RESIDENTS' PERCEPTION OF PUBLIC-PRIVATE PARTNERSHIP APPROACH IN MUNICIPAL SOLID WASTE MANAGEMENT IN MINNA, NIGER STATE, NIGERIA

BY

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MTech/SPS/2019/10410

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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY IN GEOGRAPHY (ENVIRONMENTAL MANAGEMENT)

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ABSTRACT

Solid waste management has overwhelmed municipal government's capacity, hence the need for assistance from the private sector. As a result, PPP came to the fore as a strategy that might maximize private sector advantages while preserving the overall goals of the public realm in service delivery. This study evaluates the effectiveness of the PPP approach to municipal solid waste management in Minna. The objectives include: identifying the private operators involved in partnerships for waste management in the study area; examining the effectiveness of PPP in solid waste management in the study area; analyzing the constraints of a public-private partnership approach to waste management in the study area; and identifying alternative ways of improving the services of solid waste management in the study area. Open-ended questionnaire was used to collect data and information on ways to Improve the Services of Solid Waste Management in Minna through PPP. The Likert scale Mean Score (MS) was used to interpret three ranges of public perception, with a score between 1.0 and 2.4 indicating a negative attitude, a score between 2.5 and 3.4 indicating a neutral attitude, and a score between 3.5 and 5.0 indicating a positive attitude by the general respondents. Thematic content analysis, was used to understand those aspects of a phenomenon that respondents talk about frequently on open-ended question. The research used a mixed-methods approach, including both quantitative and qualitative data collection and analysis. A survey was conducted with a sample size of 384 across the 11 wards of Chanchaga LGA to assess the level of satisfaction with the PPP managed waste collection and disposal services. In-depth interviews were conducted with key stakeholders, including representatives from private partners, public official, and community leaders. The findings showed that there are six private operators that were engaged for waste collection in Minna. In terms of manpower, each private operators had a total of (7) staffs, On the regularity of waste collections, the mean score (MS) of 2.8, indicating a neutral perception by the public respondents that private waste collectors come to pick up waste at regular intervals, and a (MS) of 2.2, indicating a slightly negative perception that the current approach to waste collection and evacuation is satisfactory, whereas on the willingness to pay for services, the respondents had neutral perception with a MS of 2.6, that they would be willing to pay for waste collections. In terms of effectiveness and efficiency, respondents had a neutral perception with MS of 2.8, that the current strategy for waste collection and evacuation is satisfactory. Poor enforcement of sanitation standards on residents is considered the most severe constraint to about 57.1% of the respondents. Based on these findings, it was recommended that adequate funding, institutional strengthening, public participation, improved service operations and accessibility, promotion of recycling, and legal compliance are essential components of an effective waste management system. By implementing these recommendations, Minna can achieve a sustainable and efficient approach to solid waste management, benefiting both the environment and the community.

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LIST OF ABBREVATIONS

3R	Reduce, Reuse, Recycle
BOO	Build, Own and Operate
BOOT	Build, Own, Operate and Transfer
BOT	Build, Operate and Transfer
DBFO	Design, Build, Finance, Operate
DCMF	Design, Construct, Manage and Finance
ICRC	Infrastructure Concession Regulatory Commission
LGA	Local Government Area
MS	Mean Score
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NGO	Non-Governmental Organization
NISEPA	Niger State Environmental Protection Agency
PFI	Private Finance Initiative
PPE	Personal Protective Equipment
PPP	Public Private Partnership
SWM	Solid Waste Management
UN	United Nations
UNEP	United Nation Environmental Protection

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Public-private partnership refers to the procurement approach where the project is executed with a broader span of contractual relationships between the public and private sectors to provide an asset and/or a service (Tang *et al.,* 2013). The Public-Private Partnership (PPP) is an option between public procurement and privatization for governments seeking to expand their infrastructure. The Public-Private Partnership Initiative aims to increase private investment in the Public-Private Partnership and key infrastructure projects in the Public-Private Partnership infrastructural markets. The asset or services includes capacity building for departments, ministries, and agencies and technical support for the reform of regulations. It also provides project preparation assistance and consultation services to help businesses build commercially viable Public-Private Partnership contracts (Tang *et al.,* 2013).

Higher living standards, along with an ever-increasing population, have resulted in an increase in waste. Consumerism and other artificial processes produce massive amounts of waste all over the world. The rates of waste production are rising worldwide. According to a study by Kaza *et al.* (2018), in the year 2016, 2.01 billion tons of waste were produced in the world's cities, about 0.74kg per person per day. The study established that annual waste generation is expected to increase by 70 percent from 2016 levels to 3.40 billion tons by the year 2050 with rapid population growth and urbanization. It was also reported that residents of developing countries, especially the urban poor, are more severely affected by unsustainable waste compared to developed countries. A poorly managed waste is a breeding ground for vectors of diseases. These poor practices have serious effects on health, safety and the environment (Kaza *et al.,* 2018). Effective waste

management is costly, with 20%–50% of municipal budgets most times. The operation of this essential municipal service requires efficient, sustainable, and socially supportive integrated systems (Kaza *et al.*, 2018).

Solid Waste Management (SWM) has been intrinsically linked to human progress throughout history because of its impact on both public and environmental health. The history of solid waste management is extensive and convoluted (Nathanson, 2010). In many constitutions, the Local Government is in charge of infrastructure such as power and water distribution, public transportation, telecommunications, security, and waste management. According to the Federal Ministry of Environment's policy guidelines on Solid Waste Management (2005), the third tier of government, namely the Local Government, is legally responsible for urban solid waste management in Nigeria (Olukanni *et al.*, 2016). However, in order to fulfill their responsibilities, this level of government has not allocated the necessary financial, material, and human resources to waste management (Anestina *et al.*, 2014).

However, while municipalities handle the services of solid waste, they have involved the private sector in the municipal waste sector for many years through outsourcing and informal waste collection and sorting arrangements (World Bank, 2021). Many state governments have established regionally focused agencies because of municipal governments' failures in solid waste management (covering over one local government). Niger State Government, for example, published a Gazette as NSLN No. 18 of 2011 which formed the Niger State Environmental Protection Agency (NISEPA) (Abdulkadir *et al.*, 2015). The agency is tasked with effectively managing the waste of the state's population and providing a clean environment through transportation, waste disposal, site management, and, more recently, recycling. As a result, NISEPA embarked on a Public-Private Partnership project to manage the scheme. It is public in

the sense that NISEPA regulates both residents and private partners. While the Private Sector Participants (PSP) offer services, NISEPA sets the prices for people and businesses. Waste collection fees are levied directly on households and other businesses. The amount to be paid for waste collection is determined not by the amount of rubbish collected, but by the location and type of households/businesses (Waziri, 2021).

Because of poverty and unwillingness to pay, several residents have refused to pay for waste disposal services, exacerbating the situation. One reason why people are unwilling to pay in the country, particularly in Niger State, is because the Waste Management Board was created as a nonprofit sector, with its services as a public good that attracts little or no fee. Based on the aforementioned challenges, as well as the fact that Minna is an urban settlement with current projected population estimates of approximately 512,947, respectively (according to this study 2022 population projection in chapter 3). Furthermore, waste management, which includes disposal, was shown to be a labor and capital-intensive service that frequently consumes 20–50% of the municipal operational budget (Ike *et al.,* 2018). As a result, the state government has contracted the collection and disposal of solid waste in some areas to private sector operators in order to maintain a clean town at little additional expense to the government.

The question here is how long the initiative will be viable in the state, ensuring that all rubbish generated by households and companies is collected without dumping it on the streets, as well as cleaner urban centers for a long period. Furthermore, conservation initiatives may be successful in the long run only if their goals and activities are embraced by local people. In contrast, perceived fairness of distribution is a critical motivator of acceptability. One of the reasons why people are unwilling to pay in the country, particularly in Niger State, is that the Waste Management Board was established as a nonprofit organization (Alabi *et al.,* 2020).

Given the challenges of providing effective and sustainable waste management in most Nigerian urban settings, this study investigates the current condition of Public-Private Partnerships approach to urban solid waste management, as well as management strategies and initiatives.

1.2 Statement of the Problem

Solid waste management is a vital component of fundamental urban services and an important environmental health service. Two key concerns have fueled research on urban Solid waste management in developing countries: public sector reform (including privatization difficulties) and sustainable urban development (Anestina *et al.*, 2014). The former is closely linked to neoliberal theory, which proclaims the return of the market and a decline in government control. The latter is concerned with the role of the private sector in service delivery, and it raises concerns about public interest and acceptability (Anestina *et al.*, 2014). These ideas highlight the importance of having an effective management system in place. A well-functioning waste management system is a sure way to ensuring economic growth.

Waste management is a vital issue in Africa's developing countries, particularly Nigeria. In Nigeria, municipal waste management issues are inextricably linked to concerns about human health, air, water, and land pollution. Analyzing the key issues affecting the efficient management of municipal waste in a developing economy like Nigeria is critical to developing a workable solution. To ensure sustainable environments and other goals, current trends in municipal waste management must be transformed. Municipal Solid Waste (MSW) disposal is becoming increasingly indiscriminate, and it is directly connected to poverty, poor governance, urbanization, population growth, low living standards, and a lack of environmental awareness (Olukanni *et al.*, 2016).

Waste management has emerged as one of the greatest challenges facing state and local government environmental management agencies in Nigeria. The volume of waste being generated continues to increase at a faster rate than the ability of the agencies to deploy financial and technical resources needed to overcome this. The increasing consumption pattern constitutes some of the sources of the waste generation creating a major concern for the management (Olukanni *et al.,* 2016). There is the need to recognize key issues that are peculiar to developing countries in managing municipal waste and to understand the reasons for these peculiar issues in order to establish sustainable management of waste. Experience shows that the conventional way of waste management by relegating responsibilities solely to the government officials has proven to be no longer effective.

Since government alone cannot expectedly bear the full burden of financing solid waste management, there should be alternative sources particularly cost recovery from user charges that is "waste generator pays – principle". This can only be successful if the responsibility is shared with the private sector. Successful Public-private partnership waste management practices are multi-faceted, which involves several stakeholders in the process of implementation. To implement an innovative Public-private partnership municipal waste management program city-wide, careful planning, organization and cooperation among these stakeholders are needed (Anestina *et al.,* 2014).

Previous researches have been carried out on Public-Private Partnership in waste management in other areas of the country such as Lagos, Bauchi, Kaduna and Suleja, but not much have been carried out to the knowledge of the researcher in Minna municipal. This gap needs to be urgently filled because it is obvious the municipal capital of Niger state, which appears to have been overwhelmed in their waste management capacities. A Pointer to this is accumulated heaps of

indiscriminately disposed waste that typifies the municipal. The assumption is that if private operators are participating in waste management under an enabling environment provided by local authorities; the waste management scenario will be greatly improved.

1.3 Research Questions

i. What are the characteristics of private operators in waste management in the study area?

ii. How effective is public-private partnership in solid waste management in the study area?

iii. What are the constraints to public private partnership in solid waste management in Minna?

iv. What can be done to improve the services of solid waste management by PPP in the study area?

1.4 Aim and Objectives of the Study

The study has appraised residents' perception of a public-private partnership approach to municipal solid waste management (MSWM) in Minna, Niger State, Nigeria.

The specific objectives are to:

i. Examine the characteristics of the private operators of solid waste management in study area.

ii. Examine the effectiveness of public-private partnership in solid waste management in the study area.

iii. Analyze the constraints of public-private partnership approach to waste management in the study area.

iv. Identify alternative ways of improving the services of solid waste management in the study area.

1.5 Justification for the Study

The waste management problem remains unresolved despite the unwavering efforts made by the Niger state government to address solid waste management issues. Due to its effects on human health and environmental sustainability, waste management is a serious problem. The world today is really facing a pressing problem because a large percentage of the waste is now disposed of by open dumping, which Minna is not an exception. This reoccurring problem justifies the adoption of this study, which will serve as a resource for government agencies, individuals, and non-profit organizations. The results of this study are expected to contribute to the little-known field of using proper public-private partnership in Municipal solid waste management services in Minna and other similar cities. The effectiveness of Municipal solid waste management, especially in Minna, is a significant public and environmental concern. In Africa, especially in large urban areas, the situation is terrible. Growing urbanization and industrialization in developing countries, as well as transforming waste characterization and generation patterns, all provide compelling reasons to prioritize effective Municipal solid waste management. The study will help to improve policy and planning in the study area in order to implement a long-term and effective Public-private partnership strategy in Solid waste management.

1.6 Scope of the Study

This study focused on the Chanchaga Local Government Area (LGA), which is part of Minna municipal. The study assessed the effectiveness of the PPP approach in managing municipal solid waste in Chanchaga LGA and employed both qualitative and quantitative research methods to gather data from various stakeholders, such as NISEPA officials, private operators and the public.

The study analyzed the constraints of public-private partnership approach to waste management and also identify alternative ways of improving the services of solid waste management. Additionally, the study compares the effectiveness of the PPP approach in Chanchaga LGA with existing literature and best practices in PPP-based municipal solid waste management. The outcomes of the research include recommendations for enhancing the effectiveness of the PPP approach in this context. The findings will contribute to broader conversation on sustainable municipal solid waste management in Nigeria.

1.7 The Study Area

1.7.1 Location and description of the study area

Minna, the study area, is the administrative headquarters of one of Nigeria's states, Niger State. Besides being a regional administrative capital, Minna is also the headquarters of Chanchaga Local Government Area (Abubakar, 2017). The population of Minna in the year 2021 is estimated to be 462,743. In 1950, there were 31,165 people in Minna. Since 2015, Minna has grown by 14, 784, an annual change of 3.35% (Abubakar, 2017). Minna covers an area of 6,784 square kilometers. The town is in Nigeria's middle belt, situated between latitude $09^0$40'0"N and $09^0$33'0"N on the one hand, and between longitude $06^0$30'32"E and $06^0$35'30"E on the other (Figure 1.1).

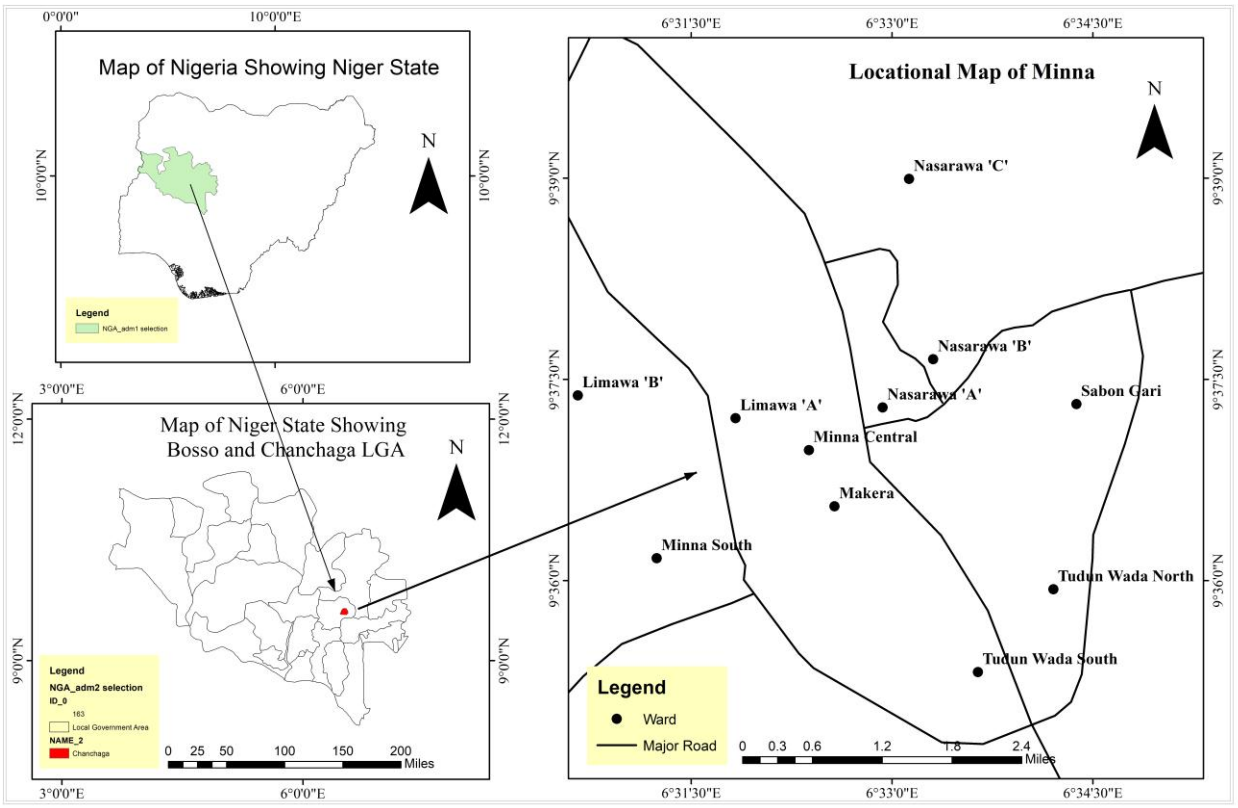

Figure 1. 1: Map of the Study Area (Minna, Niger State)
Source: Geography Remote Sensing Lab, FUT Minna (2021)

1.7.2 Geology and topography

The largely administrative settlement is majorly on a geological base of undifferentiated basement complex of mainly gneiss and migmatite to the North-East of the town where a more or less continuous steep outcrop of granite occurs (Kawu, 2016). However, As noted by Funsho *et al.*, (2018) careful planning is required to keep the construction costs of culverts, bridges, embankments, and drainage works to a minimum. There is some developable land over the hills to the north, but it is interspersed with poor land. The land to the south has potential for development, but it is hampered by the Chanchaga River (Funsho *et al.*, 2018).

