ASSESSMENT OF SOLID WASTE MANAGEMENT IN SELECTED NEIGHBOURHOODS OF SULEJA, NIGER STATE, NIGERIA

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MSUD/CHSUD/2018/7889

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN SUSTAINABLE URBAN DEVELOPMENT (M.SUD), CENTRE FOR HUMAN SETTLEMENTS AND URBAN DEVELOPMENT, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA

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ABSTRACT

This research Assess Solid Waste Management in Selected Neighbourhoods of Suleja, Nigeria through the identification of the types and sources of waste, evaluation of the existing strategies of waste management, assessment of the effectiveness of the waste management strategies and the examination of the effects of inadequate solid waste disposal on the environment in the city. Data collected with the use of questionnaire, interview guide, and physical observations captured by digital camera were analysed and presented appropriately. This study showed that municipal waste management system in Suleja is old and characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal. As a consequence, it has resulted into serious obstruction of movement, blockage of drainages and severe physical damage with attendant environmental pollution. Key findings include the quantity of waste generated which is 3,388 cubic meters, majorly made up of nylon and sachets water and evacuated by twelve vehicles with waste carrying capacity of 82 cubic meters. The study also establish that majority of the residents disposed their waste to and through cart pushers due to the fact that the waste collection trucks only evacuate waste along the major roads within the town. Field survey results further shows that not all residents of Suleja are benefitting from the waste management services provided and as a result, the residents take part in improper disposal of solid waste into waterways and drainages, on open and vacant spaces and most of the times disposed on roads. Top amongst the proffered recommendations is the establishment of a working and sustainable agencies to adequately manage the growing number and nature of municipal wastes in Suleja and similar settlements in Nigeria and beyond. In order to achieve sustainability, the research highlighted areas for further research which were designed to facilitate the establishment of an efficient urban and municipal waste management system peculiar to Suleja and it surrounding cities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Waste is unwanted or useless materials. Waste is directly associated to human development, both technologically and socially. Oyebode, (2018) sees waste as any material flow pattern that is rejected by the society. Household waste can broadly be view as waste generated by normal household activities. Collection of household waste are different around the world, while some are not organised collection others are collection from door step from ten separate recyclable fractions using multi-compartment vehicles (Dahlén & Lagerkvist, 2008).

In most of the rapid developing countries, it is important to engaging household waste as a policy problem. Good wastes management system involves the use of policies and regulation specifically aimed to control wastes at the household level and integrated municipal and economy-wide waste reduction efforts have been carried out with mixed outcomes (Tadesse, Ruijs, & Hagos, 2007). An effective management of solid waste the reuse, recycling, source reduction and safe disposal at at sequential hierarchy. Choe and Fraser, (1999) as noted by Tadesse, Ruijs, and Hagos (2007), stated that household waste reduction efforts both at the source and by means of numerous techniques such as recycling, reuse and composting determine the optimal waste management scheme. They further revealed that the way waste are disposed affects the environment as well as the waste generated. While develop world have an effective waste dump site, many cities of developing countries widely dump waste in open areas, roadsides, and valleys. This unacceptable trend calls for a systematic solid waste management in developing nations of which Nigeria, is not an exception. However, such a system or strategy must

be cost effective to be sustainable. An effective solid waste management is very vital for proper understanding of household waste generation, individual attitudes, beliefs as well as perceptions of generators, for a meaningful strategy (Longe, Ukpebor, & Omole, 2009). Household waste may constitute a large proportion of municipal solid waste. For instance, in 2004/2005, it was estimated that household waste amounted to 30 million tonnes out of 36 million tonnes of municipal waste generated in the United Kingdom (Longe, Ukpebor, & Omole, 2009). Similarly, Cummings, (2005) as noted by Longe, Ukpebor, and Omole, (2009) was of the view that household waste could constitute over 90% of municipal solid waste. Therefore, it is important to note that the methods of household waste collection and disposal utilised will to a greater extent determine the success or failure of any solid waste management strategy in a city.

Nigerians constitute the habit of dumping solid waste indiscriminately especially along the road side within the municipalities. This trend have made Nigeria cities that were once tourist centres to look dirty and not habitable for human living as compare to other countries. The Nigeria commercial cities of South West such as Ibadan and Lagos in 2010 while in 2015 cities like Onitsha and Aba in South East also join the list. This trend is witness in almost all Nigeria cities as solid waste is seen lying along the roads, on drainages and in empty space. In Nigeria the environmental and sanitary situation resulting from unplanned settlement development many cities are many. (Ejaz, Akhtar, Nisar, & Ali-Naeem, 2010). As result of ineffective public awareness and poverty, city inhabitants are compel to live with the unpleasant environment that is not good for their hygiene and health unhealthy. Uncoordinated solid waste management system can aid to worsening degradation of environment of the community. Improper communal solid waste dumping account for many ills in Nigeria.

In order to achieve sustainable economic growth and development there is need to reduce the global ecological footprint by reducing the way we produce waste from goods and services. The municipal solid waste collection and disposal is viewed as an important public service and has vital impact on public health and the outlook of cities and towns (Mohsin & Chinyama, 2016). Waste management plays crucial role in the world cleanliness and sustainability drive. The government responsibility is concern with people's health and conservation and the importance solid waste management cannot be overemphasised because when done properly, solid waste management plays a vital in the protection of the environment and the health of the population.

1.2 STATEMENT OF PROBLEM

Solid waste management systems encompass all actions that seek to minimize the negative impacts of waste on health, environment and economy. Developing countries of which Nigeria is among, are seriously facing the associated problems in collection, transportation and disposal of household waste. Solid waste management in Nigeria is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal of solid waste (Joseph, 2015). The challenge in handling solid waste management in Nigeria is the ineffective institutional framework that will effectively tackle the problem. This is due mainly to lack of political will and misunderstanding of the magnitude of the problem that waste poses to the society and the inability of authority to take cognizance of the dangers posed by solid waste such as clogging of sewage channels resulting to flooding, malaria from stagnant and stored water, and other forms of diseases (Joseph, 2015)

Mohsin and Chinyama, (2016), were of the view that the collection and disposal of municipal solid waste is considered a vital public service with crucial impact on public

health and the outlook of towns and cities. However, the management of the generation, collection and disposal of solid waste is mostly not efficient in most Nigerian cities of which Suleja is not an exception, deteriorating environment quality as well as posing risks for public health regardless of the fact that a huge budget is spent on solid waste management annually. Lack of technical expertise, lack of funds, less priority to solid waste management system and weak institutional framework are the major constraints for efficient and effective solid waste management in developing countries. (Mohsin & Chinyama, 2016). This research is examining household waste collection and disposal methods in the various neighbourhoods of Suleja, Niger state. This would go a long way in assisting relevant stakeholders and city administrators ascertain what strategies to employ to enhance the effective and efficient waste management in order to better serve the people, keep the city clean and protect the environment.

1.3 AIM AND OBJECTIVES

1.3.1 Aim

To assess household waste collection and disposal methods in neighbourhoods of Suleja, Niger state.

1.3.2 Objectives

In order to achieve the aim of the study, the under listed objectives are outline to:

1. Identify the types and sources of waste in Suleja
2. Evaluate the existing strategies of waste management
3. Assess the effectiveness of the agency responsible for waste management in Suleja

4. Examine the effects of inadequate solid waste disposal on the environment in the study area.

1.4 SCOPE OF STUDY

The spatial scope of this study intends to dwell on household solid waste collection and disposal methods in neighbourhoods of the city of Suleja while the content scope is limited to types and sources of waste, strategies of waste management, effects of inadequate solid waste disposal on the environment in the study area. The temporal scope will cover all the household solid waste management systems in Suleja as at March, 2020.

1.5 JUSTIFICATION OF STUDY

Researches has shown that solid waste management plays a major role on public health and the outlook of cities and towns and further influence the social and economic development of a city. Therefore, the degree of effectiveness and efficiency of the system effects the image and the development of a city. This study wants to demonstrate an aspect of understanding on the strategies to use or adopt by government and stakeholders to keep a clean and good environment, as this will go a long way in control of a lot of sickness, diseases and clogging of water ways which eventually lead to flooding.

This research will greatly affect planners, policy makers and the public to evolve rational and sustainable policies on proper solid waste management and disposal practice in Suleja. The findings in this research will arouse awareness and involvement of residents within and outside the city and neighbouring states around in solid waste management for sustainable and responsible environmental management.

1.6 THE STUDY AREA

Suleja is a city in the North central region of Nigeria. It is also a local government area of Niger state and among the 36 state of Nigeria and it is one of the local government area sharing boundary with the Federal Capital Territory (FCT) (Niger State Facts and Figure, 2009). As one of the closest urban settlements bordering Abuja, Suleja has provided residency to many of the low-income workers and informal sector employees who work in Abuja, but could not afford the exorbitant rent of housing charged in almost all parts of the city. As a result, Suleja has become some kind of sanctuary to this large number of low-income groups and has continuously witnessed massive inward population movement and expansion over the past couple of decades. The desire to meet the shelter needs of this group of people, among other factors, has led to the development of all forms of housing structures and sometimes on marginal lands, many of which are built without due regard to extant building development regulations and standards in the country (UN-Habitat, 2003).

1.6.1 Location of Suleja

Suleja town is the main town and the headquarters of Suleja Local Government Area of Niger State, Nigeria, lies between Latitudes 9º6’13.8’’ and 9º17’49.35’’North of the Equator and Longitudes7º6’58.6’ and 7º12’18.41’ East of Greenwich Meridian. Suleja Local Government Area has a population of 216,578 with 10 political wards (NPC, 2006). The strategic location of Suleja has had the most profound effect on its development and its potential growth in the near future. It is a rapidly growing medium-

sized city whose growth was in part attributed to its closeness to Abuja, the nation's capital city, with a distance of approximately 70 kilometres.

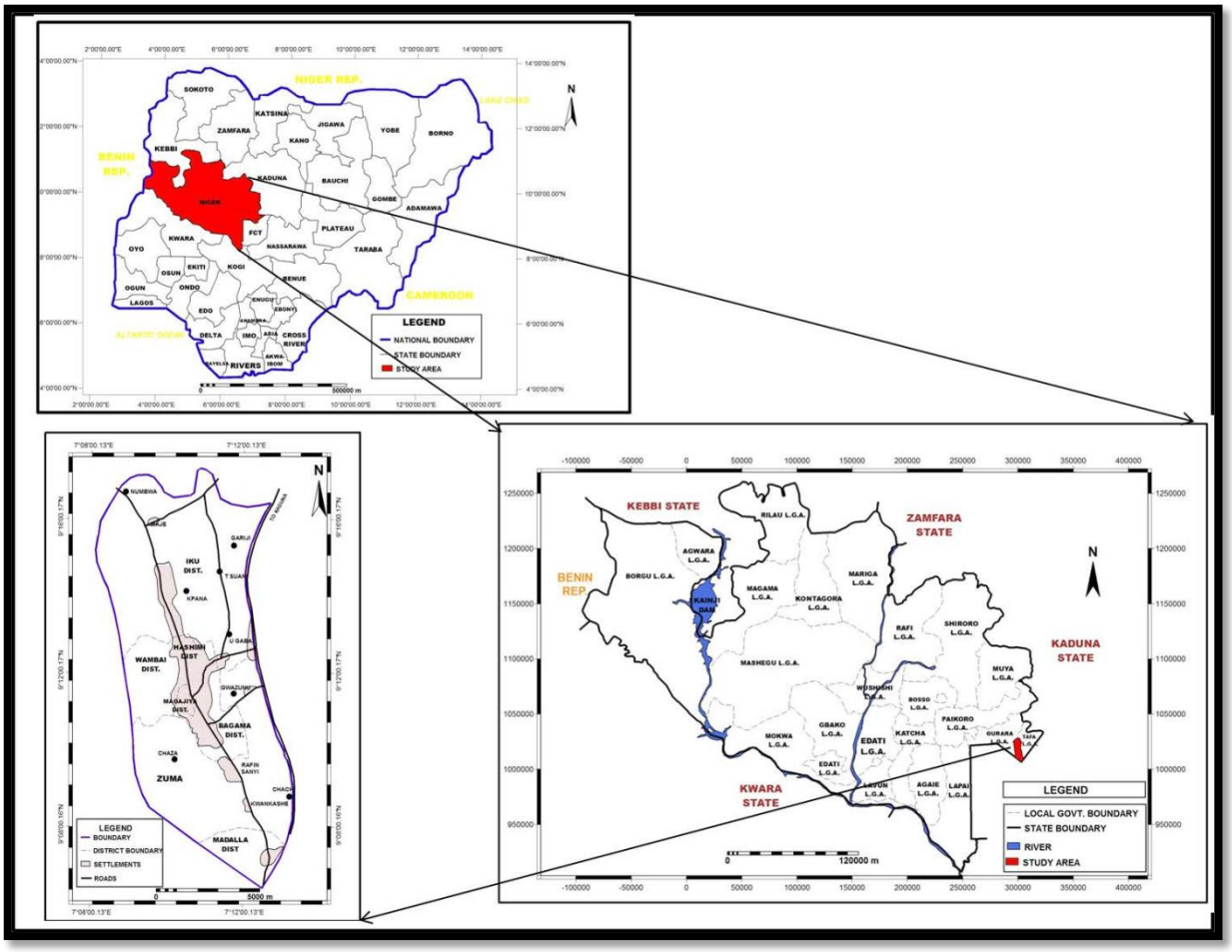

Figure 1.1: Administrative Map of Nigeria highlighting the Study Area
Source: Adopted and Modified by Author 2020

1.6.2 CLIMATE OF SULEJA

1.6.2.1 Rainfall in Suleja

Suleja has a mean annual rainfall of 1328 mm (52.3 inches) which have been observe in a long record of 54 years. September is the highest mean annual rainfall with almost 300 mm (11.7 inches). The rainy season start between the 11th – 20th April and span between 190-200 days.

