1	Believing in the norms of “no night sweeping” minimize the volume of waste generation					

2	The way people manage their waste depend mostly on what their culture classify as a dirt.					
3	Culture provides the context within which human activities takes place that include management of wastes.					
	Beliefs					
1	Waste is a dirt, so sweeping always generate more waste.					
2	Sweeping only at some specific periods reduces the rate of waste generation					
3	What you “see” or “feel” is a dirt determine the way you manage it.					
	Practices					
1	I sweep homes during the day times only, to reduce the volume of waste generated in my house					
2	I do prefer dinning out with my family to reduce the rate of waste generated in my household					
3	I do separate waste generated from my household so as to manage the rate of waste generation.					
	Religion					

1	Though cleanliness is next to Godliness, but to minimize the volume of waste generation, one need to sweep less.					
2	All religion preach cleanliness, yet we need to minimize the volume of waste generation					
3	No religion support waste of materials, to abide by this one should always keep aside used materials to control the volume of waste generation.					

Appendix "B"

Solid Waste Generation

Bariki ward

S/N	**Wards**	**Average household size**	**Total weight (kg)**	Generation rate (kg)
1	Bariki	4	1.8	1.35
2	Bariki	6	2.2	1.1
3	Bariki	6	2.4	1.2
4	Bariki	3	1.8	1.8
5	Bariki	6	2.4	1.2
6	Bariki	4	2.2	1.65
7	Bariki	6	2.9	1.45
8	Bariki	3	2	2
9	Bariki	6	2.4	1.2

10	Bariki	6	2	1
11	Bariki	6	2.4	1.2
12	Bariki	5	2.2	1.32
13	Bariki	6	1.8	0.9
14	Bariki	3	1.2	1.2
15	Bariki	6	2.4	1.2
16	Bariki	7	2.4	1.03
17	Bariki	6	2.6	1.3
18	Bariki	6	2.8	1.4
19	Bariki	6	1.4	0.7
20	Bariki	6	1.6	0.8
21	Bariki	3	1.2	1.2
22	Bariki	4	2.7	2.025
23	Bariki	8	2.5	0.93
24	Bariki	4	2.8	2.1
25	Bariki	3	1.2	1.2
26	Bariki	6	2.4	1.2
27	Bariki	6	2.2	1.1
28	Bariki	6	2.6	1.3
29	Bariki	8	2.8	1.05
30	Bariki	9	2.6	0.87
31	Bariki	3	1.2	1.2
32	Bariki	6	2.4	1.2
33	Bariki	6	2.4	1.2
34	Bariki	6	2.8	1.4
		185	**74.7**	

Cheniyan Ward

S/N	Wards	Average household size	Total weight (kg)	Generation rate (kg)
1	Chniyan	6	2.4	1.2
2	Chniyan	6	2.3	1.15
3	Chniyan	6	2.6	1.3
4	Chniyan	4	2.8	2.1
5	Chniyan	6	2.9	1.45
6	Chniyan	5	2.7	1.62
7	Chniyan	6	2.9	1.45
8	Chniyan	7	1.5	0.6
9	Chniyan	9	2.6	0.87
10	Chniyan	6	1.8	0.9

11	Chniyan	6	2.1	1.05
12	Chniyan	5	1.2	0.72
13	Chniyan	9	2.6	0.87
14	Chniyan	4	2.2	1.65
15	Chniyan	3	1.2	1.2
16	Chniyan	8	2.3	0.86
17	Chniyan	6	2.4	1.2
18	Chniyan	9	3	1
19	Chniyan	6	3.2	1.6
20	Chniyan	6	2.8	1.4
21	Chniyan	8	3.2	1.2
22	Chniyan	9	2.8	0.9
23	Chniyan	9	3.1	1
24	Chniyan	9	2.8	0.9
25	Chniyan	9	3.2	1
26	Chniyan	6	2.4	1.2
27	Chniyan	6	1.2	0.6
28	Chniyan	3	1.3	1.3
29	Chniyan	9	2.6	0.87
30	Chniyan	9	2.7	0.9
31	Chniyan	3	1.4	1.4
32	Chniyan	8	2.9	1.08
33	Chniyan	6	1.4	0.7
34	Chniyan	9	2.1	0.7
35	Chniyan	6	2	1
36	Chniyan	6	2.6	1.3
37	Chniyan	8	2.9	1.08