1.7.3 Climate of the study area

According to Funsho *et al.,* (2018) Minna is in Nigeria's tropical hinterland and has a tropical continental climate (North and the sub-equatorial South climate regions). It thus falls under the

tropical continental wet and dry climate classification scheme, according to the Koppen classification scheme. Based on an unusually long 50-year record, the town has an annual mean precipitation of 1300mm. The month of September has the highest average monthly rainfall of nearly 300mm. The rainy season begins on April 11th on average and lasts between 190 and 200 days. The temperature rarely falls below 22 degrees Celsius. Temperatures reach around 40^{o}C in February/March and 35^{o}C in November and December (Funsho *et al.,* 2018). According to the data gotten from Weather Spark (n.d.), the average annual relative humidity is 48.9% and average monthly relative humidity ranges from 21% in February to 73% in August. Over the course of the year, the average hourly wind speed in Minna varies significantly by season. From November 23 to March 9, the windier half of the year lasts 3.5 months, with average wind speeds of more than 5.7 miles per hour. With an average hourly wind speed of 7.7 miles per hour, January 2 is the windiest day of the year. From March 9 to November 23, the calmer season lasts 8.5 months.

1.7.4 Soil and vegetation

The upland soils around Minna are mainly deep, weakly to moderately structured sand to sandy clay, with gravelly and concretionary layers in the upper or beneath the top layers (Onaolapo, 2015). He noted that there is a dearth of knowledge on how to manage the lateritic soils of the Minna area, which are intensely cultivated with a variety of crops such as cowpea, groundnuts, maize, apple, exotic mango trees, and citrus, as well as bananas and plantains, for lucrative and long-term production.

Minna has guinea savannah vegetation, which is distinguished by the presence of a few scattered trees and dense grass cover. Minna has a few rivers, and the areas surrounding the river basins are densely forested (Ayoola *et al.*, 2018).

1.7.5 Land uses

The forms of land use in Minna include agricultural, commercial, and institutional land uses, as well as public and residential land uses (Kawu, 2016).

i. Residential land uses in Minna are found in all municipal areas

ii. The Kure market, Gwari market, building materials market, Tunga market, and various commercial banks and financial institutions are just a few of the commercial land uses.

iii. Industrial land use includes water treatment plants and leather factories.

iv. The town is home to several state and federal institutions, including the Niger State Secretariat, the General Hospital, the State and Federal Judiciary, and many more.

1.7. 6 Minna's people

The Gbagyi's and Nupe's are the predominant tribes in Minna, followed by Hausa, Fulani, Yoruba, Igbos, and many other tribes found in Nigeria, and even a few foreign expatriates (Kawu, 2016).

1.7.7 Socio-economic practices and governmental structures

Minna is mainly comprised of civil servants, farmers, traders, as well as small-scale mineral miners. This characteristic has given the metropolis the symbol of a settlement peopled by largely low-income earners (Yunusa, 2013). State entities are those that the government owns, operates, and manages. Some of them are Federal University of Technology Minna, Federal Government College Minna, School of Midwifery, Government Day Secondary School, Umaru Audi Primary and Secondary School, Primary Healthcare Centers, Kure Market, Niger State Environmental Protection Agency (NISEPA), State and Federal Secretariat.

1.7.8 Minna waste management activities

Waste collection in polythene bags in front of residential buildings, open burning, indiscriminate dumping on open ground, and illegal disposal within drainage are some of the key waste disposal practices adopted by Minna residents. This is done due to a lack of modern waste management equipment, insufficient funding, and residents' bad attitude, which results in faster waste generation than the city's ability to manage (NISEPA, 2021).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Definition

2.1.1 Public-Private Partnership

There exists a considerable body of literatures on PPP, according to Infrastructure Concession Regulatory Commission (ICRC) draft on PPP manual, 2017 on the National Policy on PPP of the Federal Government of Nigeria, a PPP was defined "as a contract, whereby the private sector is engaged by the public sector to manage some public services, and to design, build, finance and operate some infrastructure to enhance efficiency, broaden access, and improve the quality of public services". Alternatively, PPP is a type of partnership between the public and private sectors intended at realizing a project or supplying public services traditionally provided by the public sector, according to the European Commission's Guidelines for Public Private Partnerships (2003). PPP can be defined for our purpose in this study as agreements in which public sector bodies enter into long-term contractual agreements in which private parties participate in, or provide support for, infrastructure provision, and a PPP project results in a contract for a private entity to deliver public infrastructure-based services (Grimsey *et al.*, 2002).

Both the public and private sectors reap some benefits commensurate with the degree to which specific duties are completed. Public services and infrastructure are delivered in the most efficient manner by allowing each sector to do what it does best. The basic goal of PPP is to create such relationships between parties that they are willing to take risk in the sector that has the best control over it. With a Public-Private Partnership, the emphasis is on the purchase of services, not the procurement of an asset.

Under the PPP contract, the government pays for services provided to it by the private sector over time. These services are delivered utilizing the new infrastructure built by private sector entities as part of the service arrangement. The government does not own the infrastructure; instead, it contracts with the private sector to purchase infrastructure and related auxiliary services over time. Infrastructure procurement has always been a time-consuming process. It has been described as asset procurement, in which the public sector makes decisions on asset provision, production, and financing, as well as the operation and maintenance of services. Assets were obtained from private sector contractors whose obligations were restricted to the asset's construction, while the risks associated with the facility's operation remained with the government (Ahmed and Ali, 2006)

2.1.2 Waste

Waste is any substance that has been rendered unusable after being fully utilized for a specific purpose (Kumar, 2016). In his book Municipal solid waste management in developing countries, he noted that humans, animals, and plants, as well as any natural or manmade process, produce waste. Biodegradable waste, nonbiodegradable waste, chemical waste, building and demolition waste, electronic waste, biomedical waste, liquid waste, sludge, hazardous waste, industrial waste, food waste, and other types of waste are all types of waste.

2.1.3 Solid waste

Solid waste refers to garbage or refuse that is solid or semisolid in nature. Households, public spaces, commercial institutions, hospitals, factories, semisolid waste from wastewater facilities, electronic companies, and so on are all sources of solid waste (Kumar, 2016). Solid waste was also defined in prior study by Zurbrugg (2003), as anything that isn't liquid and has no value to the person who is in charge of it. Although human or animal excreta frequently end up in the solid waste stream, such products are not considered solid waste in such instances.

2.2 Municipal Solid Waste

Municipal Solid Waste is trash made up of material items that have been discarded for public use, such as plastics, paper, rags, green waste, electronic waste, inert waste like building and demolition debris, and so on (Kumar, 2016). It has been discussed by a great number of authors in literature that solid waste from homes, streets and public spaces, stores, offices, and hospitals is alluded to as municipal solid waste, and it is often the duty of municipal or other governmental bodies to clean it. Industrial waste is often not considered "municipal," although it must be considered when dealing with solid waste because it frequently ends up in the municipal solid waste stream (Zurbrugg, 2003). He divided Municipal solid waste into three categories:

i. Inland residential waste is generated by individual households.
ii. Commercial trash originating from a single major source, such as schools, colleges, or hotels.
iii. Waste from municipal services such as roadways, parks, and other public spaces.

2.3 Municipal Solid Waste Management

Municipal solid waste management (MSWM) is a multidisciplinary activity that includes administrative activities and solid waste management practices such as the control of waste generation, storage, collection, transfer and transport, processing, and disposal of solid waste (Hirpe and Yeom, 2021). Its overall goal is to reduce and eliminate the adverse impacts of waste on human health and the environment and to support economic development and quality of life (USEPA, 2021). Hence, effective Municipal solid waste management plays a significant role in improving the quality of the environment, human health, and socioeconomic activities of local communities. However, according to the United Nations Environment Program (UNEP, 2021), Municipal solid waste management is a major environmental problem and a public health concern.

2.4 Municipal Solid Waste Management in Developed Countries

Municipal solid waste management is one of the most significant areas to pursue economic, research, and technological developments in developed countries, and stakeholders have started to respond to it (Joshi and Ahmed, 2016). According to information gathered by Srivastava (2013), He noted that most industrialized countries, such as Germany (Enhanced Resolution, Mobile Sorting), employ advanced management strategies that are proving to be very effective in reducing waste and increasing the likelihood of recycling and reuse. By 2010, the employment of such strategies had resulted in a 62% rise in recycling and a near-zero increase in composting. The country is devoid of waste in terms of composition. Direct landfilling (maximum carbon content of 5%), or maximum carbon content of 18% if waste is pre-treated. The initial initiative was launched in 1993, with subsequent initiatives in 2001 and 2002, until being fully executed in 2005.

This program has aided the development of mechanical biological treatment facilities (MBTs), which divert biodegradable waste to fermentation and composting units for biogas production (Srivastava, 2013). By 1995, more than 35 waste categories had been banned, and a landfill levy had been implemented, which improved the recycling rate from 45% to 50% between 2001 and 2009, eleven years ahead of schedule. Due to its reliance on adapting differences in composition and calorific value of Municipal solid waste, thermal waste incineration has been practiced in the Netherlands since 1919. By 2012, the Netherlands had built 12 incineration plants, which let 50,000 families in Amsterdam meet 25% of their heat needs by burning waste (Srivastava, 2013).

2.5 Municipal Solid Waste Management Challenges in Nigeria

According to Tobore (2012), the following reasons contribute to Nigeria's Solid waste management challenges: Unplanned and uncontrolled development: most city plans and estates are not well thought out before they are built. This resulted in the haphazard construction of

structures that ignored the distribution of urban infrastructure and the provision of essential amenities such as functional drainage channels, restroom facilities, garbage receptors, and so on. Uncontrolled population growth and urbanization: The increase in urban population following the end of the Nigerian civil war in 1970, as well as the oil boom of same period, contributed significantly to the worsening of urban sanitation. The cities' available facilities became overburdened as a result of the unrestrained population growth, resulting in environmental degradation. Insufficient technical and managerial abilities Typically, career civil servants with no managerial or technical competence or waste management experience are appointed to lead the numerous state waste management authorities.

However, they are unable to deal with the difficult task of managing persons and materials in order to achieve proper waste management due to a lack of managerial capacity and competence. In Nigeria, technical defenses and a lack of technical skill frequently contribute significantly to the challenges of inadequate city management. Poor finance of waste management operations: Most state waste management agencies' equipment is imported from developed countries, yet it frequently breaks down quickly after delivery and installation. In Nigeria, a lack of technological know-how leads to poor equipment maintenance, which is exacerbated by a shortage of readily available spare parts. Indebtedness to Waste Management Agencies: Subscribers to waste management agencies' services rarely meet their financial obligations to the agencies. The operations of the agencies involved are frequently hampered as a result of this. The habit of city people to throw solid waste into nearby drains, gutters, or neighboring communities surely contributes to the unsightly appearance of our neighborhoods. A scenario like this looks to be the result of ignorance, low literacy, and a carryover from village life's unwholesome activities (Tobore, 2012).

2.6 Mechanism of Municipal Solid Waste Generation

Waste is collected and kept at a primary storage place, such as street containers, from various sources, such as houses, commercial buildings, street cleaning, and parks. The waste is then transported to secondary storage locations in cities, where it is stored and separated. Solid waste is made up of organic and inorganic waste materials that are produced as a result of human and animal activities and that are no longer required and must be disposed since their value has been lost to the user. Domestic refuse, industrial waste, commercial waste, agricultural waste, building and demolition waste, and others are examples of solid waste sources (Essuman, 2017). Domestic, industrial, and commercial trash are the main sources of waste in Minna.

2.7 Constraints to Effective Public Private Partnership Approach

2.7.1 Autocratic/Bureaucratic hostility

Many of the origins of hostility towards private sector participation are to do with attitudes, perceptions and prejudices, rather than facts. In some countries senior local government officials may be accustomed to autocratic control of certain functions and of their subordinate employees. Consequently, they may oppose efforts to involve the private sector for political, emotional and personal reasons, because control is being passed to private sector managers and actions are restricted by contracts. This opposition may express itself in the creation of obstructions to the processes of tendering and awarding contracts, in the delaying and reduction of payments, or in personal hostility towards private sector managers. Politicians and officials may be suspicious of the motives of private enterprises in negotiating long-term concessions on landfill sites and plant, fearing that the companies wish to use the assets for other purposes (Batley and Moran, 2004).

Ekpu and Archibong (2007) observed that bureaucratic problems in government do not allow for easy release of funds, employment of adequate manpower and purchase of functional tools

required for managing refuse, whereas NGOs find it easier to manage waste by various methods. Government owned organizations find this difficult to achieve. In seconding the above, Agyepong (2011) stated that the traditional method of procuring public infrastructure and service delivery including waste management proved untenable as the public sector entities mandated with execution were characterized by inefficiencies, poor pricing policies, overstaffing, mismanagement and stagnation and therefore did not provide value of money to the public clients. To effectively address bureaucratic tendencies, Da Zhu *et al.,* (2008) suggested that "some decisions should be taken by the top level of management (such as planning and monitoring) and others by the middle and lower levels of management (such as day-to-day activities related to providing service). The writers further emphasized, "a medium or large city will obtain greater efficiency by dividing the municipality into zones or wards for service provision and by delegating some decision-making powers. The powers delegated to the zones or wards will ensure more effective supervision of the work force engaged in tasks like sweeping streets, door-to-door collection, and secondary storage of waste while the municipality takes care of transportation, treatment and disposal.

2.7.2 Corruption in public sector

Plummer (2002) described that Corruption and the fear of corruption have very major impacts on public-private partnerships, and so should be considered carefully before making the decision to go ahead with involving the private sector. In the minds of many people, public officials pursue private sector participation because they see the opportunity for getting bribes and other favors from bidders and contractors. If the power is concentrated in the hands of a few local government officials, with little transparency and no quick access to effective judicial decisions, there is a serious probability that there will be arbitrary decisions and demands for additional payment.