1.6.2.2 Temperature of Suleja

Suleja mean annual temperature is 26.3^0C (79.3^0F) and lowest in august at 21.5^0C (77^0F). This happens as a result of the seasonal differences of the solar variation during wet and dry seasons.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 THEORETICAL FRAMEWORK

2.1.1 Theory of Zero Waste

Many views on solid waste management were promulgated through various studies which gave birth to zero waste management viewed by (Snow and Dickinson 2001, Spiegel man 2006). Zero waste is a set principle which entails the prevention of waste and the resource life cycles that encourages the redesign of all product and reused. Zero waste is opposed to the end of pipe waste management instead of waste prevention. In a Zero waste system, waste are recycled until the optimum level of use.

Young et al., (2010) opined that Zero waste constitutes more than disposing waste through recycling and reuse, pointing more to reorganizing manufacturing and disposing systems to manage waste. An important thought of the Zero waste viewpoint is that it is more of an objective, or ideally relative than a hard end. Though it is completely difficult to get rid of waste due to physical constraints or excessive costs, Zero waste gives guiding principles for continually working to remove wastes as a whole.

Snow and Dickinson (2001), stated that there are several successful cases around the international communities which originates from the running of the Zero waste philosophy. However, Townsend (2010), argued that Zero waste viewpoint was adopted as a guiding standard by many governmental organizations and also industries. Since the focus of Zero waste is to remove waste from the beginning, then it's requires serious

participation mostly from industry and government because they have been presented with various advantages over individual people.

Similarly, Connett and Sheehan (2001) were of the view that Zero waste cannot be achieved without significant labour, hard work and efforts from government and industries since they have the means to monitor produce and wrapping design through production processes and waste collection. Townsend (2010) also opined that the government have the capacity to build up a waste management capable of making readily available subsidies to the manufacturing of sale, design that will comprehensive waste management that will manage and completely remove waste. Snow and Dickinson (2001) contended that with the heavy participation of industry in discharging waste, wholesale manufacturing duty cannot be over emphasized because of its salient involvement in zero waste management. Ministry for Environment (2010), revealed that in 2002 the New Zealand came up with a waste management scheme that constitute a goal of achieving Zero waste, thereby making New Zealand the first country to initiates a public goal of meeting Zero waste strategies. They were able to achieve country substantial progress, although it was challenging in measuring growth and achievement towards their goals.

2.2 REVIEW OF PAST LITERATURES

2.2.1 Concept of Waste

Waste can be defined as unwanted or useless materials. Waste is linked directly to both technological and social human development. While some waste thrown away by some may be of value to others and hence waste can be subjective concept. Recently, it is widely recognized that waste materials are a valuable resource. Waste can be defined as any material flow pattern that is rejected by the owner or the society. According to the

European Union (EU) Waste Framework Directive 2008/98/EC, waste is any material that is throw-outs or that may not be required again and is discarded. In addition, municipal waste consists of waste that is generated, collected by the authorities in an organised form and it is discarded via the approved means that is created by the authorities collected by or on behalf of municipal authorities (UNEP, 2011).

According to Oyebode, (2018), industrial or domestic human activities generates waste, which can threaten the environment and health of people living around it, if not properly disposed. Though, many studies have been undertaken in the past aim at ensuring that solid waste disposal such as dumping, burning as well as landfill so that to curtail the contamination, pollution and harmful effect of the environment. The issue of improper waste disposal resulting from industrial revolution, the environmental pollution, increasing population and climate change issues have been in the forefront in recent time (Oyebode, 2018). According to Adejobi and Olorunmbe and Amuda et al., Human activities generate large volume of waste in many of our cities which is a reflection of the population explosion, urban growth and social development, exploitation of resources and unregulated technological advancement. The pollution emanating from the uncoordinated waste disposal have consequences on the environment and the health conditions of the populace (Oyebode, 2018).

2.2.2 Urbanization and Solid Waste Generation

Urbanization and generation of solid waste are interrelated and as such it vital to momentarily ponder on the urban growth issues as it influences waste generation. In 1950 the population of World that lived in urban area was 30%. The population of the world living in urban centres is presently estimated to double by 2050, rising to about 66%. Currently, urbanization in Sub Sahara Africa is increasing at a geometric rate

compare to other parts of the world. Though, Africa is the least urbanized as at 2016, and it has been projected that by 2050, about 56% of the population in Africa will be urbanized (Ziraba, Haregu, & Mberu, 2016). Urbanization is a trend tha is ongoing while cities still function as the engine room for economic development growth and associated waste generation that is, going by the current trends. Urban centres in the coming decades will bear the burden of ill-health as a result of poor waste management. Given the per capita waste generation in the developed world which is highest, and which also have better waste management practices the mitigation of adverse health impact contained (Ziraba, Haregu, & Mberu, 2016).

The continued increased in waste volume generated and the ineffective waste management practices in fast growing urbanizing and developing economies like China and India portend health risks. The human activities and their by-products are now seen as the major cause of present climatic and the world environmental changes that have impacted on the health and wellbeing (Ziraba, Haregu, & Mberu, 2016). Similarly, at a local level, a lot of human activities produce waste and these formed major drivers of environmental and health challenges among which includes diseases that are infectious malaria, dysentery cholera, respiratory complications and injuries among others. The continued growth of urban population implies that more solid waste, and higher impact on environment and health will be witnessed. As such the increased solid waste have resulted into increased demand on available solid waste management services, which abound in countries in African, with largest budgetary item for local governments (Ziraba, Haregu, & Mberu, 2016).

Urbanization in many Africa countries do not matched with more provision of social amenities and economic opportunities, as majority of cities still struggles to provide basic services such as shelter, water and clean maintenance of environment amongst

continuing growing though largely poor urban population. It is believed that urban centres have better opportunities as well as better wealth, better education and health. Thus looking at the angle of health, urban populations have overall better health indicators historically when compared to rural populations and it is known fact that urban centres have advantage in terms of health facilities. And given the new urban challenges of poor waste management, the advantage of health in the urban centres is being threatened (Ziraba, Haregu, & Mberu, 2016).

2.2.3 Solid Waste Management

Vergara and Tchobanoglous (2012) opined that more wsate is produced as population continue to grow and the increase in purchasing power there will be demand for more goods to be produced and this in turn result to generation of more. Marchettini et al. (2007) revealed that the envronment is overburden by the continous release of waste from human activities. Vergara and Tchobanoglous (2012) also stated that in order to reduce the negative effect of waste on the environment, a proper planning and effective control measure is required. As a result, Ghiani et al. (2014) also opine that in order to safeguard the environmemt, solid waste management needs to be properly organised and made it a task indispensable. Beranek (1992) further said that important amenities can be linkened to solid waste management sysytem if we are to achieved a good environment. In line with this, Basu (2009) opined that as a result of increase in waste volume, and the incessant landfill waste disposal is no longer sustainable. Hence, Basu maintains that the processing of waste is a prerequisite step needed to ensure public health (Amasuomo & Baird, The Concept of Waste and Waste Management, 2016).

The Basel Convention (2010) defines solid waste management as the collection, transportation and disposal of solid waste or other wastes, including after-care of

disposal sites. According to Kumah (2007), solid waste management involves numerous activities that encourage for the collection, source separation, storage, transportation, transfer, processing, treatment and disposal of solid waste (AyuekanbeyAwaab, Combert, & Atongdem, 2018).

Additionally, Rouse (2008) as noted by AyuekanbeyAwaab et al, (2018), indicated that the basic concept of solid waste management consist of the collection, storage, transportation, processing, treatment, recycling, and final disposal of solid waste. He further opined that the solod waste management system have to be simple, affordable, sustainable, economical efficient, environmentally sound and socially acceptable in providing the service for both the poor and wealthy households (AyuekanbeyAwaab, Combert, & Atongdem, 2018).

According to Karija, Shihua, and Lukaw, (2013), the current municipal solid wastes management practices in the developing countries especially collecting, processing and disposing are seen to be inefficient. The emblematic problems arising from burning of waste as well as open dumping not treated and left without air and water pollution couple with low collection coverage and irregular collection services, which breeds insects including flies and the control and handling of uncoordinated waste such as scavenging as well as picking from environment. They further opined that large volume municipal solid wastes produced in urban centres of the developing countries left uncollected. Due to the unregulated waste that is often combined with human and animal excreta is disposed uncoordinated along the roads and in drains, which in turn result to spread of diseases, insect and rodents as well as breed insects and flood (Karija, Shihua, & Lukaw, 2013).

2.2.4 Solid Waste Management Strategies

Solid waste management practices and strategies differs between regions as well as countries and also are different between countries too. The recent approaches to management of solid waste motivates reduction of generated wastecomposting, recycling, re-use, and safe disposal via landfills, though, they have not been put into practice (Ziraba, Haregu, & Mberu, 2016). In developing nations most of the waste is not re-used. Sorting of waste is also not put to use and this makes it hard to compost or re-cycle. This has resulted to disposal of large solid waste proportion in developing nations on open dump sites or are burnt openly atimes (Ziraba, Haregu, & Mberu, 2016). Availability of funds, policies on waste management, existing laws, waste composition and its quality generated as well as the enforcement extent are waste management strategies that reflects on the efficiencies.

Both the Government authorities and private waste management are are responsible for waste management in many devlopingcountries.Mostofbthe waste collected from the soiurce and dumped on the ground for collection are disposed of in the outskirt of the cities or towns usually in an open space. The waste arediposited on an open site used by truckload for dumping waste. The waste scavengers searched for usable materials in the dump waste while the rest are burnt to minimize the bulk of waste. As a result of ineffective sorting of solid waste which are mixed with other forms of waste like industrial, medical, human waste and electronic, the wsate is dumped all together on an open open with other municipal waste (Ziraba, Haregu, & Mberu, 2016).

In a study carried out by Azuelo, Barbado and Reyes, (2016) on the assessment of the existing solid waste management strategies in Camarines Norte, Philippines, it was revealed that the solid waste management and existing strategies and the level of the provided waste system in the twelve municipalities are trucks for conveying solid wastes and study on waste separation that was to be conducted at every

household/establishment. From the six areas examined, only four cities were found to have more and highly effective solid waste management strategies therefore, high level of effectiveness was required for significant impact on the solid waste management. At whole, the technology made available for composting was viewed more effective and utilised in all municipalities. It was further recommended that efficient solid waste management could be fully achieved through the active participation and commitment of the implementers in enforcing the passed resolutions and commitment of their initiatives that will pave way to active involvement of the community (Azuelo, Barbado, & Reyes, 2016).

2.2.5 Disposal of Municipal Solid Waste

The most common environmental issues in most developing cities is the collection, management and discard of the municipal solid waste. Abdel-Shafyand Mansour, (2018) opined that inadequate municipal solid waste management and disposal result to important environmental issues such as soil, air water, and aesthetic pollution. These environmental issues are intertwined with human health disorder, given rise to the influence in greenhouse gas emissions (Abdel-Shafy & Mansour, 2018).

Streams of waste emanating from industrial sources differs than the hazardous waste from household substances. The hazardous household wastes are discard into landfills together with other waste from household. The amounts of quantity and the importance of the poorly disposed waste are comprehended as it is always viewed that the quantity of hazardous household wastes is small, and thus, the disposal risk cannot be neglected. However, disposal of separate municipal, industrial solid waste, and some wastes raises the significance of the hazardous and toxic substance contained in such wastes (Abdel-Shafy & Mansour, 2018). There is growing concerns about the existence of many chemicals in the household products. The implication of this to and to the environment

results from the disposal of household hazardous wastes are also of concern. Thus, the disposal of such household hazardous wastes to landfill should, hence cope with present regulation so to minimize the environmental risk (Abdel-Shafy & Mansour, 2018).

According to Abdel-Shafy and Mansour, (2018), about 71% of municipal solid wastes are disposed of in landfills globally. Municipal solid waste consist majorly of hazardous substances such as pharmaceuticals, batteries, paints, vehicle maintenance products, mercury-containing waste among others. More so, over 53% of waste from landfilled comprises of hard board paper, yard waste that are biodegradable by the anaerobic bacteria and papers. Thus, primarily, landfills is the major method of disposing waste in the Europe and USA (Abdel-Shafy & Mansour, 2018).

Landfills constitutes one of the major municipal solid wastes and many other solid wastes disposal. Hence, it is very significant to understand the basic design of landfills. This will require not just an open space for slated for waste dump but a highly engineered facilities and site being design and provided. The capture polluted water that contains waste as well as regulate gas in landfills are separated from migration to environment. A typical landfill site is collected and excavated and formed into lined system with layers for protection of groundwater by reducing leachate migration to the ground and the treatment of such leachate (Abdel-Shafy & Mansour, 2018).

2.2.6 Household Waste Collection and Disposal

Most cities of developing countries, waste management is poorly handle as solid waste are dumped into open space, by the roadsides and thereby endangering health of the inhabitants and attracting vermin. In their study of household collection and disposal in Mekelle (Ethiopia) carried out by Tadesse, Ruijs, and Hagos, (2007), which examined the consequences of economic and social status, population factors and the attribute of

environment on solid waste household disposal. It revealed that solid waste collection service at household level was basically conducted with the aid of the fixe-point communal containers collection and door-to-door collection by tractor service. The basic practice for the collection of waste and disposal was communal containers service where containers are positioned in a particular place where they will be access and very close to the household. Factors such as population density, location, road accessibility to loaders, and health impact were considered in the siting of these containers. Households were expected to dispose their wastes into the nearby containers when the need arise, but it was continuously observed that a full container would remain uncollected for days giving rise to the households disposing their waste indiscriminately on ground, by the roadsides close to the container and in open places. Majority of the residents had to walk a long distance to dispose their waste in the collection point and as a result that they are likely to dump there was waste in an open space by the close by roadsides times resort to dumping their waste on the nearby roadsides and in open space (Tadesse, Ruijs, & Hagos, 2007). They further revealed that the availability of waste facilities was inadequate, lack of constant collection of solid waste services and the collection arrangement as well as disposal services by the municipality was also not commendable. Though there were some others involved in the household collection of wastes in the city municipality were the final disposal of waste. The final disposal of solid waste was done at two uncontrolled open dumping sites outside of the city, of about 10 km away from the city (Tadesse, Ruijs, & Hagos, 2007). In determining the factors that affect household waste disposal decision making, household level data were analysed using multinomial logit estimation. It was revealed that features of demography like education, household size and age play an unimportant role in selecting waste disposal means, likewise inadequate supply of waste facilities vitally

influence the disposal of choice of waste. Also, it was noted that the distance coverage in accessing the containers as well as the inadequacies probably encourages dumping of waste in roadsides and open spaces instead of using the containers. Those household with higher income are likely not to dump waste along roadsides compare to those using communal containers (Tadesse, Ruijs, & Hagos, 2007).

