ASSESSMENT OF COMMUNITY PARTICIPATION IN SOLID WASTE MANAGEMENT IN MAKURDI, BENUE STATE, NIGERIA.

BY

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M.TECH/SSSE/2005/1454

A THESIS SUBMITTED TO SCHOOL OF POSTGRADUATE STUDIES, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE MASTER OF TECHNOLOGY (M.TECH) IN GEOGRAPHY WITH ENVIRONMENTAL MANAGEMENT (NATURAL RESOURCE MANAGEMENT)

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DECLARATION

I, IKURIOR MIMI J.G., solemnly and sincerely declare that the research degree in the Department of Geography, Federal University of Technology, Minna has entirely and wholly been my research effort and has not been submitted to the department or any other institution for any degree. Materials used and quoted have been dully acknowledged.

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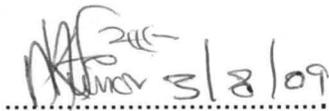
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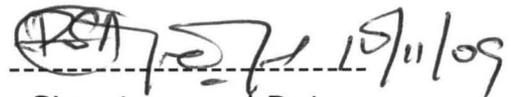
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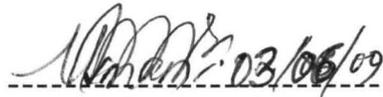
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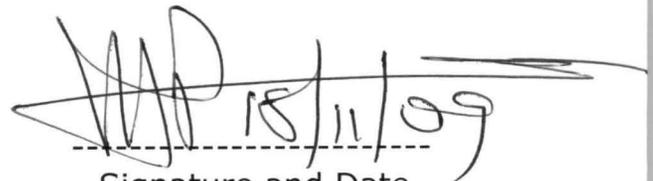
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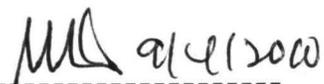
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ABSTRACT

This research focuses on community participation in solid waste management in Makurdi, and has been designed to identify a feasible alternative for solid waste management in the areas selected. Makurdi is faced with growing urban environment problems. The research discusses these problems in solid waste management and gives a general description of the community's attempts to establish a partnership approach with local and state government agencies in charge of waste management in Makurdi. The research was largely based on data gathered through field reconnaissance survey, secondary sources and the use of questionnaire that was administered on selected households to ascertain the magnitude of the problem. The research showed that environmental problems were caused by the indiscriminate dumping of solid waste in gutters, streets, open spaces etc and non utilization of specified waste dumps, which makes the environment unhygienic and unhealthy, it also showed a lack of community participation or an unwillingness by the community to participate/contribute to the management of solid waste in the areas. The research recommends that the efforts of government agencies in charge of solid waste should focus on participatory approaches to improve the prevailing conditions and share, decision making and management processes with neighbourhoods, groups and organisations at the grassroots level in Makurdi. Also, private agents/agencies be encouraged to play active roles also in participatory, decision making and management processes. The results of this research will be useful to those concerned with the volume of solid wastes in our cities and the need to involve all stakeholders to finding or identifying practical and realistic approaches to addressing the problem.

TABLE OF CONTENTS

Chapter one: Introduction

Chapter two: Literature Review

Chapter three: Materials and Methods

Chapter four: Results

Chapter five: Discussion, Summary, Conclusion and Recommendations

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

GLOSSARY

- **Solid waste management** – refers to the collection, transportation, treatment, final disposal and recycling of solid wastes.

- **Proper Waste Handling** – means the actual waste which is produced by users by industries and which should be collected properly and carefully transported to an appropriate treatment plant in such a way that is not hazardous to health and environment.

- **Community** – A community consists of people living together in some form of social organization and cohesion. Its members share in varying degrees of political, economic, social and cultural characteristic as well as interest.

- **Community Participation** – is the process by which individuals and families assume responsibility for their own health and welfare and for those of the community and develop the capacity to contribute to theirs and the community development. They come to know their own situation better and are motivated to solve their common problems. This enables them to become agents of their own development instead of positive beneficiaries of the development aid.

- **Recycling** – is the process of collecting and preparing recyclable materials and reusing the materials in their original form or using them in manufacturing processes that do not cause the destruction of recyclable materials in a manner that precludes further use.

CHAPTER ONE

INTRODUCTION

The growth in urban population and world cities has far fetched implications not only in the quality of the urban environment in cities and the standard of life for city dwellers, but also very serious and profound challenges to urban planners and for all those involved in the management of such areas.

Most cities in developing countries face urban environmental problems and these are partly caused by inadequate provision of basic services such as water supply, sanitation facilities, transport infrastructure and waste collection.

In West Africa today, the urban population is growing at the rate of about 5 – 6 %. More than 70% of urban areas on the continent are completely excluded from the urban public service network of drinking water distribution, liquid waste, drainage or household solid waste collection and disposal, as a result of lack of means, at municipal or state and local government levels. In most cities, waste is still considered as nuisance rather than a valuable, high energetic input and expensive, high technical solutions such as incineration plants or controlled landfill sites, often are not affordable or feasible. Problems associated with urban low income groups are much complicated than those of rural counterparts as many factors like neighbourhood pollution, overcrowding, unsanitary condition and poor services affect them to a much greater degree. The urban poor remain largely excluded from the benefits of growth and development because they lack productive assets.

In most of our urban centres, people tend to use the most expedient means of waste management/disposal such as; burning, dumping on land or in ditches and gutters and drainage systems. These practices could have repercussions i.e. ground or surface water could be contaminated, atmospheric pollution, and general environmental degradation.

In recent years, the problem of solid waste management has become so aggravating, that a lot of seminars, conferences were organised in various states across the nation to address the problems of solid waste collection and disposal but without success. Dumpsites or collection centres were created, incinerators built, collection vans and equipments procured, some drainages and gutters constructed/evacuated and sanitation officers recruited, environmental awareness through prints and news media carried out, but without success.

A huge backlog of uncleared wastes exist every day in our, urban centres and so the health of the citizens are constantly threatened by diseases, outbreak of epidemics as a result of poor environmental sanitation. It is against this background that this study focuses on community participation in solid waste management to supplement government effort in solid waste management.

1.1 STATEMENT OF PROBLEM

Solid waste management involves strategies for collection and removal of waste from the time it is generated to the time it is adequately disposed of. In recent times some of the management methods include the use of engineered landfills, open dumps, transfer station, incinerators, and anaerobic digestion technologies. These methods have

in most cities failed to meet required sanitation or management objectives, thus giving rise to problems such as degradation, urban decay (aesthetics), proliferation of illegal dump sites and leachate contamination problems among others.