38	Chniyan	9	2.4	0.8
39	Chniyan	6	2.8	1.4
40	Chniyan	8	2.7	1.01
41	Chniyan	6	2.9	1.45
42	Chniyan	6	2	1
		281	**100.9**	

Kyari Ward

S/N	Wards	Average household size	Total weight (kg)	Generation rate (kg)
1	Kyari	6	3.5	1.75
2	Kyari	9	3.8	1.23
3	Kyari	8	3.8	1.425
4	Kyari	9	3.2	1.07
5	Kyari	6	2.4	1.2
6	Kyari	3	1.8	1.8
7	Kyari	6	4.2	2.1
8	Kyari	6	3.8	1.9
9	Kyari	9	2.4	0.8
10	Kyari	6	2	1
11	Kyari	3	1.8	1.8
12	Kyari	6	1.4	0.7
13	Kyari	6	2.2	0.8
14	Kyari	6	3.2	1.6
15	Kyari	8	2.8	1.05
16	Kyari	6	3.8	1.9
17	Kyari	6	2.2	1.1
18	Kyari	8	2.4	0.9
19	Kyari	7	6.2	2.66
20	Kyari	6	3.4	1.7
21	Kyari	6	2.2	1.1
22	Kyari	6	2	1
23	Kyari	6	2.4	1.2
24	Kyari	6	1.4	0.7
25	Kyari	6	2.4	1.2
26	Kyari	6	2.2	1.1
27	Kyari	6	2.6	1.3
28	Kyari	3	1.6	1.6
29	Kyari	6	2.4	1.2

30	Kyari	6		1.8	0.9
31	Kyari	6	4.2	2.1	
32	Kyari	9	2.4	1	
33	Kyari	8	3.8	1.425	
34	Kyari	6		2.4	1.2
35	Kyari	6		2	1
36	Kyari	6		1.8	0.9
37	Kyari	6		1.7	0.85
38	Kyari	3		1.2	1.2
39	Kyari	6		2.2	1.1
40	Kyari	6		2.4	1.2
41	Kyari	15		4.2	0.94
42	Kyari	6		2	1
43	Kyari	9		2.4	0.8
44	Kyari	12		3.8	0.95
		291		**117.8**	

Masaba "A" ward

S/N	Wards	Average household size	Total weight (kg)	Generation rate (kg)
1	Masaba A	6	2	1
2	Masaba A	7	2.4	1.02
3	Masaba A	3	1.3	1.3
4	Masaba A	3	2.4	2.4
5	Masaba A	6	2.5	1.25
6	Masaba A	7	3	1.29
7	Masaba A	6	3.2	1.6
8	Masaba A	6	3.4	1.7
9	Masaba A	7	3.5	1.5
10	Masaba A	6	2.9	1.45
11	Masaba A	6	3	1.5
12	Masaba A	9	3.5	1.17
13	Masaba A	9	2.8	0.93
14	Masaba A	6	2	1
15	Masaba A	9	2.4	0.8
16	Masaba A	9	2.6	0.87
17	Masaba A	9	3.2	1.07
18	Masaba A	9	3.5	1.17
19	Masaba A	6	2.4	1.2