In another study of the pattern of household collection of waste and disposal in Ojo Local Government Area of Lagos metropolis embark upon by Longe, Ukpebor, and Omole, (2009), many people were of the view that the evaluation of household waste management and disposal using statistically designed household survey to conduct their study. The survey sampled 60 households have divergent economic and social characteristics that target 120 respondents considering important household characteristics including educational attainments, age distribution and gender. The feedback obtained indicates that Private Sector Participation (PSP) collection of waste from household was inefficient in both the collection and disposal system, characterised with lack of proper coordination, inadequate equipment and tools, inconsistencies in the collection of waste and the collection frequency. Results also shows that household sorting and separation of waste was absence. Although the respondents were willing to pay for the services of waste management as it is done in some places however, they opined that payment should be commensurate with amount of waste produced. (Longe, Ukpebor, & Omole, 2009). It was further argued that to sustained the present solid waste management system would significantly be subject to the services of PSP improvement in terms of quality service and since private sector participation is getting acceptance by the people, and its participation could be made so competitive so as to bring high quality service delivery (Longe, Ukpebor, & Omole, 2009).

2.2.7 Solid Waste Management and the Environment

Uncoordinated waste disposal of municipal solid waste and management result in different pollution such as water, soil, and air. Uncontrolled wastes dumps contaminants the water supply of both surface and ground. In cities, solid waste from municipal clogs drains, giving rise to stagnant water which harbours insect and also during rainy seasons cause flooding. According to Alam and Ahmade, (2013), thcontinous burning of solid waste from municipal and uncoordinated incineration largely account for cities air pollution. Greenhouse gases emanated through the organic decomposition of landfills waste, and the lack of treatment of leachate causes pollution to surrounding water bodies as well as soil. Improper municipal solid waste management have implication on health and safety issues. This breeds rodent vectors and rodents that dwells on the waste and which in turn causes outbreak of illness like dengue fever and cholera (Alam & Ahmade, 2013).

In developing nations, solid waste management is further compounded by practices that unstainable which give rise to the contamination of environment as well as diseases spread. Most especially, in open waste dumping controlled sites, open burning of waste materials and the improper controlled of the leachate produce in final sites disposal which are detected as the main problem. The trend is exacerbated areas of slums with more problems of high population density, air, traffic, and water pollution (Ferronato & Torretta, 2019). Indiscriminate waste dumping in open space around water bodies are problems that have culminated into many and corresponds to issues public health. With respect to open air final disposal, the major impact detected on the environmental includes among others:

- visual impacts,
- air contamination, odours and green-house gasses (GHG) emission,
- vectors of diseases,

- surface water and groundwater pollution.

Those are prominent issues around the world. Ferronato and Torretta, (2019), revealed that the dump site was situated in a highly populated area, which are unsightly to the inhabitants in Banjul (Gambia). This had a negative impact visible to the people and new comers to the country. Smoke coming out from burning debris was the major problem which are common in some residential areas, which thus, affects the quality of life of the populace. However, the inhabitants were disturbed from the smell of waste decomposition emanating from the burning debris (Ferronato & Torretta, 2019). The pollutants were further compounded and infested by flies and insect in the period rain. The contaminants resulting from dump site run off found their way into water bodies, while the leachate further infiltrate the soil and groundwater. Furthermore, contamination of the environment was as a result of significant of faecal and whole coliform that polluted the wells situated near the site. Those households that reside near to the dump site most use the waterb in the area containing large volume of coliforms as result of closeness to the dump site use (Ferronato & Torretta, 2019).

Similarly, in Phnom Penh which is the capital city of Cambodia, the municipal solid waste management system do not have effective regulation, households waste are commonly burned, buried, or dumped about 361,000 tons of municipal solid waste as at 2008, and 635,000 tons in 2015 (Ferronato & Torretta, 2019). In Thailand, over 60% of the final solid waste discarded were embarked upon by dumping openly. Of the 425 waste disposal sites in 2004, that constitutes 330 open dumps, as many as 25 tons waste were collected from the disposal site per day, while 4500 tons of waste was received by Bangkok landfills per day (Ferronato & Torretta, 2019). The Palestinian territory West Bank, in 2005, approximately stated that the municipal solid waste produce was put at 2,728 tons per day, while in 2001 there were 133 municipal solid waste dumpsites, 116

open burning activities at sites and burial at 13 sites; 64.9% of the populace consented that environmental problems and consequences that come with open dumpsites, and 41.6% said that they encounter some problems emanating from the final disposal environment (Ferronato & Torretta, 2019). In Nigeria and Abuja in particular, over 250,000 tons of waste were produced in 2010 alone. As a result of odour, air pollution and burning wastes at the site in 2005, the four major waste dumpsites under its management were closed. More so, leachate from buried waste rise to the surface, in the rainy seasons (Ferronato & Torretta, 2019). In Maputo, administrative centre of Mozambique, with about 1,200,000 populace, about 0.5 kg of waste per populace were produced daily, the municipal solid waste was conveyed to the designated waste site of the city, that have been existing for over 40 years. The area was of about 17 ha, with heights that achieved 15m; open fires and auto ignition of the waste were main problems, contributed to more than 500 waste pickers collecting recyclables waste at the dumpsite. Hence, solid waste management challenges are peculiar all over the world with consequences environmental as well as hazard for the population (Ferronato & Torretta, 2019).

2.2.8 Effects of Solid Waste on Human Health, Animals and Environment

Apart from the unpleasant visual effect of mismanagement of solid waste has on the aesthetics of the city, the uncoordinated handling of solid waste pose a risk to the inhabitants, the environment and the health implications. The major concern is the protection of the filed staff that have a direct health risk due to coming in contact with the waste in their daily work. Also, hospital and clinic staff will also need protection as result of coming in the contact with waste in the daily jobs. The breeding of insects,

rodents' rats and flies is the major risk for the general for the general public (Alam & Ahmade, 2013).

Municipal wastes combining with uncontrolled hazardous wastes from industries bring about possible risks to human health. Alam and Ahmade, (2013), stated that accidents from traffic can come from spilled toxic wastes. There are peculiar consequences of concentration of issues of waste that state the relationship of heavy metals in the food chain, systems in an open dump site which and the discharged of waste consisting of heavy metals discharged in drainage or sewerage system and the wastes released thereby maintains a vicious cycle among other types of menace such as

- Chemical poisoning through chemical inhalation
- Uncollected waste can obstruct the storm water runoff resulting in flood
- Low birth weight
- Cancer
- Congenital malformations
- Neurological disease
- Nausea and vomiting
- Mercury toxicity from eating fish with high levels of mercury
- Plastic found in oceans ingested by birds
- Resulted in high algal population in rivers and sea.
- Degrades water and soil quality

Alam and Ahmade, (2013) were of the opinion that the waste decomposition into constituent chemicals is a recurring source of community of pollution on environmental particularly extreme in developing countries. They further stated that the world's poorest countries have few existing landfills that would go environmental accepted standards in advance countries, there are likely to be few sites rigorously examine

before to use because of limited budgets in the nearest future. These issues are also compounded by the problems linked with fast growing population (Alam & Ahmade, 2013).

Cointreau-Levine, (1997) pointed out that decomposing gas released in garbage pose an environmental dilemma due to the thriving of bacteria in landfills that contains large moisture thereby releasing methane, which is a by-product of the anaerobic respiration of bacteria, into the atmosphere. The concentrations of methane will get up to 50% of the landfill composition gas at maximum anaerobic decomposition (Cointreau-Levine, 1997). Another setback with these gasses is their resultant effect on climate change and enhanced greenhouse gas. In developing world, landfills liquid leachate management varies. The surface local and ground water systems are threaten by leachate. The optimum strategy to curb excess liquid is the use of dense clay that is deposited at the bottom of waste pit and that is combine with plastic liners to prevent infiltration of waste to adjoining soil. As such waste is made to evaporate instead of infiltration. (Alam & Ahmade, 2013).

In a study of environmental impacts of improper solid waste in Rawalpindi, it was reported that, ineffective solid waste dumps were aiding in the springing up of various diseases in the town. The study of solid waste in Rawalpindi revealed that as a result of rapid population explosion couple with lack of funding as well as weak legislation and deficiencies in management of solid waste management were not effectively working (Ejaz, Akhtar, Nisar, & Ali-Naeem, 2010). Unintended invasion of the city, lack of social enlightenment as well as community participation, extreme weather conditions, lack of fund and uncoordinated resources and inadequacies of equipment. According to Ejaz, Akhtar, Nisar, and Ali-Naeem, (2010), environmental problem such as drain

obstruction,water and land pollution, infectious disease and biodiversity loss are serious impact created by inefficient municipal solid waste system.

2.2.9 Overview of Solid Waste Management in Nigeria

Management of solid waste is a very demanding environmental problem encountered by rural and urban dwellers in Nigeria as the population exceed 170 million, Nigeria generates one of the biggest solid wastes in Africa. Management of solid waste in the Nigeria have reach mind blowing proportions day passes by even with lots of policies and regulations. According to Oyebode, (2018), only 20-30% of around 3.2 million tons of the produced solid waste is collected in Nigeria annually.

The Municipal solid waste in Nigeria is characterise by sewers blockage and drainage lines and choking of water bodies as a result of poor and reckless of waste disposal. The household generated waste mostly from local industries traders and artisans are found littering the urban environment (Oyebode, 2018). Presently, the environmental problems aimed at municipal solid waste collection and disposal are marred by poor budgetary provisions for the implementation of coordinated waste management policies all over the States in the country (Oyebode, 2018).

The United Nations Habitat Watch, stated that populations of African cities in the next 40 years will grow geometrically. Cities in Africa are usually characterised by slums; a trend that will further boost urban population's growth and if urgent solution is not proffered will spell disaster. Only few state including Federal Capital Abuja out of the 36 in Nigeria, have initiated and show some commitment by taking some proactive measure to curb the waste problems while many states and yet to commit themselves

and are not shown any interest in fighting the scourge solid waste management menace in their respective states (Oyebode, 2018).

Similarly, Ike, Ezeibe, Anijiofor and Daud, (2018) revealed an estimateof 0.65-0.95 kg/capita/day with an average of 42 millions tonnes of solid waste is generated annually in Nigeria. The problem thus lies with how to dispose over 62 million tonnes of waste produced annually in Sub-Sahara Africa, which is already pose a very serious problems to the country. Using the mixed method of data collection in some selected cities in Nigeria to assess the management of solid waste Ike, Ezeibe, Anijiofor and Daud, (2018) disclosed that as a result of the large monopoly of the management of solid waste in Nigerian cities by government agencies and organizations, the tackling of the meanace of solid waste is incapacitated and not effective. Moreover, additional disposal problems is the 52 % of wastes produced through organic sources. (Ike, Ezeibe, Anijiofor, & Daud, 2018). According to the studies, the issues of management of solid waste in Nigeria for effective and efficient waste management of solid waste in Nigeria strict policies and regulations needs to be put in place as well as significant data base on waste.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

The study was designed to involve collection of data from the field, the sources and types of data, the technique used in collection of data, the equipment used and data analysis procedures. The research uses empirical method of both primary and secondary data collection sources.

Table 3.1: Research Matrix

S/no	**Questions**	**Data Item Required**	**Technique for Data Collection**
1.	Identification of the types and sources of waste.	• Waste types. • Capacity of solid waste generated. • Total number of facilities (Functional and Non-functional)	• Physical observation • Interviews • Maps (Satellite images)
2.	Evaluation of the existing strategies of waste management	• Physical state of the existing waste collection facilities. • Frequency of usage of the existing facilities.	• Physical Observation • Interviews • Questionnaires
3.	Assessment of the effectiveness of the agency responsible for waste management	• Issues of concern for waste management	• Questionnaires • Interviews
4.	Examination of the effects of inadequate solid waste management on the environment and the livelihood of Suleja	• Factors or issues of concern to transportation. • The various environmental challenges linked with waste generation and management	• Questionnaires • Physical Observation • Interviews

3.2 Tools for Collecting Data

3.2.1 Field survey/physical observation

This data collection method involves examining the various existing waste collection facilities, picture photographs of the facilities; and to ascertain their conditions. Also, pictures of the environment were taken to examine the effects of inadequate solid waste disposal on the environment.

3.2.2 Oral interview

Thiswill include conducting physical interview with the inhabitants of Suleja to get the opinion and views on waste management and related issues. Residents were interviewed on their usage, safety concerns as well as challenges. Deductions were drawn from the interview and it guided decision making and recommendations. Also, an interview guide was used to guide the discussion with the office of the Niger State Environmental Protection Agency (NISEPA) in Suleja.

3.2.3 Questionnaire administration

This was carried out by administering written questionnaires to the residents of Suleja. The questionnaire was structured to incorporate the demographic data of the respondents, their views on waste generation, collection and management.

3.2.4 Niger State Environmental Protection Agency (NISEPA)

Datapertaining to waste generation, collection and management and record of waste related problems as a result of improper use of the facilities.

3.2.5 Journals

Previousworks similar to this study were reviewed to have a good understanding of waste management in other parts of the Nigeria and the world in general to get acquainted with current trends.

3.2.6 Field survey/physical observation

3.2.7 National population commission

Dataof the most recent population of Suleja were derived from the national population commission and were used for projection which was the basis for selecting the sample for the study.