In spite of the numerous approaches in both policy and technologies, the problems of solid waste management persist. Current policies and technologies either advocator/support centralized management systems or present technologies that do not encourage the producer of the waste to partake in its management. In most cases, the individuals that generate the wastes are limited to only gathering of waste: Collection and disposal facilities are operated under centralized systems. In countries such as Kenya, India, Latin America, Germany and Scotland, where decentralized/localized systems exist, individuals and communities have opportunities to partake in rudimentary operations of sorting and recycling. Such communities have reduced difficulties and complications in solid waste management.

In Nigeria, management systems are centralized and policies neither impose recycling and sorting responsibilities on communities nor provide willing communities with the chance to partake in such operations. Policies tend to favor community participation only to levels of payment for services. Furthermore, the collection/revenue system have problems such as, government corruption, poor street design, unwillingness to pay, lack of enforcement, lack of intermediate collection facilities such as waste bins. In effect, no burden is placed on the polluters by policy.

Technology designs have not been of help either. Dumpsites are far from where these wastes are generated due to such impacts as odour

and leachate problems associated with such temporary facilities. The temporary dumpsites/landfills approach to waste removal, in Nigeria further excludes community participation. There are usually no intermediate facilities between the waste generated and the final dumpsite. Such facilities as transfer station will assist as intermediate facilities.

Policy and technology issues give rise to a third attitude. The exclusion overtime in both policy and technology has resulted in negligence towards waste management on the part of communities. In spite of bearing the direct brunt of poor management system in solid waste, communities still see waste as the exclusive duty of government. This attitude presents the need for community level initiative capable of reducing effects of disease, odour and degradation associated with poor solid waste management.

Makurdi, the state capital of Benue state, experiences increasing volume of solid waste generation and as such, the state capital is threatened by the scourge of a filthy environment. Environment and health are inextricably linked, in that, poor solid waste management is a threat to good health, as water, land and air can be contaminated or polluted. As at 1970, the average density of solid waste from heaps or depots in Nigeria were put at $295kg/m^2$ with attendant implications for health, drainage and aesthetic problems (Maclaren, 1970). In a related exercise, Abumere (1983) characterized some Nigerian cities by their quantities of solid waste generation per annum, with Lagos having the largest total waste generation per annum, followed by Ibadan with 55,991kg/year and 55,224kg/year respectively. Considering these issues, it is evident that immediate attention is required on systems that encourage participation approaches to reduce management

problems and promote a sustainable community based zero-waste management system.

1.2 AIM OF STUDY

Consequently, the aim of the study seeks to:

- Gain a strategic understanding of the urban waste and sanitation situation, know the extent the community is aware of the environmental hazards associated with solid waste generation and their participation in solid waste management.

1.3 OBJECTIVES OF THE STUDY

The objectives of this study are to:

i. Identify the types and composition of solid wastes generated and how often the waste or such waste is being cleared.

ii. Identify ways in which municipal authorities can link up with the community in management of solid waste.

iii. Make an assessment of social and economic changes needed to incorporate the partnership approach in municipal service delivery.

iv. Explore ways of encouraging community participation in solid waste management.

v. Advance recommendations, which will not only be of great importance to providing a better solid waste management practice, that foster a healthy environment in the study area and also other areas that share or have peculiar problems.

1.4 RESEARCH HYPOTHESIS

To achieve the main objective of this research, three related hypotheses based on the environmental planning conditions were used to undertake a comparative analysis of the three areas selected for this study.

These hypotheses are:

1. H_0: Solid waste management is not a severe problem in all three residential areas (High density, Medium density and Low density areas).

   H_1: Solid waste management is a severe problem in the high density, medium density and low density areas.

2. H_0: Awareness of the dangers to public health from the carefree dumping of solid waste around compounds is the same in all three residential areas.

   H_1: Awareness of the dangers to public health from carefree dumping of solid waste around compounds is higher in the medium and low density areas than in the high density area.

3. H_0: The degree of participation in solid waste management is not Low in all the three residential areas.

   H_1: The degree of participation in solid management is low in all the three residential areas.

1.5 SCOPE OF THE STUDY

The focus/objective of this study is concerned and limited to the community participation in solid waste management in parts of Makurdi, a rapidly growing urban city in the east central Nigeria. The areas surveyed, covered low, medium and high density residential quarters representing high/medium/low income groups in the area. Therefore all the various information used in this study was obtained from these neighbourhoods and this forms the spatial scope of the study. This will make it possible for the use of this study as a tool for planning in the areas selected as well as the entire town.

1.6 STUDY AREA

SOCIOECONOMIC SETTING

Benue state is located in the middle belt area/east central part of Nigeria. It is bordered by Nassarawa state to the north, Taraba to the east, Ebonyi and cross river states to the south and Kogi state to the west (See Figure 1). It had a population of about 2.8 million in 1991 and a population of 4.7 million this year, 2007 (National Population Commission). Benue is an agricultural region, full of rivers and as such is called the food basket of Nigeria. Its capital is "Makurdi" a rapidly growing urban city, that lies within the rich agricultural zone in the southern guinea savannah, it was selected to be the state capital following the division of the then Benue-plateau into two state namely Benue and Plateau respectively. Makurdi town is a port which lies on the south bank of the Benue River, and has an estimated population of 2,453,471, presently (National Population Commission, 2007). The town itself was founded in the year 1927, when the railroad from Port Harcourt in Rivers state, (279 miles [449km] south-southeast) was extended to Jos and Kaduna towns. Makurdi rapidly developed into a

transportation, market and local administration centre. Sesame seeds and cotton grown in the region were collected at Makurdi for transhipment. The town has a local airport and is a rail road centre as well as the terminus of a bridge across the Benue. Considerable limestone and marble reserves exist in the town which produces most of the cement used for construction in Nigeria today.

The predominant tribes spoken in the Makurdi town are: Tiv and Idoma, with other indigenous tribes such as Igede, Bassa komo, Agatu, Akpa and Etulo. The town is divided into seven (7) council wards namely: Fiidi, Wailomayo, Ankpa, Agan, Mbalagh, Modern market, Baar and North bank. (See Figure 2).