There is also the concern, which is justified because this has often occurred, that officials promote private sector participation because they will arrange that the contracts are given to friends or members of their family, perhaps at a higher price than if the contract were awarded fairly, or with the expectation that the contractor will not be penalized if the service is poor (Adrian, 2005). Fear of accusations may also make junior officials, such as field inspectors, unwilling to sign reports and reluctant to certify that a job has been well done by a contractor. If only a few officials sign all documents, it becomes easier to accuse them of taking bribes to modify records, so it is important to empower and encourage more junior inspectors to sign. Biasness in the selection process is another form of corruption which affect the effective the benefits of PPP in waste management. This is because in conventional forms of service delivery, there is always the potential for government to be accused of bias in selecting proponents. This may be more prevalent with public private partnerships given that "low bid" may not always win the contract if the government has established other criteria. The potential for accusation of bias can be reduced through well-developed policy and procedures, and by ensuring transparency in dealing with potential private partners.

2.7.3 Political instability

Changes of political leadership may bring in different concepts of private sector participation or even a reversal in policy – the new leadership not wishing to continue the relationship with the private sector. If the contract (with support from the judiciary) does not protect the contractor in such a situation there may be internal conflicts, and damage to confidence among waste management contractors (Fiszbein, 2000; Plummer 2002). In addition, governments can have less experience with PPP. The combination of inexperience by government and stakeholder unfamiliarity with public private partnerships may result in higher political risks. Governments

may wish to reduce potential risks by initially entering into less complex and better understood public private partnership contracts.

2.7.4 Lack of capacity

New skills are needed when there is a change to private sector involvement. From the development of the strategy and basic concept, and the involvement of the public, through tendering and the development of the contract, the inception stage, to the challenge of monitoring performance to get the best possible service, there is the need for knowledge, skills and a backup network of specialists. In some cases, this situation is aggravated by changes in organizational responsibility, typically that the organization that was the public sector provider of solid waste services is not the organization that is responsible for arrangements with a new private sector provider, so that the practical experience of the former operator is not used to frame the conditions for the new private sector service provider. If such a change in institutional responsibility has taken place, there is an even greater need for capacity building and exchange of experience (Adrian, 2005). Also, not all governments consider the true costs of providing services when establishing their pricing policies for fees for services. The delivery of services through public private partnerships requires pricing policies and fees to reflect all relevant costs. This can have the effect of increasing user fees for specific services. The cost of managing public controversy over increased fees or developing complex policies for staging fee increases can often negate the value of public private partnerships for specific services.

2.7.5 Clash of culture

Lack of local knowledge can also cause difficulties and hostility, particularly for foreign contractors. Successful approaches in solid waste management depend on a good understanding of the local situation, including cultural, socio-economic, employment and geographical factors.

A contractor who has been very successful in another country may not achieve good results in a new situation if he does not pay enough attention to local factors (Adrian, 2005).

2.7.6 Loss of control

If a powerful private company succeeds in winning many long-term contracts, it may work itself into a monopoly position so that there are no alternative service providers. In such a situation it becomes difficult for local government to control costs and service standards or to offer an alternative service (Barr, 2004). Public private partnerships, by their nature, involve a sharing of risks, benefits and decision making between the partners. PPP that involve significant investments and risks by the private partner often provide for greater involvement of the private partner in decisions concerning how services are delivered and priced. This often leads to concerns about who controls the delivery of services. The issue of control needs to be addressed at the time the project is defined and kept in mind when the contract is negotiated. In the final analysis, government has the authority and responsibility to establish servicing standards and to ensure that the public interest is protected.

2.7.7 Lack of acceptance by the public

Citizens are generally very aware of solid waste collection systems, and their cooperation is of great importance. Widespread objection to a private company for any reason can cause major difficulties if it induces an unwillingness to cooperate, or a lack of respect for the contractor's street containers (which can be easily damaged by fire, vandalized in other ways, stolen or even recycled). The introduction of private sector participation in solid waste management is often accompanied by a change in the way that the service is paid for (Adrian, 2005). Typically, a user charge is introduced. If public opinion is not prepared carefully for this change, resentment of or

opposition to the fee may develop into hostility towards the enterprise that collects the waste (Barness, 2005).

2.8 Integrated Solid Waste Management

Integrated solid waste management is a waste prevention, recycling, composting, and disposal program that encompasses all aspects of waste management. An effective Integrated solid waste management system considers how to prevent, recycle, and manage solid waste in order to protect human health and the environment as effectively as possible. Integrated solid waste management entails assessing local needs and conditions before choosing and combining the best waste management activities for those circumstances. Waste prevention, recycling, composting, burning, and disposal in properly designed, constructed, and managed landfills are the main Integrated solid waste management activities (Marshall and Farahbaksh, 2013). The following are the important elements of integrated solid waste management:

i. Waste prevention: Waste prevention, also known as waste reduction, aims to reduce the amount of waste produced. Using less packaging, making things to last longer, and reusing products and materials are all waste prevention measures that assist minimize handling, treatment, and disposal expenses, thereby reducing methane emissions (Miraji, 2021).
ii. Waste disposal: Waste can be disposed of in a variety of ways. This comprises biological, thermal, and landfill treatments. In developing nations, the last method has been a conventional manner of disposing of waste, although there is a growing trend to investigate alternate options, such as composting (Miraji, 2021).
iii. Composting: Composting is a natural process that turns organic waste into a chemical that can enhance soil and boost plant health when carried out under favorable environmental circumstances. This technique yields a physiologically stable, humid product that is ideal

for use as a soil amendment. Composting is described as a "natural process that provides several benefits: the process can be less expensive; it addresses over 50% of a city's waste stream; and it reduces one of the world's largest contributors to greenhouse gases" in a World Bank document by Hoornweg on composting in developing countries (1999).

iv. Thermal treatments: Incineration is one approach that is often employed in European countries. At high temperatures, the waste is burned, producing energy, gases, and solid remains (Miraji, 2021).

v. Landfilling: According to Wheeler (2004), it is the preferred strategy on the American continent. It is also the oldest method of waste disposal, which entails burying rubbish in various layouts and forms utilizing soil excavated as a cover layer.

2.9 Private Finance Initiative/ Types of Public-Private Partnership

PFI (Private Finance Initiative) is a public service delivery form of PPP where the duty for providing public services is passed from the public to the private sector for a good length of time. PFI, which is a catch-all term for all sorts of ‘construction' Public-Private Partnership, is a method of utilizing private funds and skills to undertake capital investment projects that were previously provided by the government. It is the same thing as DBFO (Design, Build, Finance, Operate), DCMF (Design, Construct, Manage, and Finance), BOO (Build, Own, and Operate), BOT (Build, Operate, and Transfer), and BOOT (Build, Own, Operate, and Transfer), (Akpoghome and Nwano, 2020).

i. Build, Operate, and Transfer (BOT): This is the most common PPP structure. In this sort of project, a private sector entity finances the infrastructure asset's construction and is given permission to own and run it for a period of time, usually a lengthy time, before returning control and ownership to the government. Greenfield projects frequently use these types of

agreements. The purpose of a BOT is to take use of the private sector's specific project design experience. The materials employed during the construction phase can lead to the creation of a custom maintenance plan for the duration of the project, (Akpoghome and Nwano, 2020).

ii. Build, Operate, Own and Transfer (BOOT): The private sector is responsible for financing the building of an infrastructure item in a typical BOOT. It is also permitted to hold and operate that infrastructure asset for a period of time before handing it to the government or the public sector, (Akpoghome and Nwano, 2020).

iii. Build Own Operate (BOO): This PPP model is similar to a BOT in that the private sector finances the infrastructure's development and is also allowed to run it; but, unlike a BOT, the private sector is allowed to own the infrastructure in permanently. It is vital to highlight that the absence of government involvement at the outset does not imply that the partnership is not a Public-Private Partnership. It's possible that the government will continue to be involved in setting tariffs and ensuring revenue. In the power generation industry in Nigeria, these kinds of arrangements are frequent, (Akpoghome and Nwano, 2020).

iv. Lease: Lease is a type of public-private partnership. It is typically used when assets already exist and infrastructure investments are no longer required, or when the risk premium of transferring responsibility for asset construction to the private sector is extremely high, (Akpoghome and Nwano, 2020).

v. Joint Ventures: Joint ventures are frequently used as an alternative to full privatizations, in which both the public and private sectors co-own and operate infrastructure. However, in fact, the private-sector partner frequently takes on the operational role. Both parties to a

joint venture may decide to form a joint venture company that will be accountable for the project. The most significant major challenge in a joint venture is drafting the agreement without considering a dispute resolution process or how to deal with future or unforeseen circumstances without causing additional delay, project failure, or frustration. Managing a joint venture is typically a difficult and time-consuming endeavor, especially when staff must collaborate with peers in other countries, (Akpoghome and Nwano, 2020).

vi. Operations and Management Contracts: Under this arrangement, the public sector essentially outsources to the private sector the provision of services that it had provided. The public partner pays the private partner directly for services, rather than collecting income from end users as in other PPP agreements, (Akpoghome and Nwano, 2020).

2.10 Concept of Waste Hierarchy

The concept of waste hierarchy, which refers to the 3Rs of reduce, reuse, and recycle, is the foundation for waste minimization techniques (see Figure 2.1). A more ecologically friendly and sustainable solid waste management plan, according to Baud *et al.* (2004), emphasizes actions related to reduction, reuse, and recycling. The 3Rs principle, when applied to waste management, reduces the quantity of waste that ends up in landfills. Reduction aims to reduce the amount of waste created by manufacturers and industries by adopting or optimizing their production procedures.

Natural resources will be conserved as a result. Reuse does not imply reprocessing or converting one material kind into another. Instead of being thrown away, reuse happens when a material is salvaged from its original purpose and reused for another. Recycling is the process of changing or reprocessing materials that previously had a purpose into new goods. Otherwise, these goods will be labelled waste, despite the fact that they served their original purpose. Resources made from

virgin materials, such as glass, plastic, metals, and electronic trash, are frequently recycled. Compost is made from organic materials that have been recycled (Zhu *et al.,* 2007).

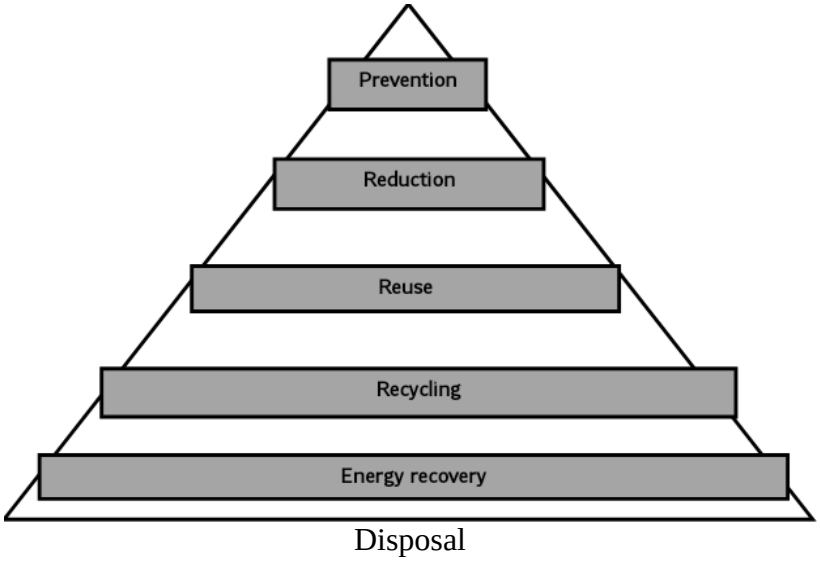

Figure 2. 1: Waste Management Hierarchy
Source: Van Caneghem *et al.* (2019)

2.11 Theoretical Framework

Theories about Public-private partnership contribute to a better understanding of their validity in terms of Solid waste management. A survey of key waste management, sociological, economic, and management theories is presented here, which emphasizes the role of PPP and solid waste disposal in the study.

2.11.1 Waste management theory

Some theories are also necessary to consider for sustainable solid waste management. The Theory of Waste Management is a cohesive body of knowledge about waste and waste management that is based on the belief that waste management should prevent waste from affecting human health and the environment while also promoting resource use optimization. Waste Management Theory

will be built using the Industrial Ecology paradigm, as Industrial Ecology may be easily adapted to include waste minimization and/or resource use optimization goals and values. (Pongracz *et al.,* 2004).

The Theory of Waste Management offers a more detailed explanation of the subject that includes conceptual assessments of waste, waste activity, and a holistic view of waste management goals. The Waste Management Theory is based on the assumption that waste management is critical in preventing waste's negative impacts on humans and the environment.

2.11.2 Sociological theories

Public-private partnerships for Solid waste management can be examined through the perspective of Abuyuanl's sociological ideas of functionalism and general systems (1999). Institutions must adapt to changing circumstances, according to the functionalism idea, by reliance on their numerous branches or partners. When we look at PPP in the context of Solid waste management, we might see the partners as elements of a larger organization that provides services. In this case, the public and private partners might be viewed as interdependent organs of a bigger organization, each with its own specialized purpose and working together to achieve the common aim of providing effective service. The general systems theory looks at things from three different angles.

i. Determine the nature of a system's relationship between its various components using system relations.
ii. System effectiveness, which determines how well the relationships between various components of a system are for the system as a whole to survive or make the most efficient use of resources.

iii. System dynamics, which entails determining what causes a system to change and in which direction it changes.

This theory applies to PPP for Solid waste management as well. To make PPP function in the Solid waste management sector, it is necessary to have a clear role demarcation and defined connection. It is critical that the private sector be given a position in which they may excel to the fullest extent possible. In the case of primary collection, for example, the private sector enjoys a comparative advantage over the public sector. Financial and management inputs for secondary operations, on the other hand, may be beyond the capacity of most private sector organizations, and it may be preferable to leave this task to the government.

In a PPP agreement, it's also crucial to analyses how the partners are working together. It may be required to make changes to the way each sector operates in order to foster and sustain the relationship and ensure optimal resource utilization. Various reasons such as population expansion, new rules, and the learning of new skills will need changes in the partnership arrangement, therefore it should be viewed as dynamic. To preserve the best balance, the force and direction of change in the work done by the private and public sectors should be carefully weighed. Both functionalism and general systems theory aid in visualizing partnerships as adaptable living entities fighting for survival in an ever-changing world. This viewpoint is useful for examining the necessity for, evolution of, and future direction of partnerships.

2.11.3 Economic theories

Several comparative economic studies comparing similar public and private corporations have been undertaken. The majority of evidence indicates that the private sector continually makes more money and runs more effectively. Economists point to the Property Rights hypothesis, which holds

that ownership rights give incentives to succeed (Hart *et al.*, 1998). People and businesses flourish in the private sector by paying only what is necessary. Businesses pay the market rate for labor, goods, and capital—no more than is required.

The government, on the other hand, purchases goods and services from the market in order to deliver public services, but market competition is not used. As a result, costs will rise. In recent decades, there has been an increase in public concern about the cost of government, and there have been major budget problems at all levels of government (Cox, 1996). In the meantime, an alternate economic arrangement has emerged. Dahl and Lindblom recognized a blurring of the lines between the public and private sectors as early as 1953 (Larkin, 1994). As the merging of the two sectors became more common, the phrase "mixed economy" was coined to characterize the situation (Larkin, 1994). Bozeman (Larkin, 1994) looked into some of the mixed economy's characteristics in depth. He claimed that private businesses are becoming increasingly independent of government agencies, and that many government institutions are becoming more like private businesses. In certain cases, he found, both public and private sector agencies function in a traditional manner, while in others, they mimic their counterparts' behavior. Bozeman also discovered that the emergence of hybrid organizations undermines the distinction between the public and private sectors.

According to Larkin (1994), these hybrids or "third sector organizations" show a lot of promise addressing many of our domestic issues. These non-profits offer a way to combine the business world's "efficiency and experience" with government's public interest, accountability, and long-term planning. All citizens must benefit, and profit cannot be the primary motivation. Because this has a public health and public benefit dimension, the government and public agencies cannot entirely withdraw from this area. As a result, the question is how to reduce costs while maximizing

resource utilization while maintaining the highest possible level of service quality. Such an opportunity might be available through a hybrid or mixed organization that combines the commercial and public sectors.