3.3 Sampling Technique

3.3.1 Sample Frame: This was derived from the total population of Suleja projected from the 2006 population figure using;

$$Pt = Po\ (1 + r/_{100})^{n}$$

Where:

Pt = Projection Population

Po = Base Population

r = Population Growth Rate

n = Number of Years

According to Owoyele, Ajobiewe, Idowu, Musa, &Ohadugha, 2015 in their study on suleja, the total population projected from the 2006 population census by NPC was 253,662 (2015) comprising nine (9) districts. Therefore, from the above formula, Po = 253662, r = 3.5, n = 5; and, the projected population for 2020 was 301,350.

3.3.2 Sample Size

The sample size for the study encompasses the number of people to be interviewed. The formula of Dillman (2007) for sample size was applied to get the sample size. The formula gives a sample size of 381.

The formula stated that:

$$NS = \frac{(Np)(p)(1-p)}{(Np-1)(B/C)^2 + (p)(1-p)}$$

Where;

Ns= Required sample size

Np= population size

p= proportion expected to answer a certain way (0.5)

B= acceptable level of sampling error (0.05)

C= Z static associated with confidence interval (1.960 = 95%)

Using the formula; **Np** = 301350, **p** = 0.5, **B** = 0.05, **C** = 1.96

Substituting, we have ***NS*** = 301350 × 0.5 × (1−0.5) ÷ (301350-1) × $(0.05 \div 1.96)^2$+ 0.5 (1−0.5) = 381 Samples.

3.3.3 Sampling Procedure

The sampling procedure that was utilised in administering the questionnaire is stratified sampling procedure; where the entire Suleja (the study area) was divided into their nine (9) districts or strata. From these districts, simple random sampling was done at household level.

Three districts were selected from the nine districts which are Bagama, Hashimi, Kabula, KurminSarki, Madalla, Magajiya, Maje&Kwamba, RafinSanyi, and Wambai.

The 3 districts used were selected according to the population of the districts (Owoyele, *et al* 2015). That is, districts with the highest, median and lowest populations. These districts were RafinSanyi, Bagama and Hashimi respectively and samples were selected from them in the ratio of 4:3:2 respectively to cover for the entire 9 districts.The sample size calculated was 381 samples and the distribution by district is illustrated in Table 3.2.

Table 3.2: Sample Size Distribution

S/No	Districts	Ratio	Number of Samples
1	RafinSanyi	4	169
2	Bagama	3	127
3	Hashimi	2	85
Total		**9**	**381**

Source: Field Survey, 2020

3.4 Methods of Data Analysis and Presentation

The researcher employed the use Statistical Package for Social Scientist (SPSS) computer software to analyse the questionnaires. The software was used to produce bar chat, histogram frequencies and percentage that were employed for the analysis of data. The SPSS significantly assist providing explanation of the collected data from the field.

CHAPTER FOUR

4.0 DATA ANALYSIS

4.1 RESULTS AND DISCUSSION

This section dwells on the presentation, discussion and analysis of the data collated using various research instruments, which includes; types and sources of waste, capacity of solid waste generated on a daily, weekly, monthly and yearly basis. It also includes the total number of facilities used for management of waste, evaluation and assessment of the effectiveness of the existing strategies of waste management and examination of the effects of inadequate solid waste management on the environment. The data that was acquired are analyse using in tables, figures and plates, and explanations are discussed appropriately'

4.2 SOCIO-ECONOMIC DATA OF RESPONDENTS

This focused on some identified socio-economic attributes of those interviewed and which the questionnaires were administered. These include neighbourhood of residence, age, gender, educational background, occupation, income, residency status and length of stay in the area.

4.2.1 Age, Gender and Residence of Respondents

The respondents to the questionnaires covers nine age groups. As shown in Figure 4.1, those within the age group 26 – 30 years old has the highest number and constituted 25%, followed by the respondents within the age group 31 – 35 years old which constituted 19%, closely followed by those within the age group 18 – 25 years old which consisted of 17% while age group 36 – 40 years old represented 14%, followed by those between the age group 46 – 50 years old which constituted 7%, also followed

by those within the age group 41 – 45 years old which constituted 6%, followed by those between the age group 56 – 60 years old which constituted 5%, while those within the age groups 51 – 55 years, those above 60 years constituted 3%.

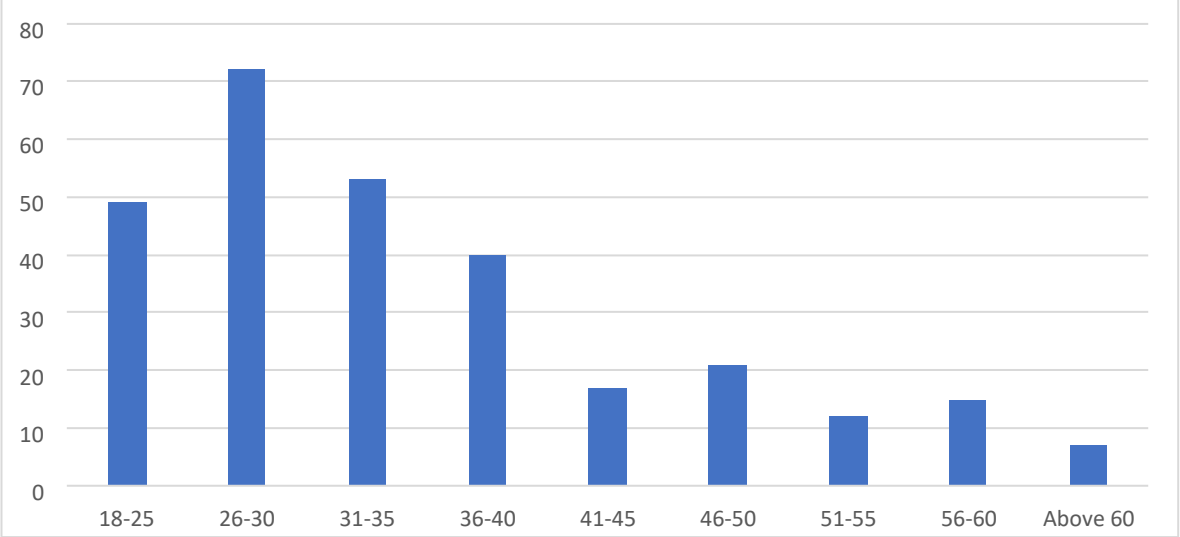

Fig. 4.1: Age structure of respondents
Source: Author's Field Survey, 2021

The age distribution therefore, shows that a sizeable numbers of those interviewed are comparatively youthful and can be considered well-informed with challenges bedevilling around them, including waste generation, collection and disposal services within their neighbourhood.

As regards the gender of the respondents, the male respondents represented 59% of the total, amounting to one hundred and seventy (170) persons while one hundred and sixteen (116) female respondents constituting 41% of the total were questioned. The number of the males were greater because most of the married women approached preferred for the male figure or the household head to react to the questions on behave of the family which was however expected in this part of the country.

As made apparent in Figure 4.2, about 47% of the respondents reside in RafinSanyi, another 34% of the respondent are from Bagama, while those that resided in Hashimi are only 19% of the total number of the respondents.

The number of samples drown from these neighbourhoods was based on the population sizes of the areas under study.

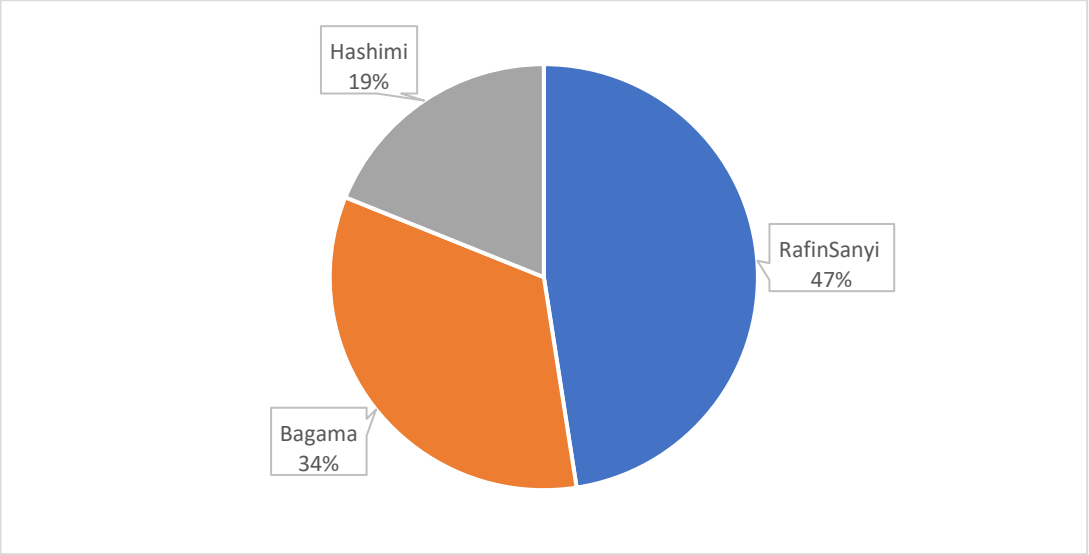

Fig. 4.2: Neighbourhood Residence of Respondents

Source: Author's Field Survey, 2021

4.2.2: Highest Level of Education Attained and Occupation of Respondents

The educational attainment of the respondents shows that respondents with Higher National Diploma (HND) or University Degrees was made up with the highest proportion, which is 38%. Respondents that obtained only a secondary education accounted for 30%, while those holding either National Diploma (ND) or National Certificate of Education (NCE) followed with 21%. Respondents possessing higher degree (Masters/Doctorate) accounted for 5%, those that attained only a primary education amounted to 4% while those that have formal education and those from Qur'anic school constitutes for 1% each. The educational qualification of the

respondents further reveals that majority of them (that is 63%) has attained a National Diploma or higher level of education therefore, they are knowledgeable or exposed to issues pertaining to household and solid waste in the city.

4.2.3 Occupation of Respondents

The occupation engaged by the respondents is shown in Figure 4.3. The figure indicates that (22%) of the respondents were involved in various trading activities, while students/apprentices constituted to 19% and those that engaged in other occupation like consulting, business men and women, teaching and are involve in the private sector also represented another 19%. The public/civil servants constituted 16% and is closely followed by the artisan which were 12%. Retirees amounted to 6% while those among the respondents that were not employed also constituted another 6%.

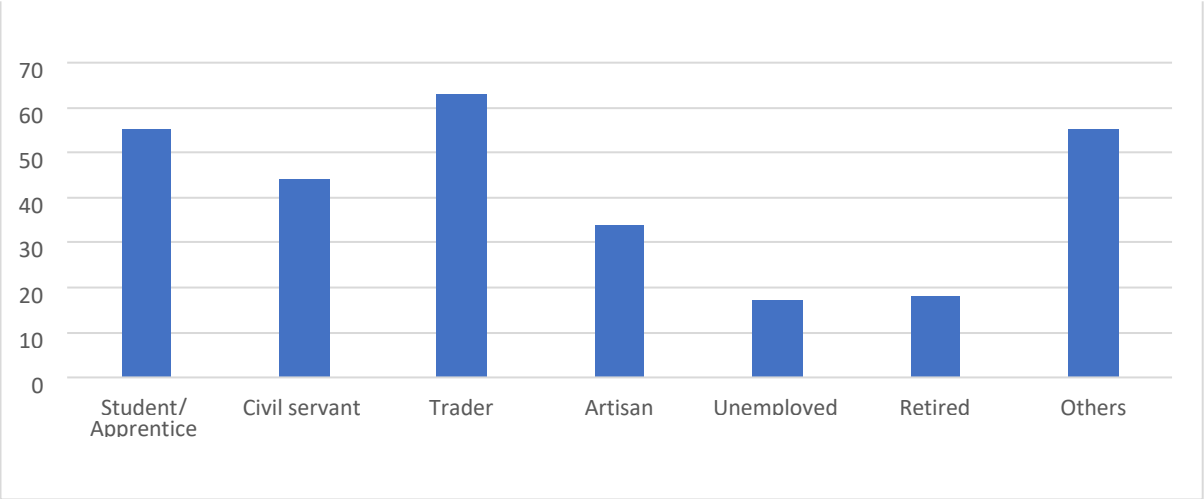

Fig. 4.3: Occupational practices of respondents

Source: Author's Field Survey, 2021

The occupational characteristics of the respondents therefore, reveals and cement the fact that a significant proportion (69%) of the respondents are gainfully employed or are employers of labour in either the public or private sector of the economy and will be able to pay solid waste management services rendered.

4.2.4 Years of Domicile in the Neighbourhood

Figure 4.4 shows how long the respondents has stayed in their present area. Those that had reside in the same area for five years and above is made up 60%, while those that have stayed for four years constituted 14%. The Respondents that have reside in the area for two to three years consist 10%, while those that had reside for five years made up 6%. Those that had stayed for a period of two years, less than a year and just a single year in the neighbourhood represented 4%, 4% and 3% respectively.