The neighbourhoods selected for this study are from Wailomayo and Fiidi wards (See figure 3) located in Makurdi local government area, they include: New GRA (low density area), High level (medium density area), Wadata (high density area), these were selected because they bear great semblance of a homogenous nature i.e. the low income groups concentrated in one neighbourhood, medium income and high income groups also concentrated in their individual neighbourhoods respectively, though in the context of the word they are not entirely homogenous, as there exist some characteristics of a heterogeneous nature in the various neighbourhoods.

New GRA is considered a low density area, because majority of the residents are high income earners, who have formal education and are exposed to variety of ideas, they are mostly private sector workers, civil servants, highly placed government officials etc., even so there are a few low income earners who reside here, they include security guards, drivers, and some land owners.

High level is a medium density area, coined so, as most residents here are middle income earners, with formal and semi-formal education; they are mostly civil servants, traders and a few private practitioners.

And finally, Wadata: a high density area, where more than three quarters of the residents are low income earners, most of whom have semi-formal or no formal education, they are traders, semi-skilled workers, farmers, fishermen who live by the banks of the river and few civil servants.

1.6.1   PHYSICAL FEATURES OF THE STUDY AREA

GEOLOGY

Benue falls within the Benue valley/trough which is structurally developed. During the tertiary and interglacial periods of the quaternary glaciations, the Benue and Niger valley were transgressed by the water's of Atlantic Ocean as a result; marine sediments form the dominant surface geology of much of Benue and basically all Makurdi which lies on the south bank of the river Benue. These sedimentary materials are underlain of variable depth by basement complex rocks, the metasediments may be more than 20m thick. Makurdi geology comprises broad metasediments associated with the Benue trough and basement rock. The metasediments are dominantly sandstone, but also contain shale, siltstone, limestone and quartzite. Basement complex rocks comprise ancient igneous and metamorphic rocks that are dominated by porphyritic granites, migmatites diorites, pegmatite and gneisses. Most of the basement complex, tertiary and sedimentary rocks have been deeply weathered to produce regolith and saprolite several metres deep. These rocks are rich in solid minerals such as

limestone, barite, coal, gypsum, salt, shale's, silica, sand and kaolin which are currently being mined.

RELIEF AND DRAINAGE

The land is generally low lying (averaging 100m – 250m) and gently undulating with occasional inselbergs, knolls, ruwares laterite, capped mesas and buties. Other areas have average gradients of less than 4^0, such areas are made up of interfluves, broad open valleys and flood plains. River Benue is the dominant geographical feature in Makurdi; it is one of the few large rivers in Nigeria that is not plagued with water falls and rapids. The flood plains which are characterized by extensive swamps and ponds for dry season irrigated farming: generally the surface drainage is good.

CLIMATE

Makurdi has a tropical sub humid climate with two distinct seasons, namely wet and dry season. The wet season usually lasts seven months starting from April and ending in October. There is however usually one or more heavy out of season rains in January, February or March, from the east west line squalls. It is this early rainstorm that enables farmers to hoe their farms in preparation for the planting season that starts in March. The annual rainfall total ranges from 1,200mm to 1,500mm. Temperatures are generally very high during the day, particularly in March and April. Along the river valleys, these temperatures plus high relative humidity produce debilitating weather conditions. Makurdi records average maximum and minimum daily temperature of 35^0c and 25^0c in the wet season and 38ºc and 21ºc respectively.

SOIL AND EROSION

The soils are mainly oxisols and ultisols (tropical ferruginous) which vary over space with respect to texture, drainage, gravel content etc. a typical profile is highly weathered with sandy surface layer overlying clay mottled subsoil.

The agronomic significance of this subsoil crust is that it often produces a perched water table which is an important source of capillary water, which keeps the surface moist long after the end of the rainy season. Entisols and inceptisols also occur associated with young soils on hill slopes and recent alluvium on flood plains.

Sheet erosion is the dominant form of water erosion in Makurdi; deep gullies occur and represent a northern extension of the eastern Nigerian, met sedimentary deep gully system.

VEGETATION

Benue state lies in the southern guinea savannah. Persistent clearance of the vegetation has led to the development, but more importantly, parklands with grasses ideal for animal grazing during their early growth. These succulent grasses can be cut with machinery, dried and baled for dry season livestock feeding. The grasses however grow tall, coarse and tough on maturity. The scattered trees are mainly those of economic value and include locust bean, shea butter, mango, silk cotton, African iron, Isorberlinia, cashew, oil palm, daniellia oliveri, gmelina et cetera. These trees produce valuable fruits, wood and fiber which can be utilized for small-scale cottage industries. They also have oil palm brush; it is utilized for its palm oil, palm kernel, palm wine, broom sticks and several other products.

Generally, forest vegetation may be group into: village forest; gallery forests; and forest reserves. In these forests, typical rain forest trees such as mahogany, obeche, iroko, afara, etc. occur and are used for timber. Other economic trees in forests include African pear, ogbono, bamboo, raffia palm, oil palm, orange, mango and coconut.

1.6.2 HUMAN ACTIVITIES

Makurdi is a large area, with many wards villages. These areas have been in existence for many years. The most human activities in Makurdi can be grouped into the following: Agriculture, Industry, Administration and Residential.

More than 70% of the people are farmers and it is not uncommon to find the people combining this practice with other formal occupations i.e. civil servants, private workers, traders etc all involved in farming therefore the practices are both subsistence and commercial in nature. The farmers derive their income from this practice, they inherit the farmlands from their fore fathers and engage in the clearing, tiling, harrowing, planting and harvesting of the land crops respectively. Most of the agricultural produce includes: sesame seeds, cotton, yams, potatoes, cassava, soyabeans, guinea corn, flax, oranges, mangoes etc. some others are engaged in fishing practices especially residents of wadata situated by the south side of the river Benue in Makurdi.