20	Masaba A	3	2	2
21	Masaba A	9	3	1
22	Masaba A	9	3.2	1.07
23	Masaba A	6	3.2	1.6
24	Masaba A	6	2.8	1.4
25	Masaba A	6	2	1
26	Masaba A	6	2.4	1.2
27	Masaba A	4	1.8	1.35
28	Masaba A	3	1.2	1.2
29	Masaba A	3	1.8	1.8
30	Masaba A	8	4	1.5
31	Masaba A	3	1.8	1.8
32	Masaba A	9	2.6	0.87
33	Masaba A	9	3.2	1.06
34	Masaba A	6	2	1
35	Masaba A	6	2	1
36	Masaba A	3	1.2	1.2
37	Masaba A	6	2.4	1.2
38	Masaba A	6	2	1
39	Masaba A	6	2.8	1.4
40	Masaba A	3	1.8	1.8
41	Masaba A	9	3	1
42	Masaba A	6	4.5	2.25
43	Masaba A	3	2.3	2.3
44	Masaba A	6	2.6	1.3
45	Masaba A	9	3	1
46	Masaba A	9	3.2	0.07
47	Masaba A	9	3.4	1.13
48	Masaba A	3	2	2
49	Masaba A	6	2.8	1.4
50	Masaba A	9	3	1
51	Masaba A	6	2.5	1.25
52	Masaba A	9	2.7	0.9
53	Masaba A	6	2	1
54	Masaba A	9	3.2	1.07
55	Masaba A	8	4.2	1.575
56	Masaba A	6	3.6	1.8
57	Masaba A	9	2.4	0.8
58	Masaba A	6	2	1
59	Masaba A	6	2.8	1.4
60	Masaba A	9	2.4	0.8
61	Masaba A	5	2.2	1.32

62	Masaba A	5	2.2	1.32
63	Masaba A	4	3	2.25
64	Masaba A	4	3.4	2.55
		410	**169.6**	

Masaba "B" ward

S/N	Wards	Average household size	Total weight (kg)	Generation rate (kg)
1	Masaba B	8	4	1.5
2	Masaba B	6	2.2	1.1
3	Masaba B	7	2.8	1.2
4	Masaba B	6	2.3	1.15
5	Masaba B	3	2	2
6	Masaba B	3	1.3	1.3
7	Masaba B	9	3.2	1.07
8	Masaba B	6	2	1
9	Masaba B	7	3.8	1.62
10	Masaba B	9	4.2	1.4
11	Masaba B	3	2.1	2.1
12	Masaba B	6	2.2	1.1
13	Masaba B	6	2.4	1.2
14	Masaba B	6	2.3	1.15
15	Masaba B	6	3	1.5
16	Masaba B	6	2.3	1.15
17	Masaba B	8	2.5	0.93
18	Masaba B	9	2.3	0.77
19	Masaba B	6	1.6	0.8
20	Masaba B	6	3.9	1.95
21	Masaba B	9	2.4	0.8
22	Masaba B	8	3.6	1.35
23	Masaba B	6	2.1	1.05
24	Masaba B	9	3.4	1.13
25	Masaba B	3	2.1	2.1
26	Masaba B	3	1.8	1.8
27	Masaba B	6	2.2	1.1
28	Masaba B	6	2.6	1.3
29	Masaba B	3	1.8	1.8
30	Masaba B	3	1.3	1.3
31	Masaba B	9	4	1.33
32	Masaba B	6	2.6	1.3
33	Masaba B	8	3.9	1.46
34	Masaba B	9	5.2	1.73

35	Masaba B	3	3	3
36	Masaba B	6	4	2
37	Masaba B	6	4.2	2.1
38	Masaba B	6	2.3	1.15

39	Masaba B	6	2	1
40	Masaba B	6	2	1
41	Masaba B	6	5	2.5
42	Masaba B	9	4.2	1.4
43	Masaba B	7	5.2	2.22
44	Masaba B	6	2.8	1.4
45	Masaba B	9	3.4	1.13
46	Masaba B	3	2.6	2.6
47	Masaba B	3	2	2
48	Masaba B	6	2	1
49	Masaba B	6	3	1.5
50	Masaba B	9	3.2	1.07
51	Masaba B	6	2	1
52	Masaba B	3	1.8	1.8
53	Masaba B	3	1.9	1.9
54	Masaba B	9	3	1
55	Masaba B	6	2.2	1.1
56	Masaba B	7	4.9	2.1
57	Masaba B	9	3.8	1.27
58	Masaba B	3	2	2
59	Masaba B	6	2	1
60	Masaba B	6	2.6	1.3
61	Masaba B	6	3.2	1.6
62	Masaba B	9	3.4	1.13
63	Masaba B	8	4.8	1.8
		392	**179.9**	