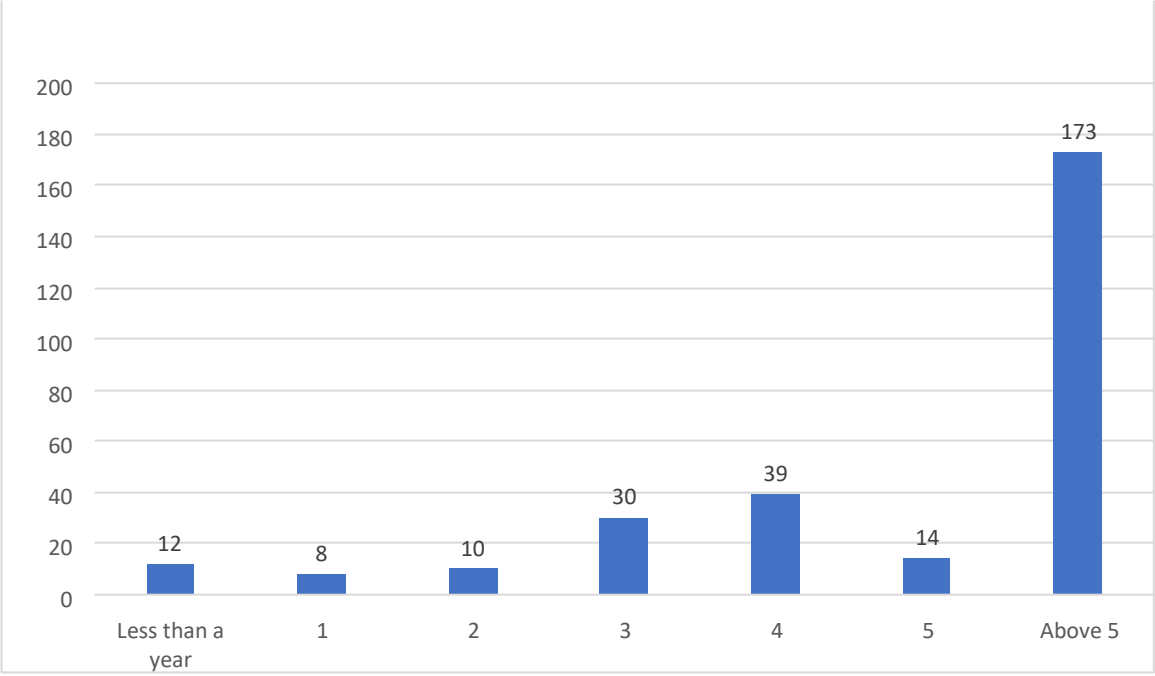

Fig. 4.4: Length of stay of respondents in their present neighbourhoods
Source: Author's Field Survey, 2021

The duration of residency indicates that having reside for at least four years, consisting of above 75% of the respondents had a pretty good knowledge of the situation of solid waste in their area and are well placed to evaluate the existing strategies of waste management and immediate effects of inadequate solid waste management on the environment in their respective neighbourhoods.

4.3 THE TYPES AND SOURCES OF WASTE

This section addressed the types of solid waste in the study area, especially the ones generated within the various resident's households and those observed in the different neighbourhoods of Suleja. Sub-issues addressed include the common solid waste generated, major source of waste in homes and total number of waste management facilities. Capacity of solid waste generated in Suleja in cubic meter as stated by Niger State Environmental Protection Agency (NISEPA) were also calculated and discussed.

4.3.1 Common solid waste in Suleja

Waste is a times a subjective concept as the end product of some people actually have value to to discard items. Although there are so many types of waste irrespective of classification, the research work has been able to narrow it down to the common waste particularly associated with residential neighbourhoods. The common household waste identified are nylon and pure water sachet, paper, food remnants, ash & dust, plastics, and glass/ceramics. These types were labelled common because apart from being generated within the households, they are being generated almost on a daily basis.

4.3.2 Major Sources of Waste in the Home Environment

With the common solid waste identified, the study sort to find out the major source of solid waste from their respective home as this gave insight into the major type of waste generated. As illustrated in Figure 4.5, one hundred and forty-one (141) respondents opined that majority of the household waste comes from the kitchen while one hundred and thirty-one (131) persons stated that packages and wraps were the major source of waste in their homes. Fourteen (14) respondents identified other major sources of waste within their homes which was a combination of both packages and plastic or kitchen and wraps.

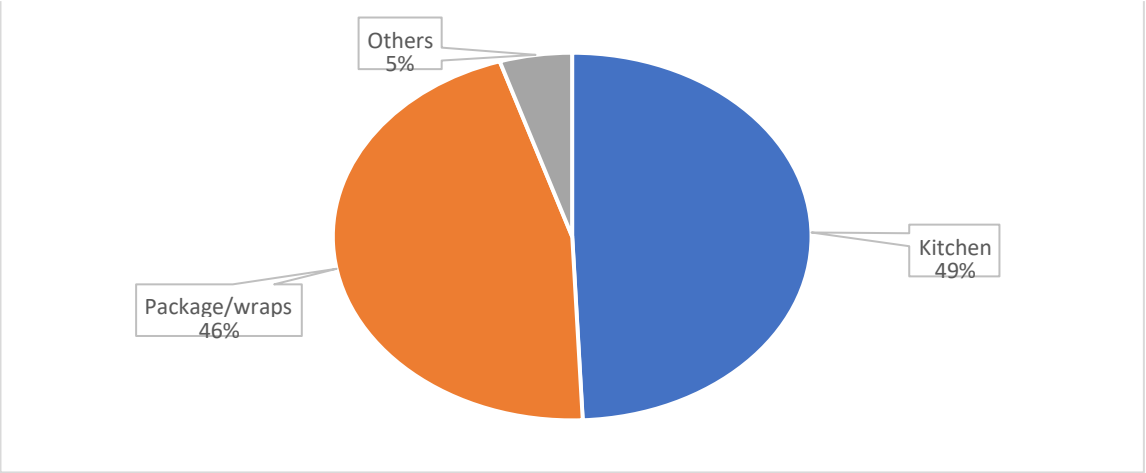

Fig. 4.5: Major source of waste in the home
Source: Author's Field Survey, 2021

When pressed further on the type of waste generated from their kitchen, most of the respondents stated that rather than the food remnants expected from kitchen waste, nylon from stuffs bought from market, pure water sachets and plastic were the major source waste from the kitchen. This is further reflected in the data on the major type of solid waste generated within the neighbourhoods. Therefore, the major type of solid waste generated from homes in Suleja are nylons, water sachets and plastics.

4.3.3 Type of Solid Waste Generated in Area

Figure 4.6 shows the major type of solid waste that is common and frequently generated within the neighbourhoods. This chart indicates that 95% respondents stated that nylon and pure water sachets were the most generated type of solid waste in the neighbourhood while 5% believed both the nylon and pure water sachets alongside plastic rubbers were the major type of solid waste in the area. One person opined that food remnant were the common type of solid waste while another person was of the view that plastics were the most common waste within the neighbourhood.

The data as opined by the respondents and backed up by physical observation by the researcher confirms the most generated type of solid waste in Suleja to be nylon, pure

water sachet and plastics and if the solid waste management strategies are developed targeting to these types of waste, it will aid in improving the management of solid waste system in Suleja.

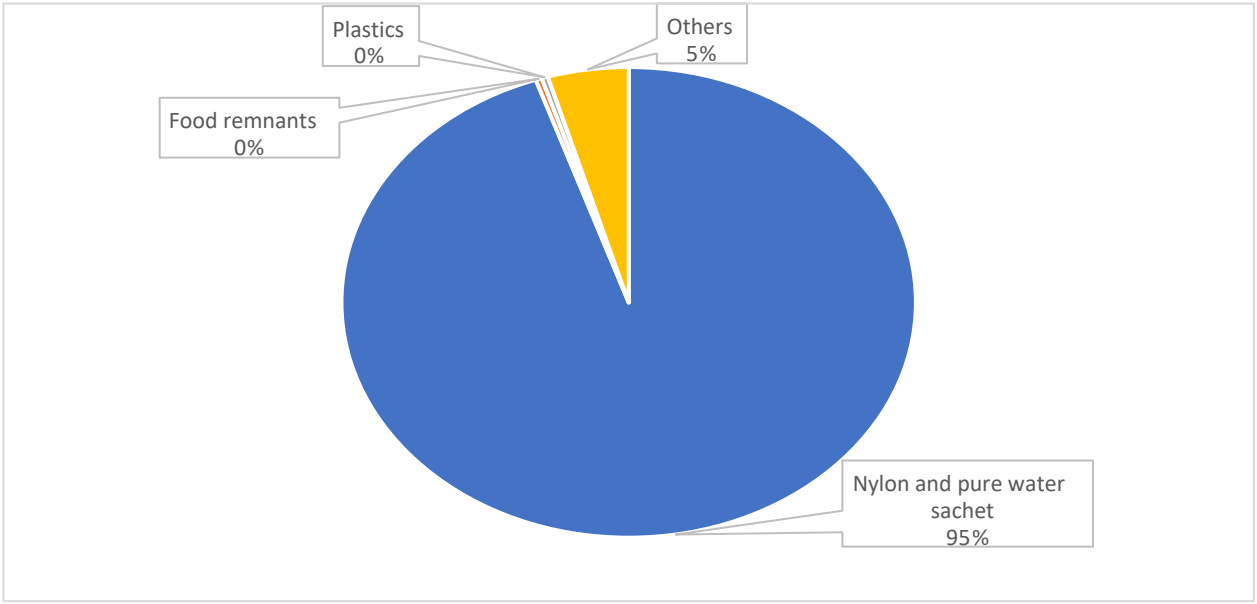

Fig. 4.6: Type of solid waste generated in the area
Source: Author's Field Survey, 2021

4.3.4 Capacity of Solid Waste Generated in Suleja

The study seeks to reveal the average capacity of solid waste generated in cubic meters. In order to achieve this, the Niger State Environmental Protection Agency (NISEPA) who are in charge of waste management in Suleja was visited. In an interview with the Head of Department, Waste Management, he stated that the department have two (2) compactor trucks that has the capacity of 28 cubic meter with each one of them going out twice daily to evacuate waste giving an amount of one hundred and twelve (112) cubic meters from this type of vehicles. From one 12-tyre truck that have the capacity of 28 cubic meter which also goes out twice daily, amounts fifty-six (56) cubic meters while a cumulative sum of two hundred and fifty-two (252) cubic meters gotten from seven (7) 10-tyre trucks which has the capacity of 18 cubic meter each with all the trucks in this category going out twice daily. Finally, two (2) 6-

tyre trucks with the evacuating capacity of 8 cubic meters each making two trips daily to evacuate waste, sums up to sixty-four (64) cubic meters of waste from this category of trucks. Therefore, the total solid waste generated in Suleja as evacuated on a daily basis will be $112 + 56 + 252 + 64 = \mathbf{484}\ \boldsymbol{Cubic\ meters\ of\ waste.}$ This implies that the weekly waste generated to be $484 \times 7 = \mathbf{3388}\ \boldsymbol{cubic\ meters\ of\ waste}$and the monthly waste generation in Suleja to be $3388 \times 4 = \mathbf{13}{,}\boldsymbol{cubic\ meters\ of\ waste}$with the yearly generation estimated to be equal to $13{,}552 \times 12 = \mathbf{162}{,}\mathbf{624}\ \boldsymbol{cubic\ meters\ of\ waste.}$

It is pertinent to note that the capacity calculated and arrived at above are based on the evacuation capacity of NISEPA, therefore, the quantity does not represent the total quantity of solid waste generated within Suleja as NISEPA were not able evacuate waste from all part of the city due to issues of accessibility as will be later discussed in this chapter. Hence, the actual capacity of solid waste generated within Suleja is expected to be greater than the capacity stated above because of the waste that were not evacuated by NISEPA.

4.3.5 Types, Number of Equipment and Facilities for Waste Management in Suleja

In the interview with NISEPA on the type and number of waste management equipment and facilities owned by the agency, it revealed as presented in table 4.1 that the agency has two (2) compactors, seven (7) 10-tyre trucks, one (1) 12-tyre truck and two (2) 6-tyre trucks. With regards to recycling and sorting, the agency reiterated that their sole responsibility was to regularly collect waste and transport them to the final dump site thereby, not having any facility/equipment to that regard.

Table 4.1: Types and numbers of equipment owned by NISEPA

S/N	Types	Number	Capacity (m^3)
1	Compactors	2	28
2	10-tyre Trucks	7	18
3	12-tyre Trucks	1	28
4	6-tyre Trucks	2	8
Total		**12**	**82**

Source: Author's Field Survey, 2021

4.4 LEVEL OF EFFECTIVENESS OF WASTE MANAGEMENT STRATEGIES

The section is fixed on the level of effectiveness as regards the existing strategies of solid waste management outlined in the previous section. Opinions of respondents was first sort on the effectiveness of their method of waste disposal. Also, the effectiveness of the efforts or strategies employed by the various neighbourhoods for waste management was appraised.

Efforts of the agencies or organisation responsible for waste evacuation was also evaluated.

4.4.1 Effectiveness of the Method of Disposal

When questioned on the effectiveness of their waste disposal method as shown in Figure 4.7, 58% opined that their method of waste disposal was effective and out of this percentage, fifty-nine (59) were referring to cart pushers, twenty-nine (29) to incineration, another twenty-nine (29) referred to open spaces, twenty-two (22) to dumping in waterways/road, twenty-one (21) referred to waste bins/bags and lastly seven (7) were referring to waste collection trucks. 19% opined that the method of waste disposal was fair and out of this percentage, nineteen (19) were referring to dumping in waterways/road, fifteen (15) referred to open spaces while eight (8) referred to cart pushers, four (4) were for waste collection trucks, another four (4) referred to waste bins/bags and three (3) were referring to incineration. those that

viewed their method of waste disposal to be very effective constitute 17%, with twenty (20) persons referring to waste bins/bags, fifteen (15) referred to waste collection trucks, three (3) were referring to incineration while four (4) were referring to cart pushers. 6% of the respondents were of the view that their method of waste disposal was not effective, out of this percentage, ten (10) people were referring to dumping in waterways/road, five (5) were dumping in open spaces and two (2) persons were burning their waste. Lastly, one person who dump his waste in open spaces opined that the method he employed was poor in dealing with the waste effectively.