2.11.4 Management theories

Three separate sectors public, private, and non-profit have emerged to address the requirements of society, though their boundaries are not always fully distinct. Each of these sectors has a distinct competitive edge. Traditionally, each sector confined itself to its own domain of operations. Organizations have recently realized, however, that considerable value may be created by collaborating with those outside of their area. Aickenhead (1999) looked into numerous management theories in order to reflect on public/private partnerships, and a summary of his findings is provided below. Partnerships between organizations have always been unusual and on a limited scale. The business world has been portrayed as a place where participants engage in acrimonious contests, not content with simply winning but also having to see others lose. However, rising demand, complexity, and resource constraints have led businesses to rethink their strategies. They've realized how critical it is to build a collaborative advantage. When others are losing, it is frequently impossible to win.

The emphasis has switched from a win–lose situation to a win–win situation. "Alliances and networks serve as alternative mechanisms to markets or hierarchies for resolving specific strategic needs," according to resource dependence theory (Saxton, 1997). The ‘co-opetition' approach provides a fresh perspective on how organizations interact. It adds a new participant to the traditional value chain of customers, suppliers, and competitors. Complementor is the name given to this new element. ‘‘A player is your complementor if clients value your product more when it is combined with the product of another player than when it is used alone" (Aickenhead, 1999). A

competitor is defined as the total opposite of a complementor. A competitor makes a competitor's product less appealing. It is normal for businesses to play both competitor and complementor roles at different times. This enhances the likelihood of collaboration. However, before a company can see the value of collaboration, it must first overcome two common mindsets: "business as war" and "either–or." The first of these narrow viewpoints regards all players as potential opponents who must be defeated. The second does not allow for the examination of different organizational relationships. It is critical for an organization to learn to use the power of perspective in order to avoid these biased, harmful practices. An organization's value net should be drawn from both its own and other actors' perspectives. Then there are the advantages of collaboration amongst individuals.

2.12 Conceptual framework

Sustainable PPP in Solid waste management emphasize the involvement of three groups (which are the State agency [NISEPA], community and private sector) of stakeholders in guiding functional elements to provide effective waste management in urban areas (Figure 2.2).

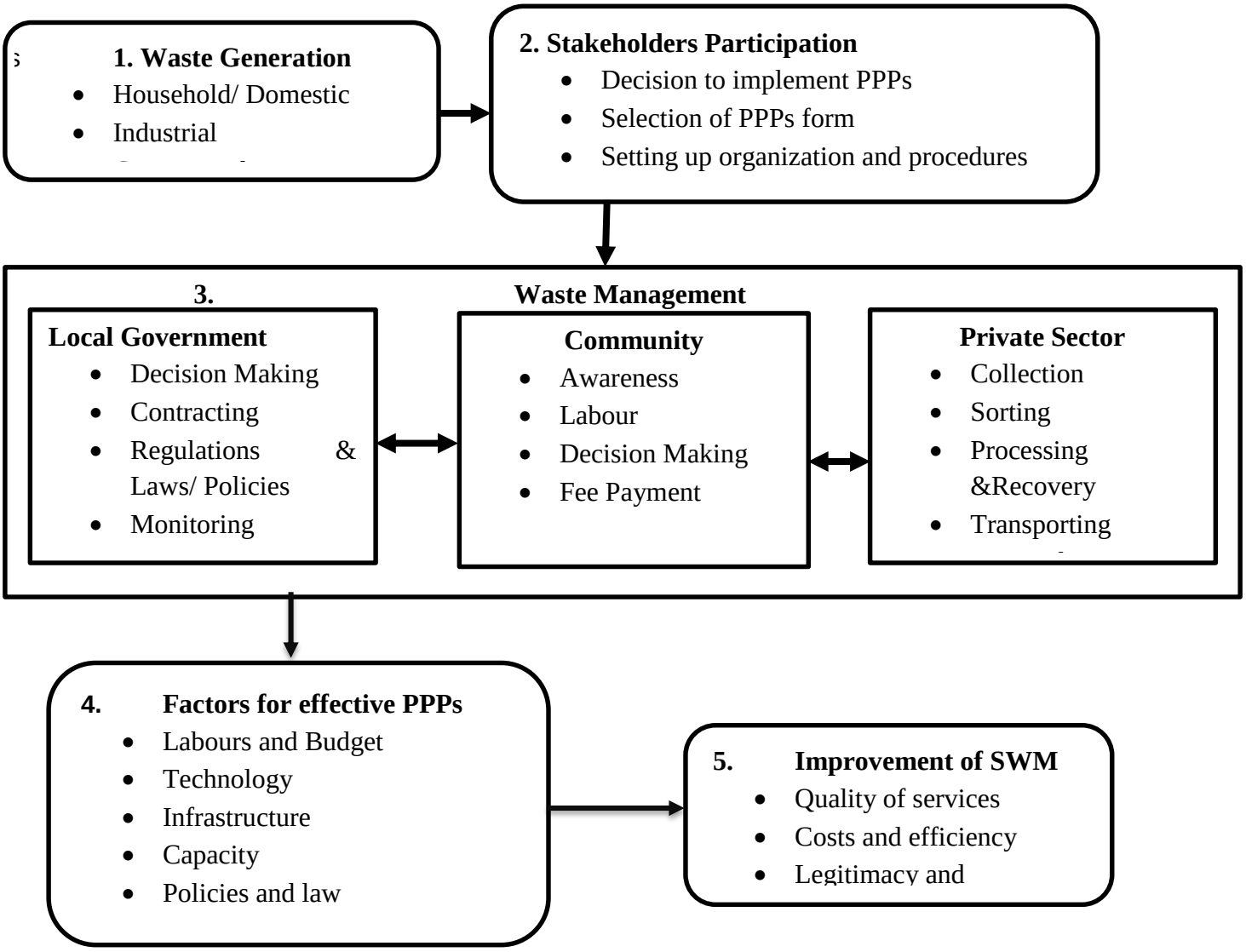

Figure 2. 2: Conceptual framework
Source: Miraji, 2021

2.13 Review of Empirical Studies

It is worth to note that there is a large body of empirical studies relating to solid waste management challenges and strategies to effective management process both across states in within Nigeria and countries outside the shores of Nigeria. Some of which includes the following;

Across the regions of Nigeria, such as the northern part of the country, Haruna and Bashir (2013), studied the nature and operational performance of PPP in waste management in Bauchi metropolis. According to the researcher, the use of public-private partnership in provision of basic urban services like water and sanitation in many developing countries is becoming inevitable for attainment of sustainable development and meeting the millennium development goals and in Bauchi metropolis, Nigeria, the case is not different, as public-private partnership in solid waste management has been in operation since 2007. The study analyzed the roles and relationships between the public and private actors, the constraints hampering success and finally suggest mechanism of bettering the partnership. A qualitative approach involving interviews, focus group discussions, observations and photography was used to gather necessary primary data, while reference to relevant literature provided the much needed secondary data.

It was found in the study that throughout the metropolis, the secondary waste storage facilities are grossly inadequate which encourages the illicit and indiscriminate disposal of waste on drainages, around the waste bins, uncompleted buildings, and vacant plots and so on, also, the newly developed suburbs were characterized by lack of planned and motor able accesses, drainages and irregular building developments and this limits the accessibility levels of the waste management service providers to the areas. The study recommended capacity building in both the Public and the Private sector in solid waste management would greatly improve their skills and competence in handling the ever-increasing waste generation in the metropolis as well as the enactment of stringent rules and regulations by both the state agency for environmental protection [Bauchi State Environmental Protection Agency] (BASEPA) and Bauchi State Urban Development Board (BSUDB) to regulate the erection of buildings illegally in and around the metropolitan areas of the state.

In addition, Ogbe (2014), analyzed the impact of private sector as against the conventional (public sector) in waste disposal in urban towns of Delta state as perceived by users as a means of advocating and promoting co-operative approach or a hand off of the weaker sector among the two. The study adopted the field survey design using 214 samples, who were Household heads (180) and Environmental officer (34), four research questions and one hypothesis that guided the study. Descriptive statistics and paired t-test were used to analyze the data at 0.05 intervals. The study found that the private sector had advantaged score in all four variables of equipment, personnel, cost effectiveness and general overall effectiveness over the public sector. It was recommended among others that government/private participation should be encouraged and the private sector participation in refuse disposal would be a better means of keeping a sanitary environment.

Also, Uwadiegwu and Chukwu (2013) studied the urban solid waste management strategies in three layouts in Enugu city. Namely, Independence Layout (low density), Idaw River (medium density) and Uwani (high density) were used for the study. About 310 households selected randomly from the layouts participated as respondents. Principal Components Analysis (PCA) version of Factor Analysis was used to analyses the responses of respondents. The PCA was used to reduce the 27 considered management options into 7 composite strategies which should be adopted for effective urban solid waste management. They are citizen mobilization and environmental education, strengthening of public agencies, responsible government, logistics and infrastructural improvement, legislation, appropriate technologies, monitoring and surveillance. It is recommended that all segments of the society must team up with public agency to find a panacea to urban solid waste management.

Elsewhere, outside Nigeria, Akaateba and Yakubu (2013) used a cross-sectional household survey to investigate householders‟ satisfaction with solid waste collection services provided by Zoomlion Ghana Ltd in the Wa Municipality. A total of 193 householders were selected through simple random sampling from registered household clients of Zoomlion Ghana Ltd in the Wa Municipality. The results of the study revealed that householders were, moderately satisfied' with most waste management services delivered by the Company indicating an acceptable level of service delivery. The one-way ANOVA results showed significant differences in householders‟ satisfaction by income level and house type for service delivery dimensions on frequency of waste collection; handling of waste during transport and disposal; and household education on waste management. The study therefore concluded that although the services delivered by the company can be considered as acceptable, much improvement could be made by simply addressing issues on household education, prompt response to user complains and ensuring effective monitoring and sanctioning by the Municipal Assembly as this will enable Zoomlion Ghana Ltd deliver quality services to its clients.

From all the reviewed empirical studies, one common trend is the focus on strategies for ensuring efficient waste management process. However, it is worth to note that from all the reviewed studies above, none have focused on assessing the effectiveness of public-private partnership strategy in waste management in Niger State in particular, hence the need for this study to explore performance of public-private partnerships involved in waste management in the study area, with a view to recommending the appropriate measures necessary to ensure that the set goals for the partnership are achieved.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Research Design

The research design adopted a mixed-methods approach, combining both quantitative and qualitative data collection and analysis methods. A survey questionnaire was administered to gauge residents' satisfaction with the waste collection and disposal services managed through the PPP. In-depth interviews were conducted with key stakeholders, including representatives from private partners, public officials, and community leaders, to gain insights into the partnership's effectiveness and identified any constraints. Open-ended questions provided additional qualitative data for thematic content analysis. Descriptive analysis techniques, such as frequency distribution and percentages, were employed to characterize private operators and analyze the quantitative data. Likert scale analysis was utilized to assess respondents' perceptions regarding the effectiveness of the PPP approach. Ethical considerations, such as obtaining informed consent and ensuring privacy, was duly addressed. It is important to note that the study's focus is limited to Minna, and there may be potential biases due to self-reporting. However, the research design is designed to ensure a comprehensive evaluation of the residents' perception of PPP approach in municipal solid waste management.

3.2 Reconnaissance Survey

A reconnaissance survey was carried out to familiarize the researcher with the study area. The list of Private operators of waste management, functions, and their locations coverage was obtained from Niger State Environmental Protection Agency (NISEPA). The interviews and discussions on waste management practices was conducted with some personnel from NISEPA, private operators

and general public. The discussions help the researcher gain a good overview of how the government partners with the private individuals on waste management in the study area.

3.3 Types and Sources of Data

Primary data was collected through semi-structured interviews, questionnaires, open-ended question and observations. Semi-structured interviews were used to collect data from NISEPA officials who are responsible as regulator for solid waste management. The following are the data collection methods to be used in this study:

3.3.1 Primary data collection

Field survey was used to obtain primary data for this study in order to gather data and important information on the success of the PPP approach in municipal solid waste management in the study area. Semi-structure interviews with employees from the government agency and private firms dealing with waste management and related concerns was conducted.

3.3.2 Questionnaire administration

In this study, data was collected through the administration of questionnaires. The statements obtained from the questionnaires served as references for the processed results represented in table and figures. A structured questionnaire with both closed and open-ended questions was employed to elicit qualitative information from the respondents regarding their understanding of the subject matter. The use of questionnaires in data collection was deemed essential due to its efficiency and ability to capture more information from the source. As such, questionnaires were prioritized as the major tool for capturing primary data in this study.

3.4 Sample Size and Sampling Techniques

According to the 2006 census (NPC, 2009), the population of Minna municipal was reported to be 293,000 residents. However, in order to obtain a more up-to-date population estimate, the researchers used a projection formula, and as a result, the estimated population for 2022 was determined to be 512,947. In order to determine the appropriate sample size for their study, the researchers decided to utilize the well-known Krejcie and Morgan's table of sample size (Krejcie and Morgan, 1970). The table provides guidelines for determining the sample size based on the population size. Considering the estimated population of Minna municipal in 2022, the researchers followed the recommendations of the table and determined that a sample size of 384 would be appropriate. This sample size was then divided among the 11 wards in Minna municipal, resulting in a sample size of approximately 32 individuals per ward. The projected population was derived from Equation 3.1 below;

$$Pn = Po\ e^{rn} \tag{3.1}$$

Where; Pn is the Future population (2022)

Po is the Base year population (2006)

r is the Growth rate (3.5%)

e is the Euler number (2.71828)

n is the Interval between future population and base year population (2022- 2006) 16 years

That is:

$$2022 \text{ population estimation} = 293{,}000(2.71828)^{0.035 \times 16}$$

2022 population = 512,947

Sample size= 384 (Appendix C)

3.5 Data Collection Procedures

Permission was sought from community leaders, relevant agencies as well as local government authorities for the data collection for this study, and once approved, the data collection instrument was administered to the targeted population within the study area in order to collect, interpret, and analyses the research questionnaire and other instrument. Waste dumpsites and collecting points, as well as waste collection points and disposal sites, was detected and identified using GPS (Global Positioning System) coordinates within the study region.

3.6 Methods of Data Analysis

i. Objective i: to examine the characteristics of the private operators of solid waste management in the study area. This objective was achieved through the use of descriptive analytical techniques such as frequency and percentage. The results were presented in bar/pie charts.

ii. Objective ii: to examine the effectiveness of public-private partnership in solid waste management in the study area. This was measured using 5-point Likert scale and the objective was achieved through the use of descriptive analytical technique to analyze the data generated on people's perception of Public-Private Partnerships approach to solid waste management in the study area.

iii. Objective iii: to analyze the constraints to public and private partnership approach to waste management in the study area. This objective was achieved using descriptive statistics such

as frequency distribution and percentages to analyze the data gathered from the questionnaires administered to both the private officers of the selected firms, and residents.

iv. Objective iv: to evolve alternative ways of improving the services of solid waste management in the study area. This objective was also achieved using descriptive statistics This study uses thematic content analysis, which is a descriptive presentation of qualitative data. Thematic analysis helps researchers understand those aspects of a phenomenon that participants talk about frequently or in depth, and the ways in which those aspects of a phenomenon may be connected (Braun and Clarke 2006).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-Economic Characteristics of Respondents

The distribution of respondents by age, sex, educational level, employment, and income level is shown in Table 4.1. The gender distribution of responders shows that males make up around 63% of the total, while females make up about 37%. Male respondents outnumbered female respondents due to the fact that male respondents were more available and willing to provide information than female respondents.

The majority of the respondents (63.1%) were married, with the unmarried accounting for 28.2% of the total. Widows and divorcees accounted for 4.7% and 4.2% of the population, respectively. Those with a university education make up roughly 65.4% of the population, followed by those with secondary education, who make up 23.8%. Other qualifications, such as Quranic education and other literacy program not covered in the regular classroom curriculum, accounted for 5.2% of the total. The large percentage of individuals with a tertiary education indicates that respondents in the study area are well-educated and should be able to easily and willingly cooperate in attaining a healthy living environment through good solid waste management methods. Pacey (1990) emphasized the importance of education in waste management, stating that "formal education is a requirement for meaningful change in sanitation behavior."