The people are also engaged in the few small indigenous industries situated in Makurdi, for instance the rice mills, Taraku oil mills, where the farmers after harvest take their produce to process into the final goods, which are then marketed. They are also involved in local traditional cloth weaving practices. They have a cement factory just outside Makurdi where people are involved in the mining of limestone

and marble which are being used in the manufacture of cement in the cement factory.
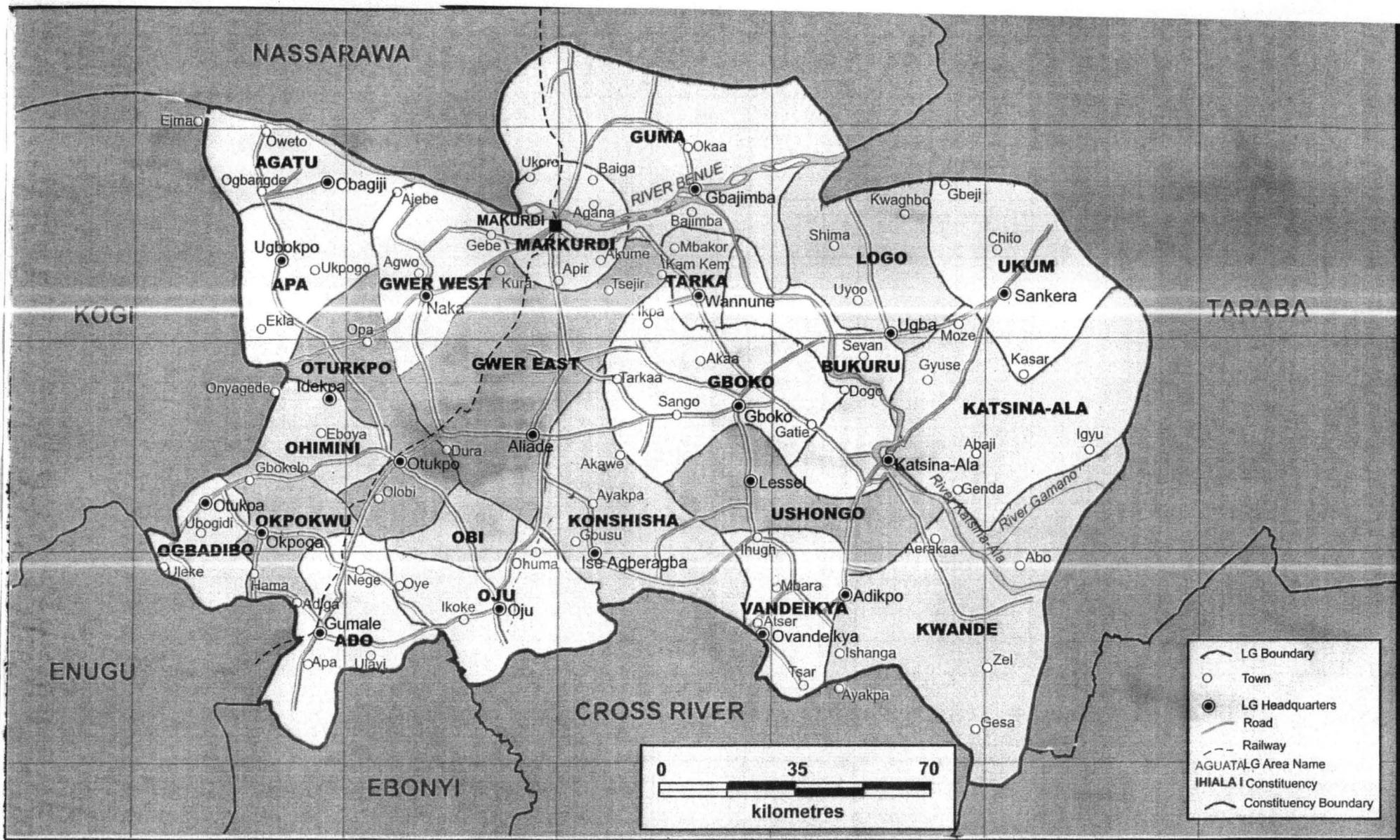
FIGURE 1   BENUE STATE AND THE 23 LOCAL GOVERNMENT AREAS
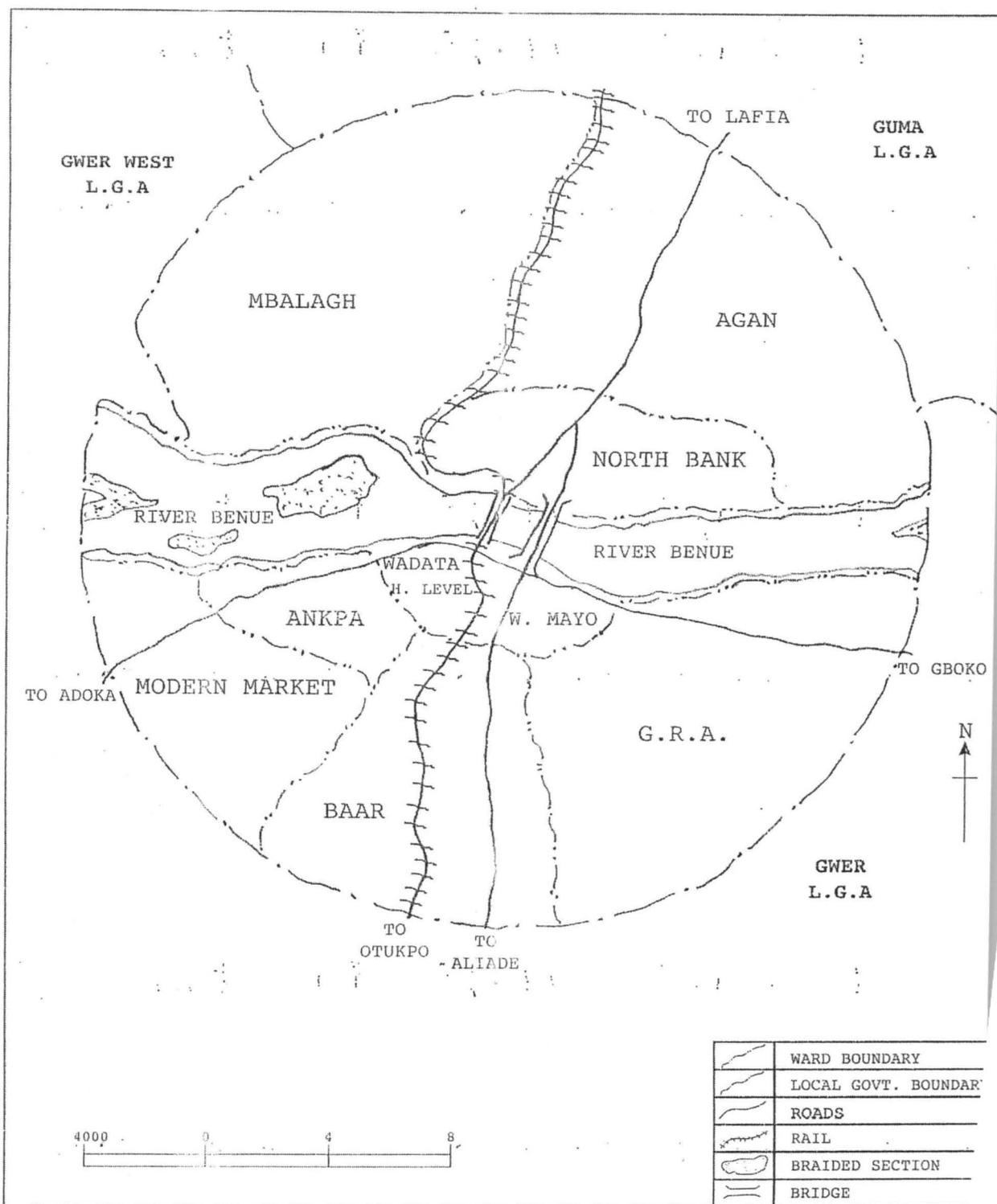
FIGURE 2   MAKURDI TOWN AND THE VARIOUS WARDS
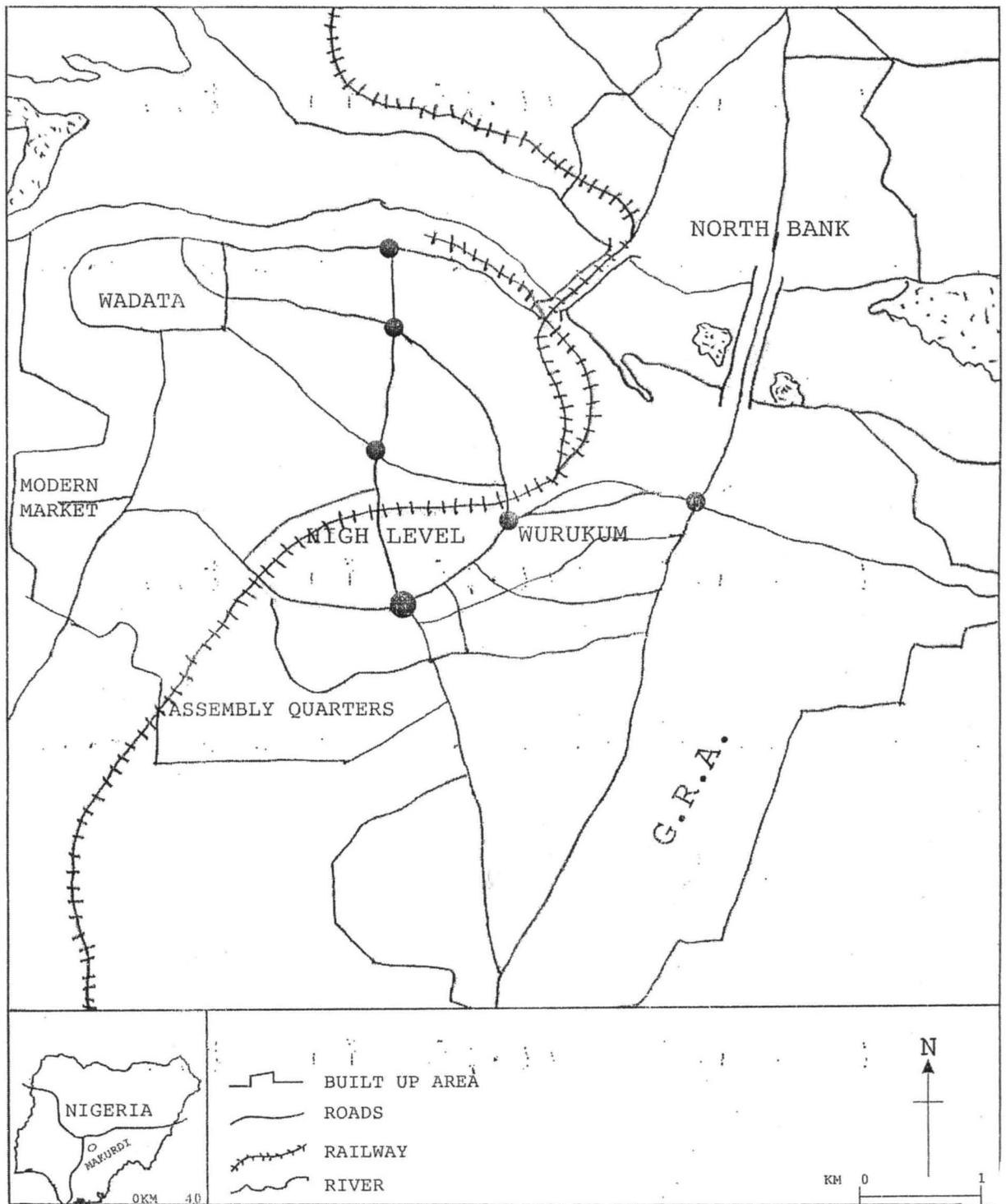
FIGURE 3 MAKURDI TOWN AND HIGH, MEDIUM AND LOW DENSITY AREAS