Umaru Majigi "A" ward

S/N	Wards	Average household size	Total weight (kg)	Generation rate (kg)
1	U/Majigi A	3	2	2
2	U/Majigi A	3	1.8	1.8
3	U/Majigi A	4	2.4	1.8
4	U/Majigi A	4	3	2.25
5	U/Majigi A	5	3.4	2.04
6	U/Majigi A	4	3.2	2.4
7	U/Majigi A	5	2.2	1.32
8	U/Majigi A	6	2.3	1.15

9	U/Majigi A	4	2	1.5
10	U/Majigi A	6	2	1
11	U/Majigi A	5	2.1	1.26
12	U/Majigi A	3	1.2	1.2
13	U/Majigi A	3	2.4	2.4
14	U/Majigi A	6	3.2	1.6
15	U/Majigi A	5	2.3	1.38
16	U/Majigi A	6	2.2	1.1
17	U/Majigi A	6	3.8	1.9
18	U/Majigi A	4	4.2	3.15
19	U/Majigi A	4	2.2	1.65
20	U/Majigi A	6	2.9	1.45
21	U/Majigi A	3	2	2
22	U/Majigi A	3	1.8	1.8
23	U/Majigi A	6	2.4	1.2
24	U/Majigi A	6	2.2	1.1
25	U/Majigi A	6	2.5	1.25
26	U/Majigi A	6	3.2	1.6
27	U/Majigi A	6	2.9	1.45
28	U/Majigi A	6	3.4	1.7
29	U/Majigi A	6	3.2	1.6
30	U/Majigi A	6	4.6	2.3
31	U/Majigi A	6	2.4	1.2
32	U/Majigi A	3	2.2	2.2
33	U/Majigi A	4	2.8	2.1
34	U/Majigi A	8	2.2	0.825
35	U/Majigi A	6	2.3	1.15
36	U/Majigi A	6	2.8	1.4
37	U/Majigi A	8	3.2	1.2
38	U/Majigi A	5	3.9	2.34
39	U/Majigi A	6	4.2	2.1
40	U/Majigi A	6	3	1.5
41	U/Majigi A	3	2	2
42	U/Majigi A	3	2.2	2.2
43	U/Majigi A	5	3	1.8
44	U/Majigi A	5	3.8	2.28
45	U/Majigi A	6	2.4	1.2
46	U/Majigi A	6	3.2	1.6
47	U/Majigi A	4	3.4	2.55
48	U/Majigi A	6	2.6	1.3

49	U/Majigi A	6	3.9	1.95
50	U/Majigi A	3	4	4
51	U/Majigi A	6	2.2	1.1
52	U/Majigi A	3	2.1	2.1
53	U/Majigi A	4	3	2.25
54	U/Majigi A	4	3.4	2.55
55	U/Majigi A	2	3.4	5.1
56	U/Majigi A	2	3.7	5.55
57	U/Majigi A	4	2.8	2.1
58	U/Majigi A	6	2.8	1.4
59	U/Majigi A	5	2	1.2
60	U/Majigi A	4	2.5	1.875
		291	**166.4**	