The distribution of respondents by occupation revealed that civil servants accounted for 45.1% of all respondents, followed by craftsmen (18.6%). Traders accounted for 16.3% of the total, while farmers, apprentices, and other occupations accounted for 20.1%.

The earnings of the respondents revealed that the majority (30.5%) earn between ₦31,000 and ₦50,000 per month, while those earning less than ₦10,000 per month accounted for the least (5.5%). The domination of individuals working as civil workers and earning between ₦31,000 and ₦50,000 per month is unsurprising, given the high percentage of respondents with tertiary degree credentials. This is because it is often assumed that one's educational achievements dictate the sort of job and the amount of money one earns. In agreement with Tsai (2007), higher incomes and education levels improve the willingness to participate in waste management program such as recycling in order to safeguard the environment.

Table 4. 1**:** Socio-Economic Characteristics of the Respondents

	Frequency	Percentage (%)
Gender		
Male	218	63.4
Female	126	36.6
Total	344	100
Marital Status		
Single	97	28.2
Married	217	63.1
Widow	14	4.2
Divorced	16	4.7
Total	344	100
Educational Qualifications		
Primary school education	19	5.5
Secondary school education	82	23.8
Tertiary education	225	65.4
Others (specify)		5.2
Total	344	100
Occupations		
Trading	56	16.3
Artisan	64	18.6
Civil Servant	155	45.1
Others	69	20.1
Total	344	100
Income level		
below N10,000	19	5.5
₦11,000 - ₦30,000	49	14.2
₦31,000 - ₦50,000	105	30.5
₦50,000 and above	171	49.7
Total	344	100

Source: Field Survey, 2022.

4.2 Characteristic of Private Operators Participation in Waste Management

The involvement of private operators in waste management has become increasingly important in many developing countries, including Nigeria. This analysis focused on identifying the characteristics of private operators in solid waste management, such as identifying the private operators, the type of partnership they are engage in, the capacity of the operators, their roles and responsibilities, size and scope of solid waste management (area of coverage of each operator), the types of solid waste management services provided and the outcome achieved.

Table 4.2 illustrates the contracted firms labor and equipment strength, which is in line with objective one. The total capacity of the entire operators in terms of manpower is 42, with 30 being laborer, 6 being drivers, and 6 being managers. In Minna, about 66.6% of operators have less than five years of experience in waste management and lacked the necessary technical expertise and equipment to hand waste management effectively. In terms of equipment, it was discovered that private operators had a total of 58 different pieces of equipment, six of which were waste-collection vehicles (None of the operators has compactor), with the remaining 59 consisting of wheel barrows, shovels, rakes, and waste barrels.

Table 4.3, lists private operators engaged by NISEPA in Minna municipal, there are six private operators engaged. Operational areas were allotted to each company for easy evacuation of solid waste. The main role and responsibilities of each operator are to carry out waste collection, transportation, and disposal from their allotted operational area (Figure 4.1). This has limited their work to service provision for NISEPA, as they are paid directly by the government agency, which is according to the type of private financial initiative agreement, namely the operation and management contract.

The survey of private operators revealed that majority of operators were small and medium-sized enterprises (SMEs) with limited resources. This is an indication that the firms are small scale in terms of size even though given the area of coverage (Minna), it is difficult to conclude that positive outcome should be expected. This is because the strength and quality of staff with available equipment and facilities are often an indication of firm's waste collection capacity even though that NISEPA supplement the workforce of the private operators by covering and evacuating solid waste from some districts that are not covered by the private operators such as Kpakungu, Broadcasting road-Morris, Dutsen Kura (Hausa), Limawa and even in some parts of districts already in coverage by the private operators.

The interview with key stakeholders like the private operator managers and NISEPA officials, provided additional insights into the characteristics of private operators involved in waste management in Minna. Majority of operators' representative noted that private operators play a crucial role in providing waste management services to NISEPA. However, they also noted that they faced several challenges, including poor waste disposal practices due to the distance from collection point to legally approve disposal site, lack of equipment and inadequate regulation.

Table 4. 2:List of Private Companies Engaged in Waste Management

S/N	Company Engaged	Operational Area	Years of involvement in SWM
1	Maigaskiya Concept	Kateren Gwari District	3
2	Naicco Concept	Zarumai District	3
3	Amjal Resources	Tunga B District (Tudun Wada South)	5
4	Difficult Solution Enterprises	Sabon Gari District	7
5	Abdulrahman Muregi Farms	Barikin Sale/Sauka Kahuta District	8
6	Ryder Transport and Travels	Tunga A District (Tudun Wada North)	3

Source: Field Survey, 2022

Table 4. 3: Capacity of Private Contractors

Capacities	Total
Manpower	
Laborer	30
Drivers	6
Managers	6
Total	42
Operational vehicles	
Waste collection vehicles	6
Others	52
Total	58

Source: Field Survey, 2022.

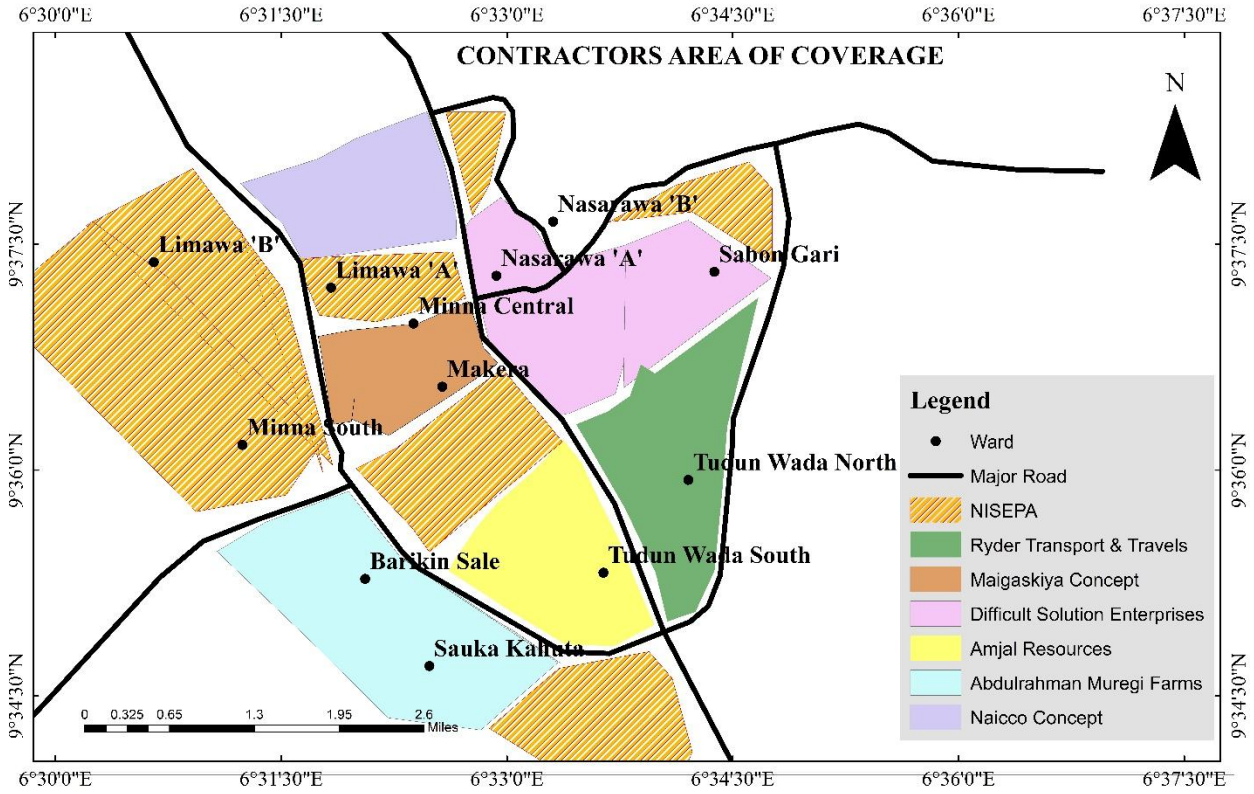

Figure 4. 1: Map of Area of Coverage by Private Firms and NISEPA

Source: Geography Remote Sensing Lab, FUT Minna (2022)

4.2.1 Types of waste collection and disposal options by private operators

Table 4.4 reveals that the types of waste most commonly collected in the study area were dominated by both residential and business waste. Industrial waste made up the least amount of waste, accounting for less than 15% of the total. This type of waste generated in the area is indicative of the predominant land use activities in the area, which include residential and commercial.

Waste sorting, recycling, and re-use practices not only improve waste management processes, but also provide economic benefits to those involved. However, none of the private firms partnering in waste management in the study area are involved in waste sorting, recycling, or re-use, as shown in Table 4.4. This is demonstrated by the fact that 100% of the companies sampled stated that after waste collection, the whole waste is disposed of at a landfill.

Table 4. 4: Distribution on Waste type and Management Practices after Collection

Variables	Frequency	Percentage (%)
Type of waste collected		
Domestic	7	100
Industrial	1	14.3
Commercial	4	57.1
Total	13	
Waste Management Practices after Collection		
Sort the re-usable	Nil	0
Sort the recyclables	Nil	0
Separate bio-degradable from non-bio degradable materials	Nil	0
Convey everything to the permanent dumpsite	7	100
Total	7	100

Source: Field Survey, 2022

4.2.2 Causes for Engaging Private Firms in Waste Management

Figure 4.2 indicated that the rationale for the implementation of public private partnership in waste management is because private operators are more efficient than public officials in service

delivery. This is because majority of the representatives of private operators stated that they are more efficient in service delivery than their public counterparts.

More specifically, about 27% of private operators indicated that the cooperation was formed with NISEPA to reduce the public sector's operational costs. Those who feel it was caused by a surge in waste generation and the public sector's failure to provide quality services accounted for 7.0% and 14.0%, respectively. Because studies have demonstrated that public sectors are often unsuccessful in service provision, particularly in waste management activities, the general argument that private sector efficiency in service delivery is the basis for accepting private partners in waste management is expected. In a nutshell, the basis for involving private operators in waste management can be summed up by Gentry and Fernandez's (1997) assertion that public-private partnerships often begin when a crisis is identified, which can occur when a service is not delivered, the need is high, and the government is unable to meet it. Also, when there is long-term planning, driven by a clear awareness of and respect for the demands of diverse actors, and when there is a powerful individual, known as a "champion," who pushes for change, it can make a significant difference.

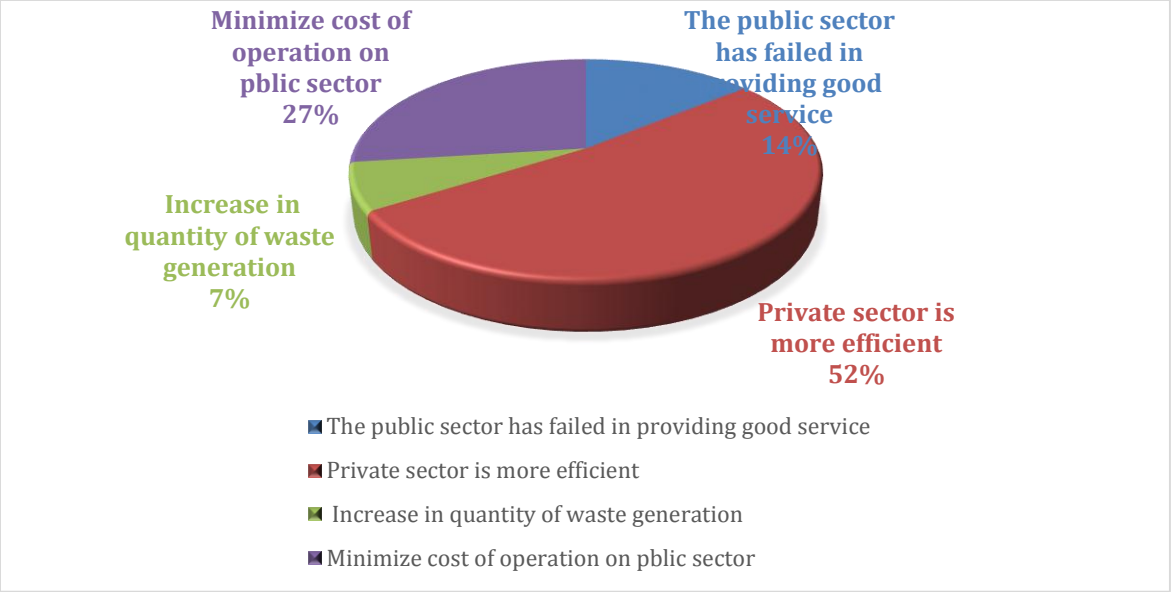

Figure 4. 2: Drivers of Private Sector Adoption in Solid Waste Management.
Source: Field Survey, 2022

4.2.3 Responsibility for solid waste management

Figure 4.3 depicts the responses to the question of who was responsible for managing the solid waste they generated. The majority of respondents (58.4%) believe it is the government's obligation to manage the waste in the environment, while just 2.9% believe it is the individual's responsibility to collect and dispose of their waste items.

This finding is unsurprising, given that waste management in Nigeria is completely the responsibility of the government. However, this could explain why the majority of people in Table 4.5 were unwilling to pay for waste collection and disposal services provided by private companies.

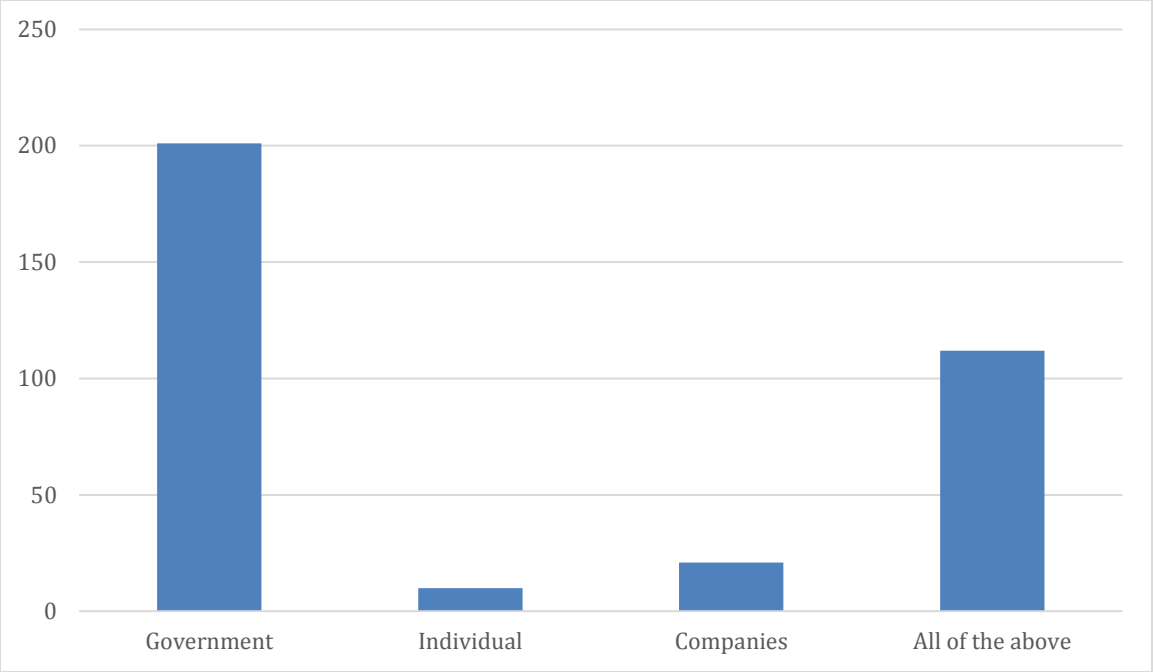

Figure 4. 3: Approaches to Solid Waste Collection and Disposal Responsibility
Source: Field Survey, 2022.