CHAPTER TWO

LITERATURE REVIEW

2.0   INTRODUCTION

Waste management status is an important parameter to measure the sanitation level in a community. An effective waste management system is necessary to enhance and sustain the public's health. Poor waste management practice will increase serious environmental problems such as air pollution, land pollution, surface and underground water pollution, create breeding grounds for insects, rodents and other alternative parasites associated human diseases.

Proper care was not taken in the past to develop a strategy to include communities in solid waste management in order to achieve a sustainable waste management in the country. An efficient solid waste system is very important in Makurdi so as to be able to achieve the objectives of proper waste management, and the community needs to be involved in ensuring a healthy living within its neighbourhood.

2.1   NATURE AND COMPOSITION OF SOLID WASTE

In the course of presenting the study some terms that are not commonly used and some that assume a meaning peculiar to the local area discussed are used to avoid ambiguity:

- **Solid waste management** – refers to the collection transportation, treatment, of final disposal and recycling of solid wastes.

- **Proper Waste Handling** – means the actual waste which is produced by users in industries and which should be collected properly and carefully transported to an appropriate treatment plant in such a way that is not hazardous to health and environment.

- **Community** – A community consists of people living together in some form of social organization and cohesion. Its members share in varying degrees of political, economic, social and cultural characteristic as well as interest.

- **Community Participation** – is the process by which individuals and families assume responsibility for their own health and welfare and for those of the community and develop the capacity to contribute to theirs and the community development. They come to know their own situation better and are motivated to solve their common problems. This enables them to agents of their own development instead of positive beneficiaries of the development aid.