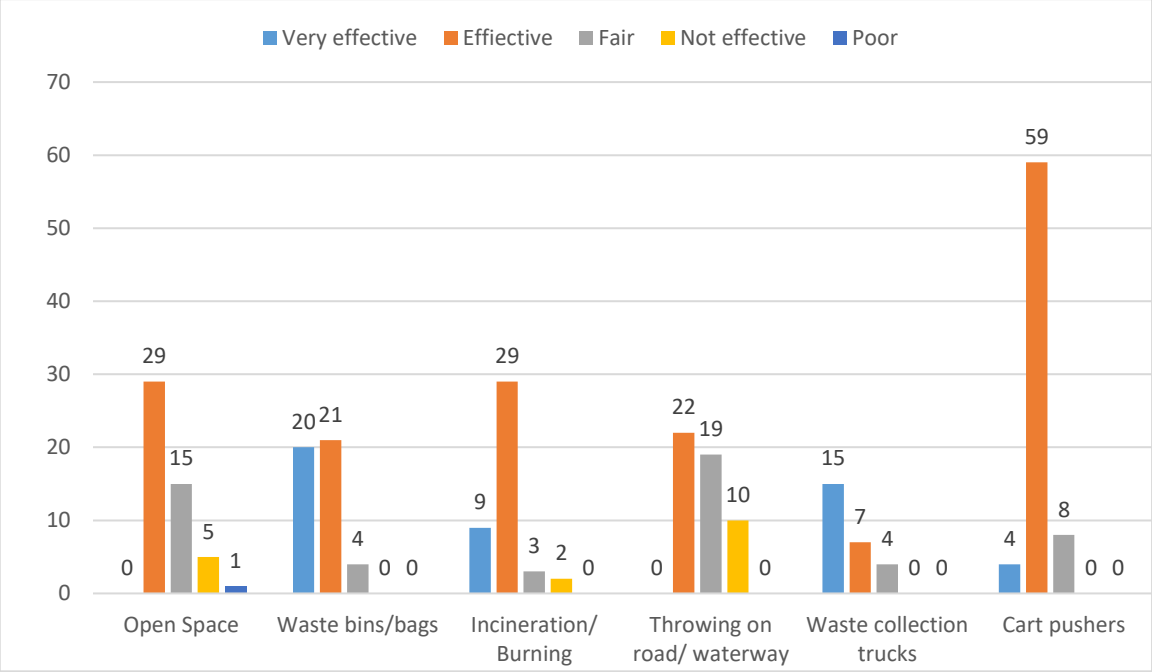

Fig. 4.7: Effectiveness of waste disposal method
Source: Author's Field Survey, 2021

4.4.2 Effectiveness of Strategies of Waste Management Employed by the Neighbourhoods

When quizzed on the effectiveness of the strategies engaged by their various neighbourhood in managing solid waste, from the 11% that identified the various efforts made by their respective neighbourhoods, 64% believed that the strategies worked effectively while 22% rated the strategies to be fair on the aspect of

effectiveness. 14% viewed the strategies to be very effective in managing waste within the neighbourhood. See Figure 4.8.

It can therefore be said that the various strategies adopted by the neighbourhoods were a success in the eyes of the residents or the beneficiaries. But from physical observation, it was noticed that success of these strategies was limited to the streets in which they were implemented and it was also observed that no one of the above-mentioned strategies was adopted throughout the entire boundary of the neighbourhoods under study but were limited to a street or two.

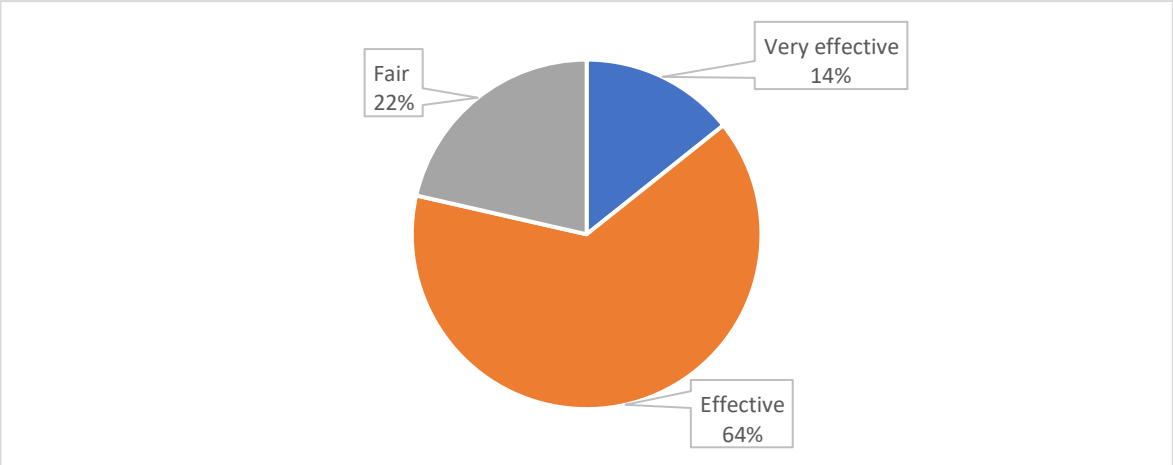

Fig. 4.8: Effectiveness of the strategy of waste management
Source: Author's Field Survey, 2021

4.4.3 Agency Responsible for Waste Evacuation

Waste is usually managed different by individuals and method of disposal and management sometimes depends on the knowledge of the individual as regards the existing waste management system and the organisation in charge of waste management. In the interview with NISEPA, it was revealed that they manage waste in all the districts of Suleja even outside the city such as Tafa and Dikko. Due to the capacity of service providers, the services rendered does not in some cases get to or felt by the end-users. The study therefore, seeks the opinion of the respondents on who was

responsible for waste evacuation from their neighbourhoods. As illustrated in Figure 4.9, one hundred and seventy-seven (177) stated that the Niger State Environmental Protection Agency (NISEPA) which is a government agency, was responsible for evacuating solid waste from their neighbourhood while sixty-three (63) opined that there was no agency or organisation performing that function within their neighbourhood. Forty-three (43) voiced that individuals (cart pushers and local errand boys) were the people evacuating waste from their residence while three (3) stated that private organisation was responsible for waste evacuation from their neighbourhoods.

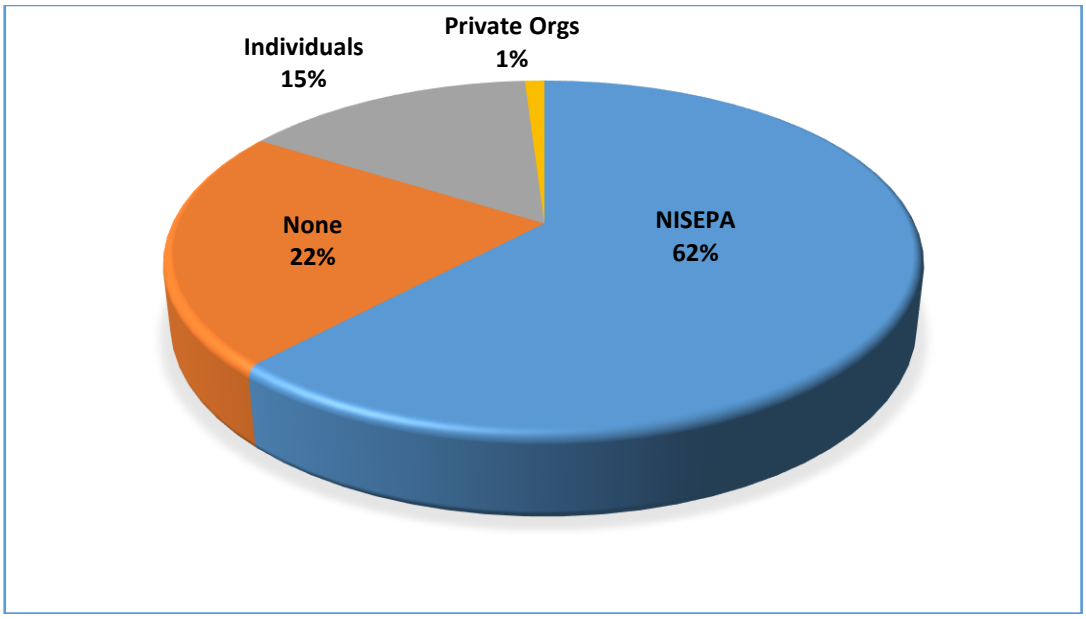

Fig. 4.9: Agency responsible for waste evacuation

Source: Author's Field Survey, 2021

Additionally, not all the respondents that acknowledge NISEPA as the agency responsible for waste evacuation actually benefited from their services. Twenty-seven (15%) out of the one hundred and seventy-seven actually opined that they were aware of the responsibility been shouldered by the government agency but do not benefit from their services. These was discovered to be true when the number of people that identified to be disposing their waste through waste collection truck and waste bin/bags which are in most case emptied or carried away by the trucks do not add up to the total

number of people that acknowledge NISEPA to be responsible for waste evacuation (collection truck users + waste bin users = 71). This can also be attributed to the fact that NISEPA tends to operate only along the major roads of the city as opined by most of the respondents and observed also by the researcher coupled with the fact that almost if not all the stipulated central waste collection point are along these same major roads.

4.4.4 Frequency of Waste Evacuation by the Agency

NISEPA, statutorily saddled with the aspect of managing and evacuating of the waste generated by the citizenry, are expected to collect, transport and dispose waste through various measures, including regular evacuation from all areas within their operational jurisdiction. As a measure of management, the study therefore, also questioned the respondents on the frequency of evacuation of waste from their neighbourhoods. About 46% of the respondents confirmed that waste was evacuated from the vicinity twice in a week while 22% of them offered that it was done on a weekly basis. 18% of the respondents stated that evacuation was done once in two weeks in their area while 9% of them complained that waste has never been evacuated from their own area. Those that stated that waste was evacuated from their vicinity on a daily basis constituted 5%.

Also, in response to the issue of how frequent waste was evacuated from the streets, NISEPA stated that waste was evacuated everyday excluding Sundays except on some occasions when necessary. On the question of what happens to the evacuated waste, it was revealed by NISEPA that the collected wastes are transported to the final dumping site so that the private agency can acts on them. Although NISEPA goes out daily to evacuate waste, it has been confirmed that they are overwhelmed by the quantity of waste to be evacuated as seen in Plate I.

Plate I: Waste awaiting evacuation – A common but unsightly scenario
Source: Author's Field Survey, 2021

4.4.5 Respondent's View on the Efficiency of the Agency Operations

Questioned on the efficiency of the operations carried out by the agency (NISEPA) to evacuate and manage solid waste, 43% of the respondents believed their services and operations were efficient while 27% rated the agency to be fair with their operations. About 18% of the respondents opined that the agency's operations were very efficient while 8% view them as being poor, in addition to about 4% of them that rated their actions and operations as not efficient.

4.4.6 Amount paid Weekly for Waste Evacuation

As indicated in Figure 4.10, 38% of the respondents said they can afford to pay one hundred naira weekly for waste evacuation while 29% of them are willing to pay two hundred naira for such services. Those that can only afford to pay less than a hundred naira constitute 11% while 9% of them were ready to pay three hundred naira. 7% of the people stated that they were not ready to pay any amount as it is "*the responsibility of the government to provide such service as waste evacuation and management*". 5% of the respondents were confident of paying five hundred naira to get the job done

while 1% were willing to pay a sum between five hundred and a thousand naira for waste management services.

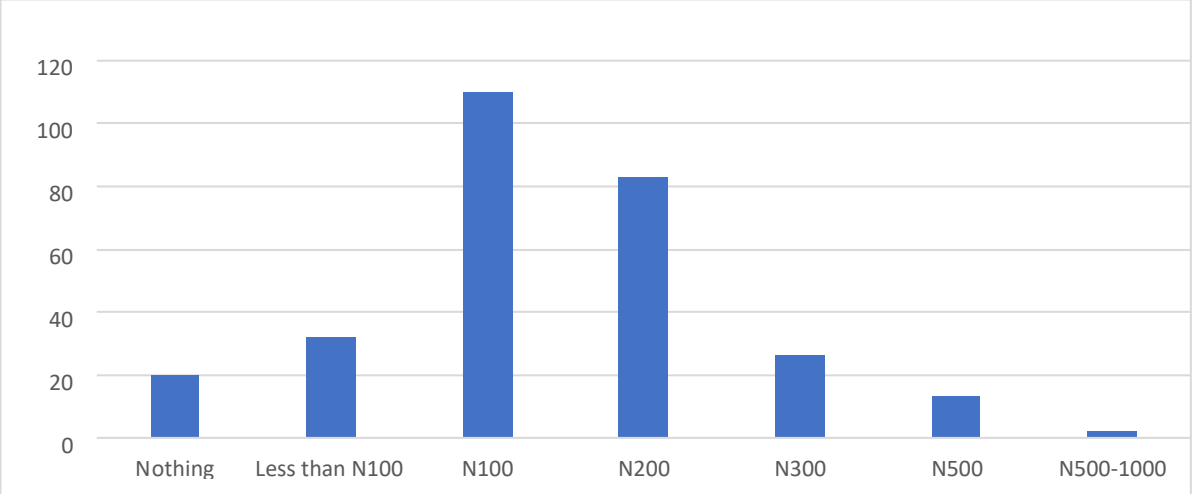

Fig. 4.10: Amount Paid weekly for waste evacuation
Source: Author's Field Survey, 2021

4.5 EFFECTS OF INADEQUATE SOLID WASTE MANAGEMENT ON THE ENVIRONMENT

The segment exposes the environmental impact of ineffective management of solid waste system as observed by the researcher and opined by the residents. The method of improper solid waste disposal within the neighbourhoods were outlined and discussed. Effects of substantial solid waste management on the immediate was investigated. Further effects on roads within the neighbourhoods as regard interruption of movement was appraised and the number of roads affected determined.

4.5.1 Method of Improper Solid Waste Disposal

First, the respondents were questioned on the nature of improper waste disposal within their neighbourhoods and as illustrated in Figure 4.11, one hundred and sixty-one (161) of them stated that waste was properly disposed in their vicinity while the

remaining one hundred and twenty-five (125) opined that solid wastes were improperly disposed within their area.

The study then seeks to understand how the solid wastes were improperly disposed in the neighbourhoods of Suleja. As indicated in Figure 4.11, seventy (70) people stated that waste were being dumped in drainages and waterways while thirty-eight (38) of the opined that disposal was done in vacant land or open and unoccupied spaces.