4.3 Effectiveness of Public-Private Partnership in Waste Management

Table 4.5 is a summary of the respondents' views on the effectiveness and efficiency of the public-private partnership strategy for waste management. This assessment is necessary because of the increasing public demand for high quality service from both public and private institutions. As a result, it is critical for various actors in the delivery of public services, including waste management services, to be increasingly concerned about enhancing customer satisfaction while also improving environmental well-being. The Likert scale Mean Score (MS) was interpreted according to three ranges, with a score between 1.0 and 2.4 indicating a negative attitude, a score between 2.5 and 3.4 indicating a neutral attitude, and a score between 3.5 and 5.0 indicating a positive attitude by the general respondents.

The first indicator, “private companies are involved in waste collection in my area,” has a mean score (MS) of 2.6, indicating a slightly negative perception of private operators’ involvement in

solid waste collection. About 54.7% of respondents “Disagreed”, while only 6.1% “Strongly Agreed”. From the interview conducted, it is indicated that quite a large proportion of the respondents attested that they are not aware of private operator’s existence but are cognizant on the waste collectors, this may be due to the fact that private contractors are more answerable and are paid directly from the agency (NISEPA) which has create a barrier between private operators and the residents. When it came to the promptness of waste collectors in responding to consumer concerns, the indicator received a MS of 2.8, which falls in the “Neutral” perception. This implies that respondents had mixed opinions on the promptness of private operators in addressing consumer concerns. While 26.5% of respondents agreed that the operators responded promptly to complaints, 36.3% of respondents disagreed, and 19.8% chose the neutral option. This result indicates that while some residents in Minna may have received timely responses from private waste operators, a considerable proportion of respondents did not perceive the operators to be prompt in addressing consumer concerns.

The general respondents’ perception to the question that private operators evacuate wastes regularly but people kept on littering the environment is neutral (MS=2.7). To some extent, their assertion is correct, because in low-density areas such as GRA, Uphill, Gidan Madara, Commissioner quarters, State House of Assembly quarters, where private firms are mostly found in the early hours of the day moving from house to house and one street after another to pick up waste from household bins to ensure that waste is timely and effectively collected and disposed of as due to ensure a healthy environment, there is little litters in these areas.

When it came to the frequency of waste collections, the mean score (MS) for this indicator was 2.8, which falls within the "Neutral" general perception. Many of respondents disputed that private waste collectors came at regular intervals to collect waste. As observed from the field survey,

respondents in this category are those residing in Angwan sarki, Kpakungu (both Soje A and B), Angwan limawa, Kwangila area, Sauka kahuta, and Fadikpe, which are largely under-served due to the high rate of waste generated as a result of the high population. Furthermore, the majority of respondents (38.4%) disagreed that the current strategy for waste collection and evacuation is satisfactory. This contradicts the findings by Kassim and Ali (2006) and Katusiimeh, *et al.,* 2012, who reported in a related study in Dar es Salaam, Tanzania and Kampala, Uganda, that the majority of households are satisfied with the frequency of services provided by private waste collection firms.

In terms of willingness to pay for services, the majority were unwilling to pay for waste collection services, which has an MS of 2.2, indicating a negative perception of the present approach to waste collection and evacuation., with only 4.1% and 20.9 strongly agreed and agreed respectively, firmly believing that payment for waste collection services is required. According to the semi-structured interview with private waste officials, the majority of respondents are unwilling to pay for waste generated. In many cases, particularly in unplanned areas, residents and businessmen believe it is the municipality's responsibility to collect waste, and because they are still receiving the service without paying for it, they are often unwilling to pay for the continuation of that service.

The table below which measures respondents' perceptions of the adequacy of private operators' equipment for waste collection. The mean score for this indicator was 2.5, falling into the "Neutral" category, suggesting a slightly neutral perception of private operators' equipment adequacy for waste collection. Many respondents (52.9%) disagree that private operators have appropriate waste collection and disposal equipment, while only a handful 15.1% and 2.9% firmly agree and strongly disagree respectively that private operators have adequate waste collection and disposal equipment. It is important to note that the majority of these private operators are smaller companies

attempting to work with the state agency (NISEPA) on waste management. As a result, while the small size is noticeable, the capacity issues (equipment, manpower, etc.) should be acknowledged.

Responses on the overall service delivery of private operators, mean score for this parameter was 2.8, which falls under the "Neutral" category which show that a many (36.3%) disagreed that the services are commendable. This indicates that the private sector's involvement in waste management has yet or not resulted in a favorable improvement in waste management. This is not in line with Kassim and Ali (2006) assessment, which stated that the gradual expansion of private service providers' engagement in waste management over the last few years has enhanced efficiency, effectiveness, integration, and accountability.

Table 4. 5: Distribution of Effectiveness and Efficiency of PPP in Waste Management

Indicators of Effectiveness and Efficiency		SD	D	N	A	SA	Total	MS
Private companies are involved in waste collection in my area	Freq	40	188	21	74	21	344	2.6
	%	11.6	54.7	6.1	21.5	6.1	100	
Private operators give prompt response to user complaints	Freq	41	125	68	91	19	344	2.8
	%	11.9	36.3	19.8	26.5	5.5	100	
Private operators evacuate wastes regularly but people kept on littering the environment	Freq	42	138	81	60	23	344	2.7
	%	12.2	40.1	23.5	17.4	6.7	100	
Private operators collect wastes at regular intervals	Freq	30	132	72	84	26	344	2.8
	%	8.7	38.4	20.9	24.4	7.6	100	
Present approach to waste collection/evacuation is satisfactory	Freq	80	172	40	41	11	344	2.2
	%	23.3	50	11.6	11.9	3.2	100	
People that are more willing to pay for waste collection and disposal	Freq	20	200	38	72	14	344	2.6
	%	5.8	58.1	11	20.9	4.1	100	
Private operators have adequate equipment for waste collection	Freq	33	182	67	52	10	344	2.5
	%	9.6	52.9	19.5	15.1	2.9	100	
Overall service delivery of private operators is commendable	Freq	27	125	92	96	4	344	2.8
	%	7.8	36.3	26.7	27.9	1.2	100	

Source: Field Survey, 2022

4.3.1 Waste collection point/equipment used and frequency of collection

Table 4.6 shows the distribution of responses from private firms on the type of collection points from where waste is collected by the private waste management companies. 100% attested to collect the waste from personal bin (household dustbin), while also 100% of the private collectors regularly packed wastes from NISEPA bins and unauthorized dumpsites respectively. Moreso, trucks (Waste collection vehicles) dominated the type of conveyance equipment used for waste collection (100%), Plate I shows an example of an unauthorized waste collection point along Paikoro road in Minna, with waste dumped openly near the roadside instead of inside proper

disposal bins (see Plate I). Unfortunately, there is no single compact vehicles in use both by the private contractors and the agency. This implies that waste collection and disposal in the study area is expected to be carried out less efficiently and effectively as the use of these forms of unsophisticated equipment won't help for better collection and evacuation of wastes. Plate II illustrates a waste collection vehicle used by Amjal Resources that lacks a cover, along Kure market road in Minna. The lack of a cover allows litter to fly out of the truck during transportation (see Plate II).

The locations of waste collection point across Minna are mapped in Figure 4.4, with many concentrated along major roads. Based on the frequency of waste collection, 100% majority of firms collected wastes once a week in each district of allocated area of operation while also all the firms agree that most unauthorize dumpsites gathered their wastes daily and are collected. The frequency of waste collection seemed to be in line with the standard frequency of waste collection especially if wastes are sourced from the residential areas. This frequency is typical of urban centers as documented by Akaateba and Yakubu (2013) that the officially stipulated frequency for waste collection is once a week for house-to-house collection and no defined collection frequency for the Central Collection Point where by waste is collected as and when containers are full.

Table 4. 6: Distribution on Waste Collection point/Equipment, Frequency of Collection

Collection Point	Frequency	Percentage
NISEPA bins	7	100
Personal bins	7	100
Authorized dumpsites	7	100
Total	21	
Collection Equipment		
Wheel barrows	4	57.1
Waste collection vehicles	7	100
Compact vehicle	0	0
Others	48	
Total		
Frequency of Waste Collection in a District		
Once weekly	7	100
Twice weekly	0	0
Others	4	57.1
Total	11	

Source: Field Survey, 2022

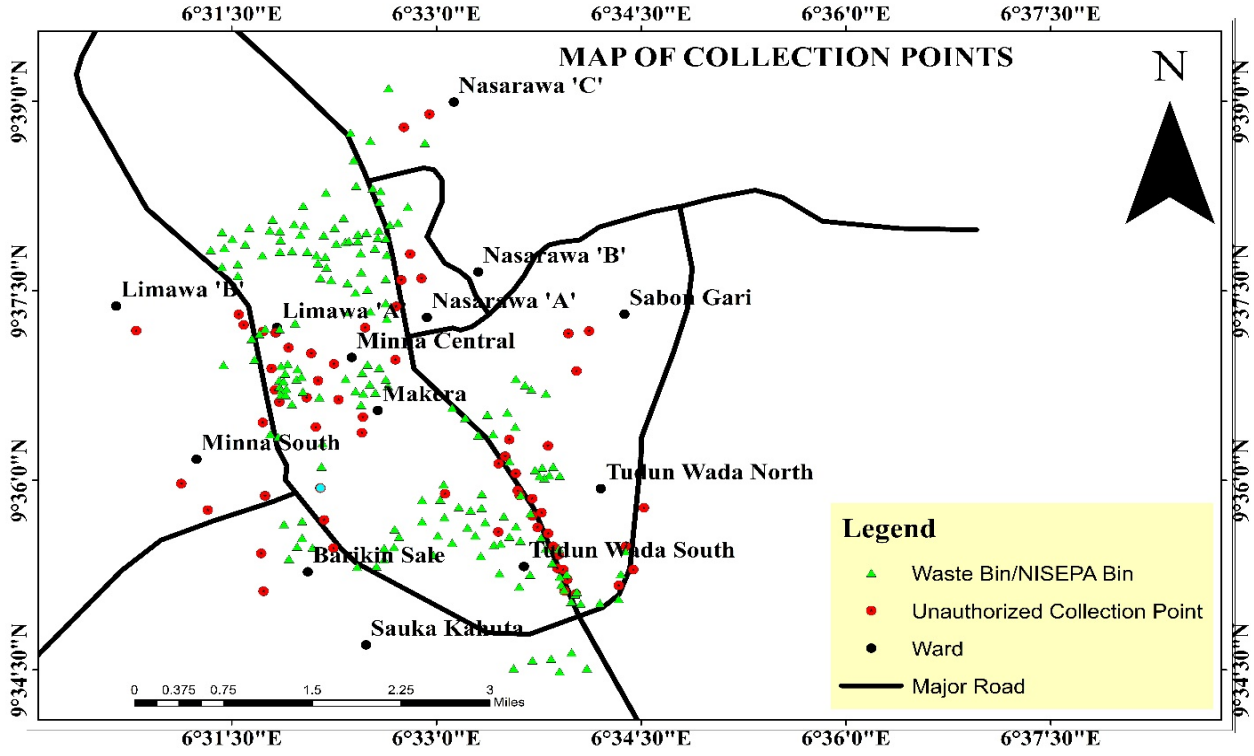

Figure 4. 4: Map of Collection Points

Source: Geography Remote Sensing Lab, FUT Minna (2022)

Plate I: Unauthorise waste collection point along Paikoro road
Source: Authors Field Survey, 2022

Plate II: A Waste Collection Vehicle Without a Cover along Kure Market Road use by Amjal
Source: Authors Field Survey, 2022

4.3.2 Nature and types of waste generated by public

Table 4.7 shows the public respondents' concerns about waste generation. It was discovered that the majority of respondents agreed that they primarily generate domestic waste which received a positive MS of 3.5. This is not surprising, as it indicates that the area is primarily used for residential purposes. This is because the types of waste generated in a given area are a result of the predominant socioeconomic activity in that area. When it comes to the sort of dumpsites where waste is disposed of which received a positive MS of 3.6, the majority of respondents claim to use authorized dumpsites, with only a small fraction claiming to use unauthorized dumpsites on a regular basis.

The majority of respondents were neutral with MS of 3.0 that dumpsites are not far away from their residence, while about a quarter of the respondents neither agreed nor disagreed that the dumpsite is far away from them, according to an analysis of the location of dumpsites where wastes are temporarily disposed before final collection by the authorities from the residence. This indicates that indiscriminate waste dumping, which normally occurs when dumpsites are located far away from residential areas or when dumpsites are not available, is unlikely to occur in most portions of the study area especially the planned areas. The researcher's observations during the reconnaissance survey around the metropolitan areas that are well served with NISEPA barrel bins where indiscriminate waste disposal is rarely witnessed include the Farm Centre, Tunga Low Cost, Zarumai quaters, Old airport, commissioners' quarters, and Uphill, among others.

Furthermore, the results of the level of knowledge of the negative impacts of improper waste disposal on human and environmental health revealed that the vast majority strongly claimed to be aware that poor waste management had negative consequences on human and environmental health. Only 3.5% and 4.1% of respondents said they were unaware of the harmful impacts of

improper waste disposal on their health and the environment. This indicates that the respondents are well aware of the harmful consequences of poor waste management on their health and the environment.

Table 4. 7: Opinion of Respondents on Waste Generation Issues

Variables		SD	D	N	A	SA	Total	MS
I mostly generate Residential wastes	Freq	19	53	28	216	28	344	3.5
	%	5.5	15.4	8.1	62.8	8.1	100	
I dispose my wastes in an authorized dumpsite	Freq	19	60	13	200	52	344	3.6
	%	5.5	17.4	3.8	58.1	15.1	100	
The dump-site is far away from my vicinity	Freq	10	164	15	114	41	344	3.0
	%	2.9	47.7	4.4	33.1	11.9	100	
I'm aware of the effect of waste disposal on the environment	Freq	12	12	8	184	129	344	4.2
	%	3.5	3.5	2.3	53.3	37.4	100	
I'm aware of the effect of waste disposal on the human health	Freq	14	26	10	147	148	344	4.1
	%	4.1	7.5	2.9	42.6	42.9	100	

Source: Field Survey, 2022

4.3.3 Methods of waste disposal by the public.

Figure 4.5 indicates that the open dump system dominates the method of waste disposal practices of most survey participants. This is obvious in the fact that 56.4% of respondents chose an open dump system as their waste disposal method. Field observations around Tunga maje, Kpakungu soje A and soje B, Kateren Gwari, Fadikpe, Barikin sale, and Sauka kahuta reveal a huge quantity of carelessly deposited wastes littered along gutters, ponds, roadside, and backyards of residential, commercial, and industrial districts (See Plate III and IV). The waste generated in these parts of the study area is more than the waste collected. The residents are poorly served by private sectors

as compared to the low-density areas of Farm center, Commissioner quarters, Government Residential Area, Old airport quarters, and most planned areas in the municipal, although even in some planned areas for example Old airport quarters and 123 quarters, there are places where waste littering and dumping was also observed.

Furthermore, the smallest percentage of respondents (4.9%) buries their waste. The use of waste burying as the least expensive waste management strategy can be attributed to a shortage of undeveloped land space as well as awareness of the potential for groundwater pollution as a result of such actions.