- **Recycling** – is the process of collecting and preparing recyclable materials and reusing the materials in their original form or using them in manufacturing processes that do not cause the destruction of recyclable materials in a manner that preclude further use.

The term "wastes" defies precise definition. According to Miller (1994 waste is seen as man's unwanted materials that do not need to discarded. Okechukwu (1995) defines it as "substances, materials

objects discarded as worthless or unwanted, defective or no further value for human economic productive activities or processes".

Solid waste has been defined by United States Environmental Protection Agency as any useless, unwanted or discarded material with insufficient liquid content to be free flowing (American Public Works Association, 1975).

However, we may agree that "wastes" are materials that are dumped or discarded because they do not have immediate economic value either to the owner or to the public and occupy valuable space.

Wastes generally are classified into three major categories, namely gaseous, liquid and solid wastes can be classified into four main categories namely, industrial, Agricultural, mineral and municipal solid wastes.

TABLE 2.1 Estimated and projected volumes of solid waste (tonnes per year) in some selected Nigerian cities.

TONNES PER YEAR

	1982	1985	1990	2000
Lagos	625,399	681,395	786,079	998,081
Ibadan	350,823	382,224	440,956	559,882
Kano	319,935	348,580	402,133	535,186
Kaduna	257,837	280,925	324,084	431,314
Onitsha	243,240	263,929	304,477	387,593
Port-Harcourt	210,934	229,921	265,129	352,853
Osogbo	131,903	143,712	173,720	253,841
Aba	131,903	143,712	169,719	236,703
Jos	99,871	111,905	135,272	197,660
Warri	67,477	75,607	91,396	133,531
Gusau	44,488	48,471	57,243	79,835
Potiskum	15,434	16,816	19,399	28,347
Uyo	12,508	13,628	15,721	20,923
Suleija	9,383	10,514	13,311	21,336

Source: Federal Ministry of Housing and Environment. "The State of th Environment in Nigeria". Monograph series No. 2, Lagos.

TABLE 2.2: Growth rates of volume of solid waste generation in some Nigerian cities

Period	% change
1982 – 1985	9.0
1985 – 1990	15.4
1982 – 1990	25.7
1990 – 2000	27.1
1990 – 2000	59.6

Source: Federal Ministry of Housing and Environment. "The State of the Environment in Nigeria". Monograph series, No. 2 Lagos.

TABLE 2.3: Nature of solid waste depots and dumps in 15 Nigerian cities

Types of Depot/Dump	Frequency (%)
Ground Surface	77.0
Metal/Plastic container	17.8
Walled Structure	4.0
Pit	6.4
Others	0.8
Total	**100**

Source: Federal Ministry of Housing and Environment. "The State of Environment in Nigeria". Monograph series, No. 2, Lagos.

As urbanization and modern living rises, the rate at which wastes generated also increases, thereby constituting a much greater bu Table 2.2 shows that the rates at which wastes are generated has on the increase, moving from 9.0% between 1982 and 1985 to 1

between 1985 – 1990; percent between 1982 and 1990; and by about 60% by the year 2000.

2.1 COMMUNITY PARTICIPATION IN SOLID WASTE MANAGEMENT

The literature in this subsection covers various theories and case studies of community participation in solid waste management in West Africa and other parts of the world.

Community participation is also known as "popular Participation", "Grassroots development". Sylvian (1999: p.9) defined community participation in urban services as:

> The sociological process by which resident organize
> themselves and become involved at the level of a
> living area or neighbourhood. To improve the conditions
> of daily life (water, sanitation, health, education etc.)
> by individual and voluntary membership, they consist
> of members who are active to various degrees and take
> the form of associations. The principal sociological
> base of development project consist of such basic
> organisations since they formally represent the resident.

These statements outline several fundamental factors in the community participation, namely community organization and community involvement and the degree of active involvement. The degree of involvement of the people is affected by the conditions and context in which the development takes place.

Participation is also defined by the United Nations (1979:p.225) to mean:

"Sharing by the people in the benefits of development, active contribution by people to the development and involvement of people in decision making at all levels of society".

People's participation in solid waste management depends on several factors including their interest in participation, economic and social objective of participation and the importance and degrees of participation. Participation relates to the concept of peoples' interest in solid waste management, which means that they are contributing to a collective action of common interest to their neighbourhood as in the case of urban dwellers participating in a clean up campaign or join together to gain access to financial resources or to get jobs (Sylvain, 1999, p.11).

One essential element in community participation is the degree of involvement of people. According to Gajayaneke and Gajayanake (1993) "Recent experience in development activities suggests that there is a significant correlation between the level or intensity of people's participation and increase in the success of development activities.

There are different degrees of the community participation, ranging from the mobilization of residents or representation and to the creation of management structures. According to Pretty (1995), there are seven typologies of community participation in development programs and projects namely:

- Manipulative participation – where people participate by pretence.

- Passive participation – where people participate by being told what has been happening or what had happened.
- Participation by consultation – where people participate by being consulted or by answering questions.
- Participation for material incentives – this is where people participate by contributing resources.
- Functional participation is seen by external agencies to achieve project goals, especially reduced cost.
- Interactive participation – where people participate in joint analysis, development plans and formation or strengthening of local institutions
- Self mobilization involves people participating by taking initiatives depending on institutions to change systems.

Participation in solid waste exists at two levels; the first is at the neighbourhood level and the second at the city level. These two levels should ensure good collaboration between community and government, especially through awareness, organization and mobilization of government and community resources. Private agencies may also be tapped to enhance the two sectors, which will result in better service delivery (Ramos and Roman 1986).

Experience from other places show how communities can effectively participate in solid waste management:

Belo Horizonte, Brazil was selected as the winner of the local initiatives award for excellence in waste management for its work with street Scavengers Association to dramatically improve the social status of street scavengers by involving them in the planning and implementation of a comprehensive recycling and waste management

programme for the town. Before the project started, they were engaged in the formal collection of recyclable materials in the city, they gathered their materials with manual carts, sorting it on the streets. In 1993 the city established a selective handling and treatment system for solid wastes, working with the street scavengers association as its partner. The programme expanded rapidly and between 1994 and 1996, several warehouses were established eliminating the need for sorting on the streets. Presently there are three sorting warehouses and 300 collection containers located throughout the city. The membership has increased from 31 scavengers to 233 and the quantity in terms of collection increased from 15 tons to 500 tons per month in 1993 (Local Initiative Award 2000).