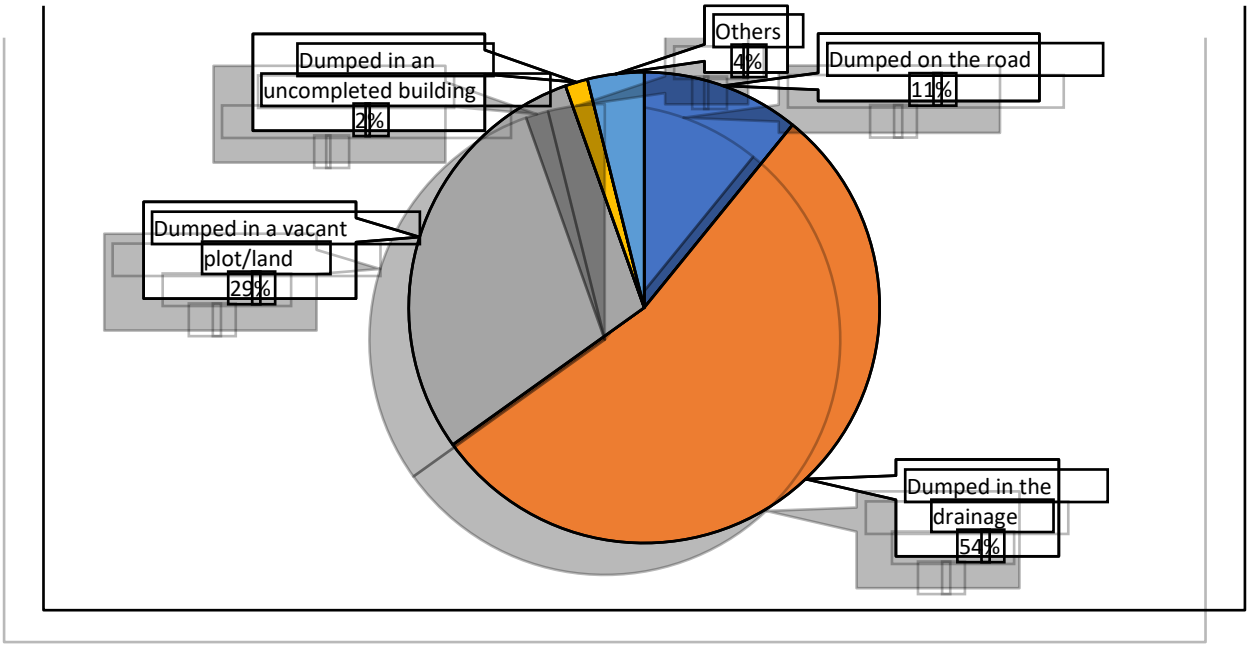

Fig. 4.11: Method of improper solid waste disposal
Source: Author's Field Survey, 2021

Fourteen (14) respondents stated that waste was being dumped on road while five (5) people believed that solid wastes were disposed improperly on both road, drainages and vacant land. Only two (2) people opined that waste were disposed in uncompleted buildings.

4.5.2 Effect of Improper Solid Waste Disposal on Immediate Environment

In any locality where there is improper solid waste disposal or management, effects on the environment on which the waste is being disposed will be evident be it immediate

or in the foreseeable future. In the study carried out, the immediate effect of improper solid waste disposal was sorted and as illustrated in Figure 4.12, 40% of the respondents attested that the improper disposal of waste blocks the drainages within the area as seen in Plates II and III closely followed by those who believed the waste made the environment untidy and unhealthy constituting 37%. Those that felt the waste pollutes the land, pollutes the air and causes two or more of these effects on the environment constitutes 6% each while the remaining 5% of the respondents opined that improper waste disposal blocks the roads thereby obstructing movement on such routes.

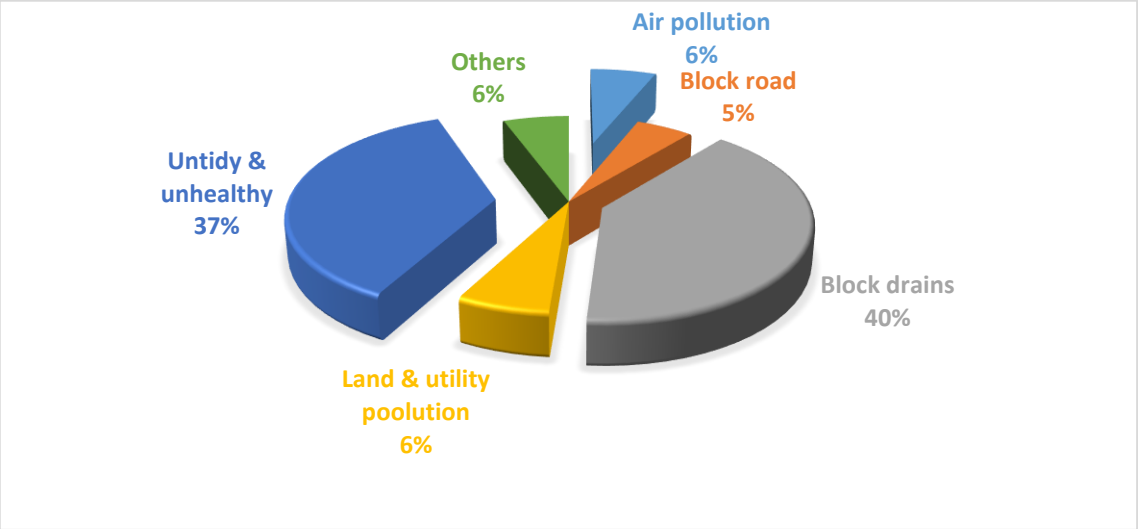

Fig. 4.12: Effect of improper solid waste disposal on environment

Source: Author's Field Survey, 2021

The data was further confirmed from the response from NISEPA who outlined water pollution which leads to blockage of water ways and later results to flood and air pollution stemming from the stench of the waste and carbon emission from incinerated neighbourhood waste as some of the environmental challenges linked with waste collection and disposal within Suleja.

Plate II: Blockage of drainage and water ways due to improper waste disposed
Source: Author's Field Survey, 2021

Plate III: Drainage blocked by waste in Bagama, Suleja – Main cause of urban floods
Source: Author's Field Survey, 2021

4.5.3 Effects on Movement on Roads and Numbers of Roads Affected

When questioned on the effects of inadequate solid waste management on movement on roads within the neighbourhoods, two hundred and thirty-two (232) respondents

reported that movement on roads has never been affected by inadequate solid waste management while fifty-four (54) people stated that is has.

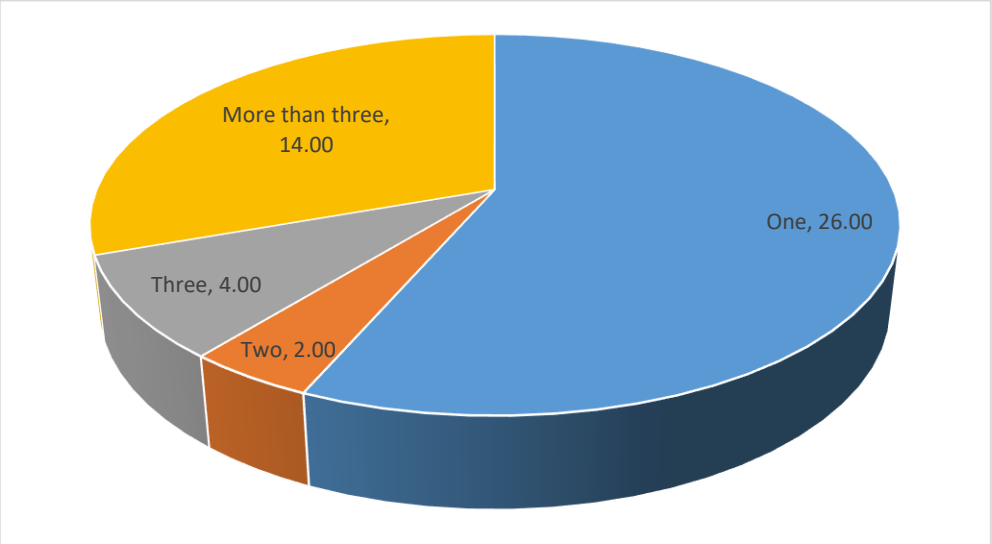

Fig. 4.13: Numbers of roads affected
Source: Author's Field Survey, 2021

The number of roads affected as displayed in Figure 4.13, out of the respondents who stated that inadequate solid waste management has ever obstructed movement on road 48% of them said only one road was affected while 26% of them stated that there were more than three roads affected within the area. those that can't say or can't recall how many roads were affected constituted 15% while 7% stated that three roads were affected. 4% of the respondents opined that the movement on two roads were affected by inadequate waste management.

4.6 IMPROVEMENT AREAS IN THE WASTE MANAGEMENT SYSTEM

4.6.1 Respondents' Perception on Area to Improve the Solid Waste Management

The survey rounded up by inquiring from the respondents based on their knowledge of their neighbourhood, possible actions to be taken to improve the solid waste management within the various neighbourhoods.

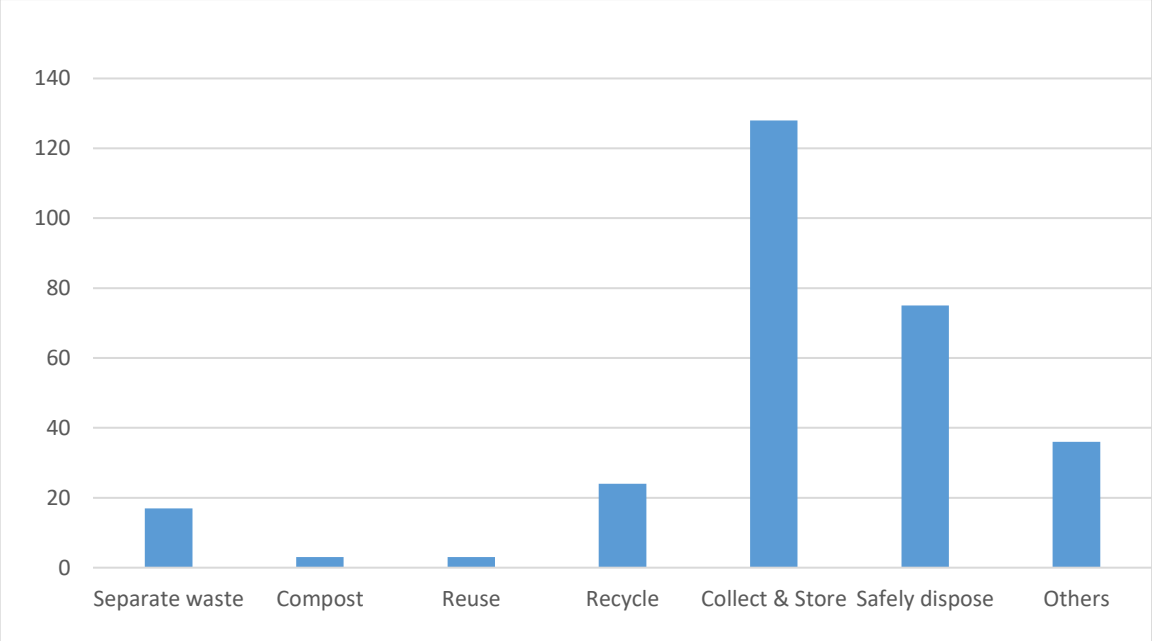

Fig. 4.14: Opinions on Improvement Areas

Source: Author's Field Survey, 2021

As represented in Figure 4.14 above 45% of the respondents believed that effective collection, transportation and safe storage of solid waste would massively improve the system while those that opined that the safe disposal of all solid waste that cannot be reuse and recycled constituted 26%. 13% of the respondents offered that other options like the combination of two or more of the strategies like separating waste from home, reusing, recycling and collection, transportation and safe disposal of waste that can't be reuse or recycled; provision of more waste bins and more collection outlets; sensitization of the people on proper waste management; bringing waste collection services into every street within the neighbourhood to meet the demand of the people; control of indiscriminate disposal of waste by passers-by/road users and stop disposal into waterways; and employment of more staff and purchase of more equipment. 8% of the respondents stated that promoting recycling and introduction of recycling programs would advance the system while 6% of them opined that separating the different types of waste from home before disposal will progress waste management.

Those that believed that reusing materials that can be reused and those that advised composting organic waste constitute 1%,

1% respectively.

4.7 SUMMARY OF FINDINGS

The summarization of the findings from this thesis was done under four major subtitle which are; types and sources of waste, the existing strategies of waste management, levels of effectiveness of waste management strategies and impact of inadequate management of solid waste on the environment.

4.7.1 Types and Sources of Waste

The common household waste as identified in the study area were nylon and pure water sachets, paper, food remnants, ash & dust, plastics, and glass/ceramics. The major source of waste was discovered to be from the household kitchen followed by packages and wraps from products bought while the types of generated solid waste within the neighbourhoods was opined the majority of respondents to be nylon and pure water sachets. The amount of solid waste produced in Suleja as estimated by the NISEPA using their evacuating capacity was given to be 3,388 cubic meters while the type of equipment used by them for managing waste include a compactors, 10-tyre trucks, 12-tyre trucks and 6-tyre trucks giving a total of 12 vehicle with waste carrying capacity of 82 in total.

4.7.2 The Existing Strategies of Waste Management

From the questionnaire administered, majority of the residents disposed the waste to and through cart pushers due to the fact that the waste collection trucks only evacuate

waste along the major roads within the town although other method of solid waste disposal like open space dumping, incineration, waste collection trucks etc. was still practice by the residents. It was discovered that most of the respondents dispose waste on a weekly basis and this is done usually in front of their residence. The study also exposed that central waste collection point were form by NISEPA along the major roads because of the hilly and undulating nature of the city and the difficulty of trucks entering into the neighbourhoods although only half of the people interviewed were aware of these collection point which are averagely above 250 metres away from the residence of the respondents.

Except for few efforts made by some selected individuals which were effective in the view of the beneficiaries, it was discovered that the neighbourhood had not implemented any strategies for waste management. The study was also able to determine the level of satisfaction of the residents with the waste management within their area which majority agreed to be fair though some were satisfied while the waste in the area was not efficiently delt with.