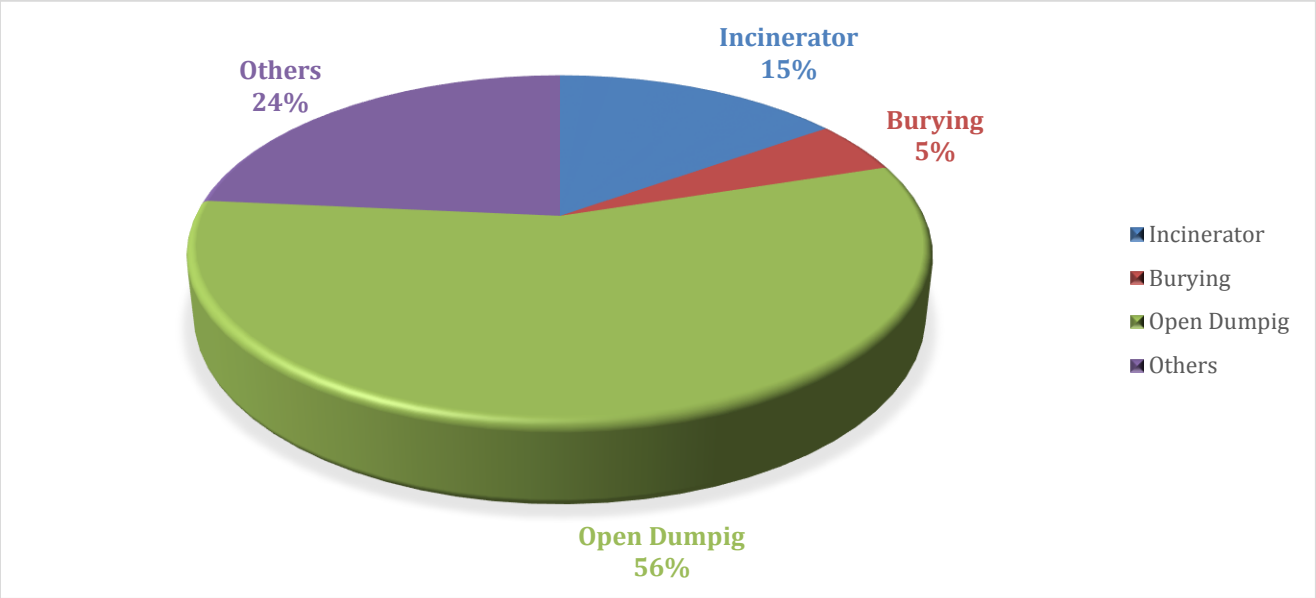

Figure 4. 5: Distribution of Respondents on Waste Management Methods

Source: Field Survey, 2022

Plate III: Indiscriminate Dumping of Refuse in Unauthorize Dumpsite, Barikin sale

Source: Authors Field Survey, 2022

Plate IV: Indiscriminate Dumping of Refuse in Tunga Maje.

Source: Authors Field Survey, 2022

4.4 Constraints to Public Private Partnership

Table 4.8 shows the challenges that private waste management companies encounter in offering their services. Poor enforcement of sanitation standards on residents is considered the most severe restraint by slightly more than one-third of the respondents. The finding on poor sanitation enforcement is not surprising because, in general, people have negative attitudes toward sanitation issues, particularly in developing countries, and this, according to Enweze (2000), stems from the perception that environmental sanitation and hygiene issues are less important than most other social issues.

Poor building accessibility was also cited as a major impediment to private companies providing effective waste management services. From field observations, areas around Sauka Kahuta, Barikin Sale, Kpakungu, Kwasau and its environs are mostly inaccessible due to the slum nature of the settlement as well as bad road conditions, especially during the rainy seasons.

Because all participating firms within the study area are allotted territories of operational jurisdiction within which they are expected to cover, as shown in Table 4.2, there is no unfair competition from other agencies. This assignment of duty units is supposed to make it easier for government taskforces to supervise and monitor performance. Plate V shows waste disposed of at the single composting site located at Kuyi village, which must handle waste from the entire municipality

Table 4. 8: Constraints to Service Provision by Private Firms

Constraints	Frequency	Percentage
Unfair Competition from other Agencies	Nil	0
Non-Cooperation of Residents	1	14.3
Poor accessibility to Buildings	2	28.6
Poor location of Permanent Dumpsites	Nil	0
Poor enforcement of Sanitation rules	4	57.1
Total	7	100

Source: Field Survey, 2022

Plate V: Waste Dispose of at Composting Site Located at Kuyi Village
Source: Authors Field Survey, 2022

4.4.1 Problems encountered in service delivery of private operators among residents

Table 4.9 presents the distribution of respondents on the problems encountered by private firms' participation in waste management in the study area. Discriminatory service supply by private enterprises topped the list of issues with 43.6%, followed by irregular rubbish collection with 23.5%. Residents around the Sauka Kahuta, Barikin Sale, and the surrounding areas are underserved by private firms, owing to the inaccessibility of residential areas by waste management service providers due to the nature of settlement patterns and road networks, which are mostly in poor condition. That's from a cursory observation by the researcher.

Furthermore, approximately 11.4% of residents stated that they had never had an issue with patronizing private firm operators. It can be concluded that variations in the level of services received by respondents may be due to location of residence, compliance with payments of ₦1,000 per household per month where service providers (NISEPA as levy collector) claim that some areas do not pay regularly, social status of residents, particularly those in slum areas who cannot afford three square meals, not to mention the payment of waste charges, as some locations generate obnoxious waste that is difficult to evacuate.

Table 4. 9: Associated Problems of Waste Collection by Private Firms

Constraints	Frequency	Percentage
Discriminatory Service Provision	150	43.6
Irregular Collection of Wastes	81	23.5
High Charges	57	16.6
Lack of Clean environment after waste collection	17	4.9
None	39	11.4
Total	344	100

Source: Field Survey, 2022

The findings can also be used to support the generally held belief that private waste collection companies primarily serve the high-income residents especially as noted in Katusiimeh *et al.*, 2012; Kasim and Ali, 2006.

4.5 Improving the Services of Solid Waste Management in Minna

MSWM is one of the most expensive services (Grazhdani, 2016), so MSWM bodies should be able to rely on a consistent source of funding to provide an effective MSWM service. 44% of private operators respondents identified within the category that government institutions has a vital role to play especially the Ministry of Environment and it relevant agencies to cover most of the capital costs required for MSWM in Minna. Also, a government staff noted that "Chanchaga local government area should provide an extra fund to cover the cost of the management system". Most

of the private operators respondents believed that proper institutions should be pump with enough capital to improve the present system. On top of this, there should be proper revenue generation plan by NISEPA; the current system lacks user cost recovery such as MSW collection fees and disposal charges which is currently at a meager of N1000/month. 20.2% of public respondents make their opinion base on Role of Institutions and Funding Management. One public respondents write that there should be "Adequate funding to the environmental sanitation agency for good service delivery"

In order for waste management programs to thrive and be effective, the head of NISEPA's Solid Waste Management Department suggests that an adequate division of responsibilities, authority, and revenues be determined between national, regional, and municipal governments. The role of government institutions needs to change from service-providing to regulation.

Besides this, 22% of private firms and 19.3% of the public respondents implies that the institutions must have strong public education program regarding MSWM. One of the public respondents noted that "There should be permanent public education scheme provided by schools or colleges", another one also noted ".... Sometimes printed posters should be used, so has to have a good impact on public behavior". These situations can lead to gains in opportunities for the improvement of the MSWM system. The current poor public involvement and awareness are similar to many developing countries such as Tanzania (Alsebaei 2014) and Kenya (Ahmed and Ali 2006).

The proper functioning of MSWM initiatives requires a clear, transparent, and unambiguous legal and regulatory framework, as well as working inspection and enforcement systems at the national, provincial, and local levels (Marshall and Farahbakhsh, 2013). It is critical to have robust and effective waste management legislation at both the national and municipal levels to guide waste

management decisions and plans (Asase *et al.*, 2009). These policies should promote the urban poor's knowledge, education, skills, and empowerment in order to improve their living situations (Murad *et al.*, 2012). 22.2% of private operators suggest that there should be an Enactment and Enforcement of Policy/Programs. 15.3% of public respondents believes there are delicate issues that should be enforce. One public respondent writes that "there should be punishment for anyone who fails to dispose refuses in an authorized dumping site" another one noted that "Good government policy inform of by laws to checkmate indiscriminate disposal of waste".

The provision of a clear space for stakeholders (users and non-government providers) to make a contribution to the planning and delivery of MSWM services significantly improved the efficiency of any MSWM system (Wilson *et al.* 2012). Sheau-Ting *et al.* (2016) stated that the full engagement of the MSWM system user is among the key elements which can improve MSWM services. In this regard, 11.1% of private firms felt that public participation in MSWM service development, implementation, and assessment should be promoted. Most public respondents and private firm concord that there should be a well-developed mechanism or legal obligation to ensure actual public participation at appropriate stages of the MSWM services planning and implementation process.

11.1% and 13.2% of private operators and public respondents respectively believes that communities should participate and be involved in making decisions concerning waste management strategies. There should be a way to communicate the performance of the waste management system and recommended plans to the community in order to gain input and support (Asase *et al.*, 2009). NISEPA is responsible for regulatory, planning and also supplementing the workforce in delivery of MSWM services in Minna including the collection, transportation and disposal of MSW with it private partners. These organizations have a low percentage of adequately

trained and skilled staff members, poor staff training, and limited development programs, while having a well-organized and structured career progression. According to the findings, the majority of private firm respondents preferred that both the public and private sectors be allowed to provide MSWM services within the current operating framework. However, the researcher believes that a clear and transparent bidding procedure for MSWM service delivery should be available to all and that the most competent organizations capable of delivering MSWM services should be selected, as most current private operators lack the capacity to do so.

Improvements to service operations, technology, and accessibility were suggested by 21.4% of public responders. Many respondents believe that the government (NISEPA) should increase the number of litterbins and barrel bins on the streets and in other public locations and optimize their distribution to deter people from littering. Access to these units will reduce littering, relieve some of the load on towns, and shift resources to assist with efficient waste disposal. Another change that could be made is to the storage containers. One of the public respondents suggests that the volume of the storage enclosures should be designed by overestimating the generation of waste, not underestimating it, as is now being done. This also includes improving transportation and other equipment, particularly the procurement of more waste vans and compact trucks, which will expand operations in the long run. However, according to research by Parrot *et al.* (2009), transfer stations should be developed through the partnership of communities and governments because distance and access to paved roads is still a hindrance to service. This is a fantastic method to cut transportation costs while still increasing service. Another study conducted in India revealed that labor may substitute technology in certain situations, such as waste collection from difficult-to-reach places. This may be accomplished by involving residents of low-income neighborhoods, which would then result in the creation of jobs and income for these individuals, particularly in

the areas surrounding Kpakungu (Soje A and B), Tudun Wada A (behind Mr. Biggs), inner Kateren Gwari, and others. On Honduras' North Coast, community members participated in recycling and composting activities as well as establishing localized waste collection and disposal systems, which proved to be a success (Goett, 1998).

The respondents and researcher field observations confirmed that composting system is used to manage the MSW generated in Minna. Right now, there is one composting site located about 17km northwest of Chanchaga LGA (Figure 4.6), which has been legally approved by the Niger State Ministry of Environment. This site lacks fencing, access control, proper vehicular access, site security and MSW scales (see Plate VI). A senior government staff of NISEPA advocate that "The government should carry out regular inspections of the composting site to ensure that it does not create negative impact on the environment and there should be more than one disposal site that should be legally approved".

Recycling, according to scholars like Zheng *et al.* (2017) and Alsebaei (2014), is a good alternative to increasingly expensive treatment alternatives like thermal treatment. Formal recycling initiatives do not exist in the Kuyi composting site, according to both the respondents' responses and the researcher's field observations. NISEPA now lacks a plan that promotes an MSWM hierarchy that should encompass reduction, reuse, recycling, and recovery, despite the vast volumes of MSW produced in the municipal sector.

However, during the last few decades, an active informal recycling sector has emerged, with scavengers sorting through and retrieving recyclable items from collection points and composting sites (Plate VII). Because no organization has made an effort to represent or integrate this sector inside the formal MSWM framework, it is working on its own. Plastic, metal, and paper make up

the majority of the materials recovered. Scavenged MSW is often segregated at the dump for reuse or recycling, resulting in a significant reduction in the amount of MSW disposed of in composting sites. Informal sector activities not only reduce the environmental burden of MSW but also improve economic opportunities (Masood *et al.* 2014). However, scavengers, on the other hand, work in unfavorable conditions, lacking proper PPE (such as safety shoes and gloves), as well as recycling infrastructure (Plate VII). Due to a lack of effective recycling infrastructure and planning, Minna continues to rely on informal recycling activities.

Table 4.10: Summary of Private Operators Respondent on Improving the Services of Solid Waste Management in Minna

Category	Sample Comment	*N*	(%)
Role of Institutions and Funding Management	"More funding should be made to private firms so as to encourage effectiveness of waste management" "NISEPA should increase the current levy"	4	44.4%
Improvements in Education and Awareness	"Public enlightenment campaigns should be initiated by the Government agencies about waste reduction and management"	2	22.2%
Enactment and Enforcement of Policy/Programs	"Monthly sanitation should be reintroduce"	2	22.2%
Public Participation	"People should pay their waste bills regularly"	1	11.1%

Source: Field Survey, 2022

Table 4. 11: Summary of Public Respondent on Improving the Services of Solid Waste Management in Minna

Category	Sample Comment	*n*	(%)
Enactment and Enforcement of Policy/Programs	"There should be punishment for anyone who fails to dispose refuses in an authorized dumping site"	78	15.3
	"……. Implementing government policies in alleviating the dangers of open dumping in Minna"		
Improvements to Service Operations, Technology, and Accessibility	"Government should increase the number of waste collectors in the areas"	109	21.4
	"New trucks and necessary equipment for waste collection and transportation should be provided to ease work"		
Improvements in Education and Awareness	"Residents should be educated about the health implication of dirty environment"	98	19.3
	"…… and also programs and jingles should be feature in multimedia to make Minna residents aware about indiscriminate waste disposal"		
Public Participation	"Citizens should help in bringing there refuse to the appropriate collection point"	67	13.2
	"People in inaccessible areas should comply and bring the refuse to where NISEPA agents can collect the refuse easily to dispose"		
Role of Institutions and Funding Management	"Government should have a strong Mou with PPP and the charges should be in a way that would be friendly to all."	103	20.2
	"Adequate funding to the environmental sanitation agency for good service delivery"		
Utilization of Recycling Initiatives and Improvements in Disposal	"….. Recycling company should also be involved."	54	10.6
	"Standardized method of waste collection, disposal and recycling while making profits out of it"		

Source: Field Survey, 2022

Plate VI: Composting site at Kuyi
Source: Authors Field Survey, 2022

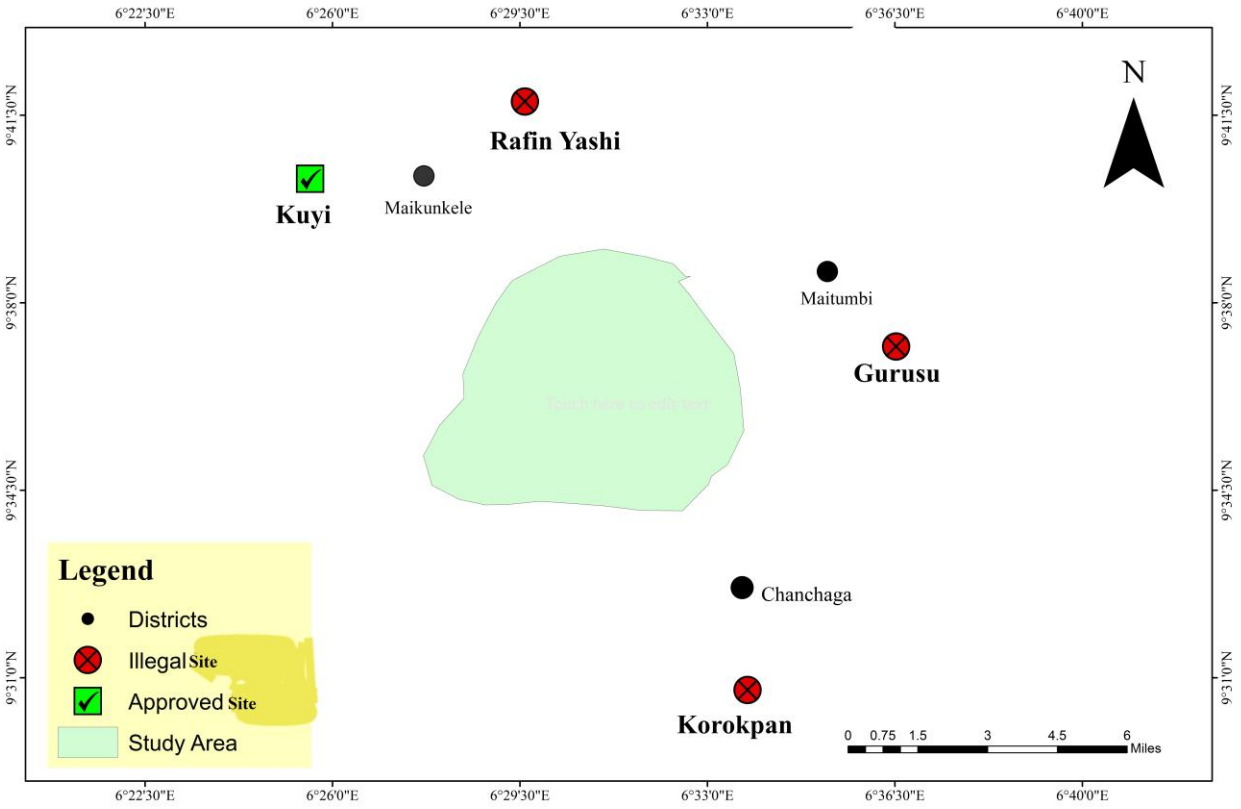

Figure 4. 6: Location of Compost Sites in Minna Metropolis
Source: Geography Remote Sensing Lab, FUT Minna (2022)

Plate VII: Field Observation of the Informal (Scavengers) Sifting through at the Composting Site
Source: Authors Field Survey, 2022

4.6 Summary of Findings

Public-private partnerships in waste management have emerged as a promising option for improving municipal waste services in a more efficient and cost-effective manner. Success is largely determined by the capability of private partners, the population to be serviced, the amount of waste generated, and government policies governing citizen waste management behaviour, as well as the activity of other waste management stakeholders.