The objective of the project in Koramangala in Bangalore is to create a zero waste residential neighbourhood and to promote a sustainable community based zero-waste management system in the slums of Koramangala. Committed staffs have been involved in making the project work successfully with the cooperation of the local community. (Ravindra 2006)

In the initial stage, waste collectors worked along with Municipal Corporation of Bangalore sanitation staff to implement the community based solid waste management program. This has enabled them to overlook internal differences and has encouraged them to work together towards a long term sustainable development. With the aim of disseminating the information about the program throughout the slum and bringing the stakeholders together on a common platform, the team of FEDINA organized an orientation program on Solid Waste Management for stakeholders and Municipal officials at Koramangala. Detailed discussion on waste management took place and all the

stakeholders decided to contribute towards the efforts to make Koramangala a Zero Waste community. In the intervention area the project provided tricycles, dustbin plastic drums and hygiene education to about 1000 households of the Koramangala area. At the beginning of the project year, the field staff intervened and through various means like meetings, trainings, exposure visits sensitized the whole slum community about the problem. Two women groups have emerged from this project and the team promoted the formation of a maintenance committee from among the target group. FEDINA urges door-to-door waste collection system has been started with 800 households out of total 1000 households in the slum. Before the initiation of the project, no system of waste management existed in the area and the people were not aware of segregation into dry and wet waste. For the purpose, FEDINA organized door-to-door meetings, cluster meetings, awareness generation program, rally school programmes, etc. The aim has been to bring together all stakeholders like Self Help Groups (SHGs), residents, school children, and key persons of the community and waste collectors. The agency is also strengthening linkage with CMC sanitation staff so that cleaning of drainage can take place on regular basis. (General News:as posted by Ravindra on 8/5/2006)

For sustainability of the program, the committee started collecting monthly contribution of Rs. 15 each from household towards payment of the four workers (who were drawn from among themselves). The system has been running smoothly with proper monitoring and guidance of the field staff of FEDINA. Calendars of the year 2006 emphasizing the importance of source segregation and specifying elements that fall under the category of recyclable and organic waste have been circulated among the residents of Koramangala. Also, a door-to-door awareness campaign on the importance of source

segregation has been going on in the area with the view to educating housewives and other family members. Communities and waste team has also distributed information education and communication (IEC) materials. The IEC material includes poster on segregation of waste, leaflet and filters on 'How to become a Zero Waste Community. (General News:as posted by Ravindra on 8/5/2006)

The Shah Rasool Colony covers an area of 3.7 ha (9.2 acres) with a population of approx. 3000 inhabitants or about 400 households. Since background data on the Shah Rasool Colony was scarce so the APE conducted various surveys on physical reconnaissance, available infrastructure and the communities' attitude towards solid waste and waste handling habits. The socio-economic and attitude survey was conducted in 10% of the households. (Zurbrügg and Ahmed, January 1999).

This survey revealed that 85% of the households use some sort of waste container. For reasons of limited container capacity and average of six persons per household, the household waste container in emptied on a daily basis. Most household waste is disposed of by women or children in informal heaps in the neighbourhood. These are, however, subsequently scattered due to scavenging. Private sweepers are hired only in a few cases to dispose of the household waste. Two municipal bins are available in the area but their capacity is insufficient and the municipal collection service is very unreliable or inexistent (Fig. 2). Only 12% of the respondents use these municipal bins. APE also defined waste defined quantity and quality at household level. The data revealed a generated average waste quantity of 0.4kg/cap/day with an average bulk density of 130kg/m^3. (Zurbrügg and Ahmed, January 1999).

Mwanza in Tanzania is also an example of local initiative in waste management for the way that it engaged the community had used the local Agenda 21 process to address a serious solid waste problem as its priorities. The community identified solid waste problem as its number one priority. Stake holder working groups brought together community representatives to develop a three year strategy to enhance solid waste collection and recycling. With community participation in collection, sorting and recycling, preliminary data indicated that waste collection capacity had increased to 70% in the pilot areas. For instance, bans were placed on the disposal of corrugated cardboard in 1997 and on newspapers and office papers in 1998 (Local Initiative Award 2000).

According to Rayamajhi (1990) proper waste handling costs a lot of money which developing countries cannot afford and at the same time the people do not gain directly from it. At a symposium organized by the community, participants came to the conclusion that community participation being an integral part of solid waste management and resources mobilization centre's service approach should foster not only in regards to waste handling and disposal but also in reduction at the source.

In India and Terai belt, the waste system was introduced in 1980, where people from an area in the south Nepal, came and started collecting the recyclable materials from waste generated. Collection of recyclable materials in Nepal involved three processes as follows:

- People visit door-to-door where they pay certain amount to the householder for their scraps, metals, papers, or for empty bottles. (see Plate 1)

- Pick up recyclable materials from the containers at the collection points, transfer stations and composting plant

- Collection of old cars, lorries, broken bottles, papers etc. from auctions advertised by offices, institutions and factories through Newspapers and journals.
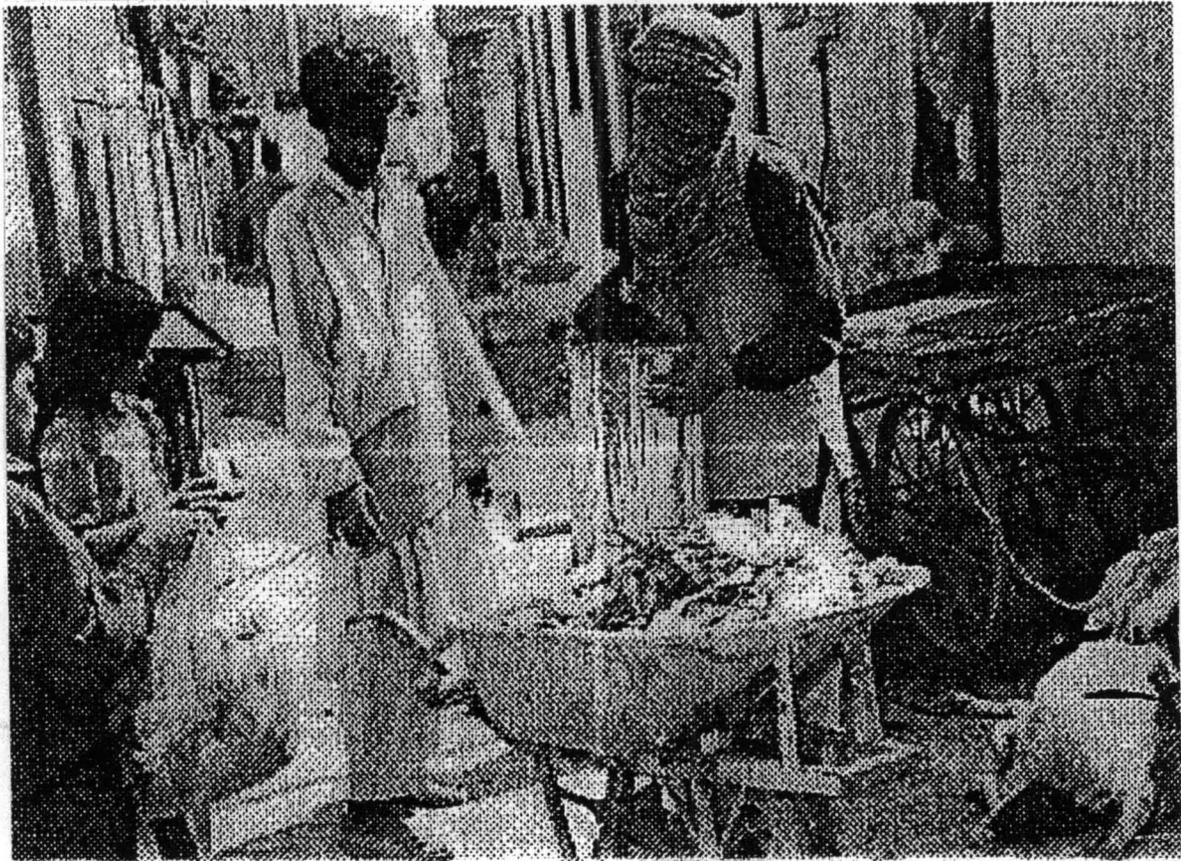
Plate 1: Door-to-door collection with wheel barrows