Umaru Majigi "B" ward

S/N	Wards	Average household size	Total weight (kg)	Generation rate (kg)
1	U/Majigi B	6	3.2	1.6
2	U/Majigi B	9	3.5	1.17
3	U/Majigi B	7	2.4	1.02
4	U/Majigi B	6	3	1.5
5	U/Majigi B	6	3	1.5
6	U/Majigi B	9	3.2	1.07
7	U/Majigi B	6	2.4	1.2
8	U/Majigi B	3	2.2	2.2
9	U/Majigi B	6	3.4	1.7
10	U/Majigi B	3	2.2	2.2
11	U/Majigi B	7	4.2	1.8
12	U/Majigi B	5	4.6	2.76
13	U/Majigi B	6	2.4	1.2
14	U/Majigi B	6	2.2	1.1
15	U/Majigi B	6	5.2	2.6
16	U/Majigi B	6	3.6	1.8
17	U/Majigi B	9	2.6	0.9
18	U/Majigi B	6	2.4	1.2
19	U/Majigi B	9	3.8	1.27
20	U/Majigi B	6	2.6	1.3
21	U/Majigi B	6	3.4	1.7
22	U/Majigi B	9	3.9	1.3

23	U/Majigi B	6	2.8	1.4
24	U/Majigi B	3	2	2
25	U/Majigi B	5	3.6	2.16
26	U/Majigi B	6	3.3	1.65
27	U/Majigi B	9	3.4	1.13
28	U/Majigi B	6	2.6	1.3
29	U/Majigi B	6	2.4	1.2
30	U/Majigi B	6	3.9	1.95
31	U/Majigi B	6	4.2	2.1
32	U/Majigi B	3	2	2
33	U/Majigi B	6	3.2	1.6
34	U/Majigi B	3	2.8	2.8
35	U/Majigi B	8	4.8	1.8
36	U/Majigi B	7	5.4	2.31
37	U/Majigi B	6	2.2	1.1
38	U/Majigi B	6	2.9	1.45
39	U/Majigi B	6	5.2	2.6
40	U/Majigi B	6	3.2	1.6
41	U/Majigi B	9	3.4	1.13
42	U/Majigi B	6	2.2	1.1
43	U/Majigi B	5	3.9	2.34
44	U/Majigi B	6	2.4	1.2
45	U/Majigi B	6	2.8	1.4
46	U/Majigi B	6	4.6	2.3
47	U/Majigi B	6	4	2
48	U/Majigi B	3	3.2	3.2
49	U/Majigi B	6	3.2	1.6
50	U/Majigi B	9	3.8	1.27
		308	**162.8**	

Wadata ward

S/N	Wards	Average household size	Total weight (kg)	Generation rate (kg)
1	Wadata	5	2	1.2
2	Wadata	6	3.4	1.7
3	Wadata	3	1.4	1.4
4	Wadata	4	2.6	1.95
5	Wadata	6	3.6	1.8

6	Wadata	6	2.8	1.4
7	Wadata	6	2.2	1.1
8	Wadata	3	1.6	1.6
9	Wadata	6	2.6	1.3
10	Wadata	4	1.4	1.05
11	Wadata	6	1.4	0.7
12	Wadata	6	2.4	1.2
13	Wadata	4	3.2	2.4
14	Wadata	2	1.6	2.4

15	Wadata	6	3.3	1.65
16	Wadata	4	2.8	2.1
17	Wadata	6	2	1
18	Wadata	6	1.8	0.9
19	Wadata	6	3	1.5
20	Wadata	3	2	2
21	Wadata	4	1.6	1.2
22	Wadata	4	2.8	2.1
23	Wadata	8	4.2	1.6
24	Wadata	8	2.2	1.8
25	Wadata	9	3.6	1.2
26	Wadata	6	3.8	1.9
27	Wadata	6	1.9	0.95
28	Wadata	6	2.5	1.25
29	Wadata	3	1.7	1.7
30	Wadata	4	2.9	2.2
31	Wadata	6	1.9	0.95
32	Wadata	6	1.8	0.9
33	Wadata	6	3.2	1.6
34	Wadata	9	3.6	1.2
35	Wadata	6	2.8	1.4
36	Wadata	6	3	1.5
37	Wadata	5	1.9	1.14
38	Wadata	6	3.2	1.6
39	Wadata	5	4.2	2.52
40	Wadata	6	2.4	1.2
41	Wadata	6	2.8	1.4
42	Wadata	5	2.2	1.32
43	Wadata	5	3.7	2.22
44	Wadata	6	2.4	1.2
		239	**113.4**	