4.7.3 Level of Effectiveness of Waste Management Strategies

The effectiveness of the method of waste disposal as employed by individual was assessed and findings showed that most of respondents believed that their method of disposing waste was effective. Beneficiaries of the individual effort or strategies implemented within some parts of their neighbourhood were quizzed on the effectiveness of the strategies and in their opinion, the efforts were effective in managing waste. It was revealed that NISEPA was the recognised agency saddled with the responsibility of evacuating waste from all the districts of Suleja with their services extending to place Tafa and Dikko which were out the city and they evacuate waste on

a daily basis although not from all the neighbourhoods in a day also not all of the citizens benefit from their services because they operate only along the major roads of the city. Irrespective of this, most of the respondent believed that the agency was efficient in its operations and were ready to pay sum of 100 and 200 naira for waste evacuation when necessary.

4.7.4 Effects of Inadequate Solid Waste Management on The Environment

To acquire information on the effects of inadequate waste management on environment, the nature and method of improper disposal of waste was studied and it was revealed that most the waste dumped into drainages as observed by the researcher, opined by respondents and stated by NISEPA. This was not the only way waste was disposed improperly as some dumped in open spaces or vacant land, in uncompleted building and sometimes dumped on roads creating or having effects on the environment. These effects include; blockage of drainages and water ways which in turn leads to flooding in Suleja, makes the environment untidy/unhealthy as well as polluting the land and air which stems from the stench of the waste and carbon emission from incinerated neighbourhood waste.

The effect of waste on movement on roads was also assessed and the average number of affected road inquired. Although, only a fraction of the respondents indicated that waste has ever obstructed movement in their neighbourhoods, most of them stated that only one road was affected while others estimated the number to be more than three.

CHAPTER FIVE

5.0 RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

Issues and characteristics associated with the existing strategies of waste management in in Nigerian city as exemplified by the study area has been to a degree exposed through the examination of household waste collection and disposal methods in neighbourhoods of Suleja in Niger state. Consequently, this section of the research presents an appropriate summaries from the preceding chapters of all important findings pertaining the research so as to offers a clear understanding of the foremost planning aspect of this research with a goal of offering workable and sustainable solutions to these issues by way of making appropriaterecommendations on likely measures that when properly adhered to, will improve the waste management in Suleja and similar cities in order to make it efficient.

5.2 RECOMMENDATIONS

From the series of information processed, observation of the status of waste management and discussion with stakeholders it is pertinent to note that the household waste management system in Suleja is far from what it is meant to be. The study in order to maximize the results of waste management and also minimise the effects of inadequate management practices in the study area and in the Nigeria urban areas, especially as it affects the environment and the urban dwellers, the following recommendations are made.

i. Enlightenment of the general public on proper waste management practices like separating waste from the generation points and emphasizing the importance of

reducing waste from generation, reusing waste materials where possible and recycling of the different types of waste.

ii. Provision of more vehicles and equipment for waste evacuation especially types that are more suitable for undulating terrain to increase access to all the streets within the city thereby improving the coverage of the waste management services provide by NISEPA.

iii. Establishment of policies to curtail and reduce the production and usage of nylons and plastics materials and further proffer the promotion of better and environmentally friendly alternatives. These alternatives can be use of re-useable bags, use of biodegradable materials, use of jute bags, and similar materials

iv. Because of the huge capital required to operate efficient and effective urban waste management system, it is pertinent that improve partnership of the government with organizations that are relevant for the recycling of waste. Particular areas of partnership can be in the acquisition and management of modern waste management equipment and machineries, and the further training of staff on latest technologies in the waste industry.

v. Establishment of a compulsory city-wide sanitation day so as to promote awareness of a clean and waste free environment and create a sense of responsibility in the citizenry to maintain their immediate environment.

vi. Proper and more encouragement on involvement in the recycling process, vigorous public enlightenment should be carried out by the relevant authorities and recycling programmes developed with incentives to increase the understanding of the concept of waste as a resource among the general public.

vii. Creating a punishment system for indiscriminate disposal of waste especially by passers-by and road users and the provision of more waste bins to prevent littering of roads, blockage of drainages and similar acts.

viii. Regular evacuation of city drains is recommended as part of waste management practices that can also help in reducing or even completely eliminating the disastrous incidence of flooding particularly in urban areas of Nigeria.

5.3 AREAS OF FURTHER RESEARCH

1. Issues of effectively financing urban waste management is an area that is deserving of attention in order to instil the needed sustainability of waste management. This is vital so as to be abreast with the current global trends in all facets of urban planning, management and sustainability.

2. Another important aspect is the area of the involvement of stakeholder. More information is needed in order to establish the duties and limits of the different stakeholders in urban environments today.

3. There is the need to establish effective spatial distribution of urban waste collection centres to efficient evacuation of household and other municipal wastes. This can increase usage of such facilities and further inculcate good practices required for clean and efficient cities.

4. Whereas literatures are available on the nature and sources of urban wastes, little is still known regarding how urban residents in developing countries like Nigeria passives people ad environments suffering from un-evacuated wastes. This can assist in evaluating the level of assistance residents and stakeholders can provide in order to have conducive environment of their dream.

5. Research is needed in the areas of planning and financing of municipal wastes. This would explore the possibilities and viability of multi-stakeholder joint tasks that is suitable for the 21st century Nigerian cities as they continue to expand into nearby territories with different jurisdictions and authorities. For example, the borderline areas surrounding Abuja like Madalla-Suleja, Nyanya-Dutsi Alhaji in Nassarawa State.

5.4 CONCLUSION

The increasing need for efficient solid waste management system and services have become a more constant concern in the minds of city managers and stakeholders. The effects of the inadequately managed waste on the environment have been a global concern, with water bodies being at the receiving end of the non-biodegradable waste. Thus, stressing the need for waste management strategies that will effectively deal with ever-growing and increasing amount of waste generated by man's activities.

This study therefore concluded that the existing waste management systems and the strategies employed in Suleja are inadequate and unable to evacuate the total waste generated. The agency responsible for waste management are overwhelmed as equipment, facilities and even needed staff are in short supply. Similarly, a study of these factors that influence delivery of service and waste generation is very significant to the increasing demands of all socio-economic class within the city and beyond. Thus, making available more facilities, creating extensive public enlightenment and sensitisation toencourage waste reduction, reuse and recycling in the management of solid waste and also advance the services of the waste management to reach every citizen of Suleja so as to achieve clean and zero waste city.

Although, the prospects of efficient urban and municipal waste management are enormous, the city authorities at different level have to have in place strategies that are people-oriented, time tested and sustainable. The present practice of waste evacuation merely relocates the ever-expanding menace of unsightly environment; areas that are today use as dumping ground with tomorrow be sort for particularly as cities continue to expanding and living and livelihood continue to dominate the peripheries of burgeoning cities.

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APPENDIX I

CENTRE FOR HUMAN SETTLEMENTS AND URBAN DEVELOPMENT

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

QUESTIONNAIRE ON HOUSEHOLD WASTE COLLECTION AND DISPOSAL IN NEIGHBOURHOODS OF SULEJA, NIGER STATE, NIGERIA

Dear Respondent,

This research field work is part of requirement leading to the award of Master in Sustainable Urban Development (M.SUD). All information supplied will be used purely for this academic purpose and shall be treated with utmost confidentiality. You are therefore kindly requested to tick (✓) from the options provided or fill in the spaces provided. **Thank You Sir/ Ma.**

QUESTIONNAIRE FOR RESIDENTS

A) PERSONAL DATA

(1) Neighbourhood/Street _____

(2) Age of respondent (in years) (a) 18-25 __ (b) 26-30 __ (c) 31-35 __ (d) 36-40 __ (e) 41-45__ (f) 46-50 __ (g) 51-55 __ (h) 56-60 __ (i) Above 60 __

(3) Gender (a) Male (b) Female

(4) Marital status (a) Single (b) married (c) Separated/ Divorce (d) Widow/ Widower

(5) Occupation of respondent (a) Student/Apprentice (b) Civil servant (c) Trader (d) Artisan (e) Unemployed (f) Retired (g) Others specify _____

(6) Highest level of education (a) Primary (b) Secondary (c) OND/NCE (d) HND/B.Sc. (e) Higher Degree (Masters/PHD) (f) No formal education (g) Qur'anic school __

(7) Are you a resident of Suleja (a) Yes __ (b) No __

(8) Years of domicile in the Neighbourhood. (a) Less than 1__ (b) 1 __ (c) 2 __ (d) 3 __ (e) 4 __ (f) 5 __ (g) Above 5 __

B) WASTE MANAGEMENT STRATEGIES

(9) What is your method of waste disposal (a) Open space (b) Waste bins (c) Burying in own land (d) Incineration/Burning (e) Composting (f) Throwing on road/waterway (g) Waste collection trucks (h) Cart pushers__

(10) How often do you dispose your waste? (a) Daily (b) Twice a day (c) Weekly (d) Twice a week (e) Once in two weeks

(11) How far is the disposal point from your residence? (a) In front of residence (a) 0-50m (b) 51-100m (c) 101-150m __ (d) 151-200m (e) 201-250m (f) Above 250m __ (g) Down the street/road (h) Over 1km away (i) Within the residence__

(12) How effective is the method selected in 9 above? (a) Very effective (b) Effective (c) Fair (d) Not effective (e) Poor

(13) What is the major source of waste in your home? (a) Kitchen (b) Packages/wraps (c) Plastic (d) Paper (e) Others specify _____

(14) What type of solid waste is being generated in your area? (a) Nylon and pure water sachet (b) Paper (c) Food remnants (d) Ash and dust (e) Plastics (f) Glass/Ceramics (g) Others please specify _____

(15) Is there a central waste collection point in your area? (a) Yes (b) No

(16) If Yes, what is the distance from your house (a) 0-50m (b) 51-100m (c) 101-150m (c) 151-200m (e) 201-250m (f) Above 250m

(17) What are the efforts made by the neighbourhood for waste management? (a) Reduce waste (b) Separate waste (c) Compost (d) Reuse (e) Recycle (f) Collect, Transport and Store (g) Safely Dispose (h) None
Others, please specify_____

(18) How effective is this strategy? (a) Very effective (b) Effective (c) Fair (d) Not effective
(c) Poor

(19) Which agency is responsible for waste evacuation (a) None __ (b) Government agency __ (c) Private organization (d) Individuals

(20) How often is the waste evacuated? (a) Daily (b) Twice a day (c) Weekly (d) Twice a week (e) Once in two weeks (f) Never/Not evacuated __

(21) How efficient is the operations of the agency? (a) Very efficient (b) Efficient (c) Fair
(d) Not efficient (e) Poor

(22) How satisfied are you with the solid waste management in your neighbourhood? (a) Very satisfied (b) Slightly satisfied (c) Fair (d) Not satisfied (e) Very dissatisfied __

(23) How much are you ready to pay EVERY WEEK for waste evacuation services? (a) Nothing/Not ready to pay __ (b) Less than N100 ___ (c) N100 __ (d) N200 __ (e) N300 __ (f) N400 __ (g) N500 __ (h) N500 - 1000 (i) More than N1000 __

EFFECT OF SOLID WASTE ON THE ENVIRONMENT

(25) In your opinion, is solid waste properly disposed in your neighbourhood? (a) Yes _(b) No_

(26) If No, how is the solid waste improperly disposed in your neighbourhood? (a) Dumped on the road (b) Dumped in the drainage (c) Dumped in a vacant plot/land (d) Dumped in an uncompleted building (e) Others specify
_____

(27) What effect does the improper disposal of solid waste has on your immediate environment? (a) Pollute the air (b) Blocks the road (c) Blocks the drainages (d) Pollute the land (e) Makes the environment untidy/unhealthy (f) Others specify
_____

(28) Does inadequate solid waste management have any effect on movement on roads within your area? (a) Yes (b) No

(29) If Yes, how many of such road are there? (a) One (b) Two (c) Three (d) More than Three (e) Can't say how many

(30) In your opinion, what can be done to improve the management of solid waste in your neighbourhood?

(a) Reduce waste generation (b) Separate waste from the home (c) Compost food scraps and organic waste (d) Reuse material, when possible (e) Recycle material and develop recycling programs (f) Collect, transport and store waste safely (g) Safe disposal of all waste that cannot be reused or recycled.

Thank you for your time

APPENDIX II

CENTRE FOR HUMAN SETTLEMENTS AND URBAN DEVELOPMENT FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

INTERVIEW GUIDE ON HOUSEHOLD WASTE COLLECTION AND DISPOSAL IN NEIGHBOURHOODS OF SULEJA, NIGER STATE, NIGERIA

1. What type of equipment/facilities do you use for the management of solid waste in Suleja and how many are there?
(a)Small waste collection vehicles__(b)Agricultural tractors and trailers___(c)Truck cha ssis and cabs__ (d) Non-compacting collection vehicle bodies__ (e) Semi-compaction vehicles___(f) Compaction vehicles __ (g) Waste bins __ (h) Incinerators __ (i) Sorting facilities___ (j) Recycling facilities_____ (k) Other, specify _____ .

2. Does your agency manage household solid waste in all the nine (9) districts of Suleja? If No, what are the neighbourhoods benefiting from your services and why?

(a) Bagama, (b) Hashimi (c) Kabula (d) KurminSarki (e) Madalla (f) Magajiya (g) Maje&Kwamba (h) RafinSanyi (i) Wambai_____ .

3. How often do you evacuate waste from the streets/neighbourhoods?

4. What happens to the evacuated waste?

5. If there are use of landfill,

   a. State uses of the landfills.
      (a) effective disposal (b) sanitary disposal (c) energy production and fast degradation
      (d) land reclamation
   b. how many landfill sites are there?

6. What are the challenges or issues of concern associated with solid waste management in Suleja?

(a) Bad roads (b) Inadequate staff (c) Lack of waste sorting (d) Inadequate equipment/vehicles(e) Others specify_____

7. What are the various environmental challenges linked with waste collection, disposal and management in Suleja?
(a) Land pollution (b) Air pollution (c) Water pollution (d) Leaching (e) Obstruction of drains(f) Loss of biodiversity __ Others specify _____

Thank you for your time