According to the socioeconomic characteristics of private firm executives, the majority (79.5%) have only completed secondary education and their earnings are comparable, with the majority earning between ₦11,000 and ₦30,000 per month.

In terms of manpower, the total capacity of the entire firms is 49, out of which 35 are laborer, drivers 7 and managers are 7 and in the area of equipment capacity, it was found that the entire private firms have a total of 59 different types of equipment, out of which 7 were waste collection

vehicles, while other types of equipment like wheel barrows, shovels, rakes, waste drums totaled 52. The type of wastes collected by the companies involved in waste management shows that both residential and commercial dominated and the least type of waste being industrial wastes with 14.3%, which is an indication of the type of land use activities dominant in the area.

More so, all the firms use waste collection vehicle which dominate the type of equipment used for waste collection, with majority of waste collection of once a week dominating the frequency of waste collections. The frequency of waste collection seemed to be in line with the officially stipulated frequency for waste collection of once a week for house-to-house collection and no defined collection frequency for the unauthorized dumpsites or central collection point (waste is collected as and when containers are full). It is also clear from the study that none of the private firms partnered in waste management in the study area are involved in either waste sorting, recycling and or re-use.

On the causes for engaging private firms in waste management by the government, it was found that majority of the private officials (52.0%) indicated that they provide more efficient service delivery than the public counterparts, while about 27.0% of the private operators indicated that the partnership was formed to minimize cost of operation on public sector. Those who feel it was caused by a surge in waste generation and the public sector's failure to provide quality services accounted for 7.0% and 14.0%, respectively.

Residents were asked to confirm the existence of private waste managers within their respective areas to determine the level of waste service coverage in the area, and the majority stated that they were unaware of private waste managers but were aware of waste collectors, compared to those

who agreed and strongly agreed with 21.5% and 6.1%, respectively. On the promptness of waste managers' responses to customer complaints, 36.3% disagreed, whereas 5.5% strongly agreed.

On the regularity of waste collections, the majority of respondents (38.4%) disagreed that private waste collectors come to pick up waste at regular intervals, and the majority of respondents (50%) disagreed that the current approach to waste collection and evacuation is satisfactory, whereas on the willingness to pay for services, the majority of respondents (58.1%) disagreed to be willing to pay for waste collections, while the least% disagreed to be willing to pay for waste collections. About 52.9% of respondents, or the majority, disputed that private operators have appropriate waste collection and disposal equipment, while only about 2.9%, or the least strongly agreed, agreed that private operators have adequate waste collection and disposal equipment. Notably, the majority of respondents (45.3%) agreed that the services provided by private operators are commendable, followed by those who did not agree or disagree.

Research results on the constraints faced by firms in providing their services show that poor enforcement of sanitation rules on residents helped contribute the most, with 57.1%, followed by poor accessibility of buildings with 28.6%. Residents' non-cooperation is rated the lowest, at 14.3%. On the other hand, the distribution of respondents on the challenges experienced in the study area as a result of private enterprises' involvement in waste management. Discriminatory service supply by companies was the most common complaint, with 43.6%, followed by irregular rubbish collection with 23.5%, and only 11.4% of residents said they had never had an issue with private firm operators.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In terms of manpower capacity, the study shows that the majority of waste management companies are small businesses; nonetheless, given the study's covering area (Minna), good results are unlikely. This is because a company's waste collection capability is typically determined by the strength and quality of its workforce in conjunction with available facilities. Furthermore, studies have shown that governmental sectors are often unsuccessful in service provisioning, particularly in waste management activities. Therefore, the general claim of private sector efficiency in service delivery as the basis for acceptance of private partners in waste management is expected.

To ensure sustainability and efficiency in service delivery from the private sector, adequate cooperation is required from the government, businessmen, politicians, religious organizations, civil servants, men, women, literate, illiterate, the rich, the poor, and a host of other tangible and intangible groups, particularly with regard to waste management in the study area. It's also worth noting that waste management providers have difficulty accessing some parts of the study area due to their inaccessibility, limiting the level of service coverage among households in the study area.

Solid waste management remains the single environmental issue that affects all Nigerian cities. This study shows that solid waste management in Minna has seen numerous setbacks, including insufficient financial resources, a lack of and non-compliance with government policies, a lack of proper record keeping, and incorrect garbage management at composting sites and dumpsites, among others. Any waste management policy, however, necessitates cooperation from all parties, particularly the public. Abbreviations like LULU (Locally Unaccepted Land Use), NIMBY (Not

In My BackYard), NOTE (Not Over There Either), and others are used to describe public opposition to new waste management laws.

5.2 Recommendations

Government should encourage PPP and give the private firms full autonomy and discarding the present approach (that is the operations and management contracts arrangement) which the public sector essentially outsources to the private sector the provision of services that it had provided. NISEPA pays the private partners directly for services, rather than collecting income from residence as in other PPP agreements. This method of operations and management contracts should be cast-off and new effective private finance initiative should be introduced.

The government should offer incentives and rewards to private operators who perform well. This is done to feign other operators' interests and promote competition among them, resulting in higher waste management standards and a cleaner environment. In the same vein, concessionaires should be able to impose penalties and collect user fees from private operators if they fail to meet their obligations, guaranteeing that some areas remain unserved or underserved.

Waste collector capacity must be strengthened through proper capacity building measures. To do so, businesses must hire more workers, purchase more equipment, and provide a higher compensation package for employees, all of which will help to boost the firm's capacity to deal with municipal waste generation rates in the long run.

There is a need for the government to make a concerted effort to develop new road networks as well as repair existing ones, particularly in the areas around Sauka Kahuta, Barikin Sale, and the surrounding areas, where residents are underserved by private firms due to the inaccessibility of

residential areas by waste management service providers due to the nature of settlement patterns and road networks, which are generally in poor condition.

All stakeholders in a public-private partnership must carry out their assigned responsibilities in order for the partnership to achieve its goals. Therefore, there is the need to collaborate with the residents, especially the women, as well as the communities in service monitoring as this will go a long way in trying to eliminate irregularities in waste collection as well as ensure service payment compliance by service benefactors.

5.3 Contribution to Knowledge

The study "Residents' Perception of Public-Private Partnership Approach in Municipal Solid Waste Management in Minna, Niger State, Nigeria" provides valuable insights into the challenges and potential solutions for improving MSWM in the study area. The findings established that there are six private waste management operators that were engaged for waste collection in Minna. On the regularity of waste collections, the thesis established a mean score (MS) of 2.8 indicating a neutral perception by the public respondents that private waste collectors come to pick up waste at regular intervals, and a (MS) of 2.2, indicating a slightly negative perception that the current approach to waste collection and evacuation is satisfactory Furthermore, on the willingness to pay for services, the study established a neutral perception with a MS of 2.6, indicating residents' willingness to pay for waste collections. Finally, in terms of effectiveness and efficiency of waste management the study revealed a neutral perception with MS of 2.8, indicating that the current strategy for waste collection and evacuation is satisfactory. The implication of the finding of this study is a general satisfactory perception of residents on public-private partnership approach in municipal solid waste management in the study area. To address this issue, the thesis recommends that the NISEPA take a more active role in coordinating and regulating the PPP approach,

including providing financial and technical support to private operators and implementing performance-based contracts to ensure that waste management targets are met.

Overall, this study contributes to the knowledge base on PPP approaches in MSWM and provides practical recommendations for improving waste management in Minna. It is a valuable resource for policymakers and practitioners seeking to enhance the efficiency and effectiveness of MSWM in the study area.

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APPENDIX A

QUESTIONNAIRE I- FOR PRIVATE WASTE MANAGEMENT COMPANIES

Dear Sir/Ma,

This questionnaire is designed to obtain information on the topic "Residents' perception of public-private partnership approach in municipal solid waste management in Minna, Niger State, Nigeria", an MTech. research project in the Department of Geography, Federal University of Technology Minna, Niger State. I assure you that the information provided will be used strictly for academic purpose and treated with utmost confidentiality it deserves.

Thank you.

Muhammad, Haruna Mashin

January, 2021

Please **TICK (√)** where applicable.

SECTION A

SOCIO ECONOMIC CHARACTERISTICS

1. Name of your waste management company……
2. Area of coverage.....
3. How long your company has been involved in waste management partnership a. 5> b. 5<
4. No. of personnel in the company.....
5. Types and number of equipment.....
6. Educational attainment a. primary school b. secondary school c. tertiary institution d. none f. Others (specify).....
7. What is your income per month? a. below N10,000 ( ) b. N11,000 – N30,000 ( ) c. N31,000 – N50,000 ( ) d. others (specify).....

SECTION B; INFORMATION ON EFFICIENCY OF PUBLIC-PRIVATE PARTNERSHIP TO WASTE MANAGEMENT AND BASES FOR WIDESPREAD ADOPTION OF APPROACH IN MINNA;

8. What type of waste is normally being collected? a. Residential waste ( ) b. commercial waste ( ) c. industrial waste ( ) d. All of the above ( ) e. All of the above ( )

9. Where do you collect the wastes? a. NISEPA Bin ( ) b. Personal Bin ( ) c. Authorized dump sites ( ) d. Un-authorized dump sites ( )

10. How many times per week does your company collect waste? a. 1 ( ) b. 2 ( ) c. 3 ( ) d. 4 ( ) e. others (specify).....

11. What do you do with the solid waste? a. sort the re-usable ( ) b. sort the recyclables ( ) c. separate bio-degradable from non-bio degradable materials ( ) d. convey everything to the permanent dump site ( ).

12. How do you dispose these wastes? a. Incineration ( ) b. Burying ( ) c. Open dumping ( ) d. Others Specify.....

13. Where do you dispose these wastes? State the location.....

14. Do you think private actors are adopted because a. the public sector has failed in providing good service ( ) b. private sector is more efficient ( ) c. Increase in population d. increase in coverage area ( ).

15. Do you think public and private involvement will improve waste management? a. Yes ( ) b. No ( )

16. If yes, how do you think public private partnership will improve waste management? .....

..

.....

.. **SECTION C; OPINION ON PPP APPROACH TO WASTE MANAGEMENT**

17. Do you think people are cooperating with agencies in managing wastes? a. Yes ( ) b. No ( ) If No, state your reason.....

18. Do you think people should pay for solid waste collection and disposal? a. Yes ( ) b. No ( ) if No, why .....

SECTION D; INFORMATION ON CONSTRAINTS OF PPP TO WASTE MANAGEMENT

19. Are you facing any challenges with the public a. Yes ( ) b. No ( ) if yes, specify .....

20. What are the major constraints of private companies on waste management? .....

.. ..

21. What are your suggestions for improvement …….?

…….....

..

APPENDIX B

QUESTIONNAIRE II- FOR MEMBERS OF PUBLIC

Dear Sir/Ma,

This questionnaire is designed to obtain information on the topic "An appraisal of the efficiency of public private partnership approach to waste management in Minna metropolis, Minna State, Nigeria", an MTech. research project in the Department of Geography, Federal University of Technology Minna, Niger State. I assure you that the information provided will be used strictly for academic purpose and treated with utmost confidentiality it deserves.

Thank you.

Muhammad, Haruna Mashin

January, 2022

Please **TICK (√)** where applicable.

SECTION A; SOCIO ECONOIC CHARACTERISTICS

1. Gender: a. Male ( ) b. Female ( )
2. Marital Status a. Single ( ) b. Married ( ) c. widow ( ) d. divorced ( ) e. Separated ( )
3. Educational qualification: a. Primary school education ( ) b. Secondary school education ( ) c. Tertiary education ( ) d. Others (specify) ……...
4. Occupation: a. Trading ( ) b. Artisan ( ) c. Civil Servant ( ) d. Others (specify) ……
5. What is your income per month? a. below N10,000 ( ) b. N11,000 – N30,000 ( ) c. N31,000 – N50,000 ( ) d. N50,000 and above ( )

SECTION B; WASTE GENERATION ISSUES

Please **TICK (√)** where appropriate. SD= Strongly disagree. D= Disagree. N= Neither agree nor disagree. A= Agree. SA=Strongly Agree

No.		SD	D	N	A	SA
6.	I mostly generate Residential wastes					
7.	I dispose my wastes in an authorized dumpsite					
8.	The dump-site is far away from my vicinity					
9.	Am aware of the effect of waste disposal on the environment					
10.	Am aware of the effect of waste disposal on the human health					

SECTION C; RESIDENTS OPINION ON PPP APPROACH TO WASTE MANAGEMENT IN THE STUDY AREA

Please **TICK (√)** where appropriate. SD= Strongly disagree. D= Disagree. N= Neither agree nor disagree. A= Agree. SA=Strongly Agree

No.		SD	D	N	A	SA
11.	There is a private company involved in waste collection in my area.					
12.	Private actors give Prompt response to user complains.					

13.	Private actors are efficient in waste evacuation but populace kept on littering the environment					
14.	Private operators collect wastes at regular intervals					
15.	present approach to waste collection/evacuation is satisfactory					
16.	I am willing to pay for solid waste collection and disposal					
17.	Private actors have adequate equipment for waste collection and disposal in my area.					
18.	Overall service delivery of private actors is commendable					

19. Who is responsible for collection and disposing of the waste? a. government ( ) b. individual ( ) c. Companies ( ) d. all of the above ( ) e. Others (specify).....

20. How do they dispose these wastes? a. Incineration ( ) b. Burying ( ) c. Open dumping ( ) d. Others Specify.....

SECTION C; INFORMATION ON CONSTRAINTS TO PPP FOR WASTE MANAGEMENT

21. What are the problems of patronizing private firms in waste management? a. Discriminatory service provision ( ) b. Irregular Collection of Wastes ( ) c. Lack of Clean environment after waste collection ( ) d. High Charges e. None ( ) f. others (specify) .....

22. What are your suggestions on how to improve waste collection and disposal ……

…….....

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APPENDIX C

KREJCIE AND MORGAN TABLE

The ever-increasing need for a representative statistical sample in empirical research has created the demand for an effective method of determining sample size. To address the existing gap, Krejcie and Morgan (1970) came up with a table for determining sample size for a given population for easy reference (see Table 1).

The Table is constructed using the following formula for determining sample size.

Formula for determining sample size

$$s = X\,NP(1-P)-d'\,(N-1)+X^2P(1-P)$$

s = required sample size

X = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841)

N = the population size.

P = the population proportion (assumed to be 50 since this would provide the maximum sample size)

d = the degree of accuracy expressed as a proportion (.05).

Source: Krejcie and Morgan, 1970

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970