Also in Nepal waste picking (scavenging) is being from containers in the streets to transfer stations. Whole family members of some poor family do scavenging, but there are some orphans, who run-away children, single women and old people working as waste pickers. They pick only materials which are saleable and collected materials are sold to dealers, Plate 2. (Shanker S. and Surya M.S. 2005)

Plate 2: Overloaded municipal bins & formal recycling activities

Scientists and experts taking part in an international conference in Kathmandu have said community participation is a must for effective and sustainable solid waste management. Sharing his experience at the international conference on "For a better tomorrow: Sustainable solid waste management in developing countries" in Kathmandu metropolis on Wednesday, former general manager of Solid Waste Management and Resource Management Centre (SWMRMC), Surya Man Shakya, said it took a whole decade to find out a suitable landfill site to dispose of waste solid waste generated in Kathmandu metropolis. He said Okharpouwa landfill site came into operation from June last year only after local communities were involved in the process. According to an estimate, around 350 tonnes of solid waste is generated everyday in the Kathmandu Metropolis (KMC) Sisdole area at Okharpouwa has the capacity of absorbing up to 333 tonnes of solid wastes everyday, according to KMC. Shakya further said besides participation of local

communities, institutional and legal issues and financial commitment and transparency were equally important. Vice chairman of National Planning Commission (NPC), Dr. Shanker Sharma, said development of infrastructure and involving all the stakeholders was crucial in the solid waste management "involving local communities in the management of solid waste themselves has helped. We also need support from developing countries as well as in the area of solid waste management" (nepalnews.com, Jan. 11-05).

In Senegal, the most visible effect on urban policy is shown by the feasibility of inhabitants taking direct charge of their own waste collection, disposal, recycling and the construction of private sanitation infrastructures within their community. Also the municipal authorities have recognized the validity of this alternative solution, which is particularly well suited to the layout of poor neighbourhood.

Management and recycling solid waste in Curritiba city, Brazil, demonstrates that involvement in solid waste management is related to the economic objective of selling garbage in return for bus tickets and agricultural and dairy products. This demonstrates incentives for both the community and governments to co-operate. For the community, the interest is economic; and for the government agencies, the benefit is in developing effective ways to manage solid waste. The critics of this model suggest that, the community, particularly poor people participate in solid waste management for money alone, but the best underlying motive to participate comes from the community's awareness of their improved environmental conditions. (Rabinovitch J. and Leitmann J. 1993)

Women have strong involvement in improving the environment particularly, sanitation since they are first to be affected by unhealthy sanitation on a domestic level. In the urban Kampong in Indonesia, activities organized by housewives are frequently successfully participated in (Yeung and Gee, 1986).

The proposal in Mail by neighbourhood leaders to create waste management associations in each locality was democratically accepted at general meetings held in each neighbourhood (Bouroa and Bechraoui, 1995). Six neighbourhoods did indeed establish their own association. They stopped asking for material or financial rewards for attending training and even said they were prepared to contribute towards the costs of improving their technical skills (Keita and Maiga, 1999).

In Ibadan, people bear responsibility for manual carrying of wastes generated in their households to the skips (that is in cases where households do not have refuse bins or drums). This responsibility is particularly the inner core which is not accessible to trucks, thus making it necessary to place the skips far away at the main roads. This demands a lot of cooperation from people, because they may decide to throw away the refuse before they get skips, the pollution problems persist. (NISER 1998).

In November 2003, the Lagos state governor, Alhaji Asiwaju Ahmed Tinubu introduced the Kick Against Indiscipline (KAI) campaign to enforce discipline and help sanitize the state. Sixteen (16) new waste compactors and generators were purchased for the major markets and industrial estates which are said to be functioning effectively each with capacity to process 120 tons of waste daily. All land-fill sites are

currently being rehabilitated and expanded at a cost of ₦400 million to enhance high level of hygiene as well as accelerate the turn around time for the waste disposal by vehicles. In the same vein the Lagos state government's PSP scheme in refuse disposal is being comprehensively reviewed and reorganized to enhance its efficacy and enable the Lagos state government enforce a zero level of tolerance for refuse disposal on the highways. (Lagos State Environment News, 2004).

The environmental sanitation exercise introduced by the military in Nigeria made every last Saturday of the month to be set aside (between the hours of 7am and 10am) for households to keep their surroundings clean. This was an approach of involving the community to participate in waste management (Okon Etto, Hallmark Paper 6th – 12th June, 2001).

The aim of reducing waste through facilitating community development is to contribute to environmental sustainability. They should demonstrate and promote closing resources loops, reducing the common impact upon the environment, community development and capacity building. The closing of resource loop by recycling and reuse can be done by both the communities and individual who include, separating garbage into organic and inorganic materials (metal, paper, glass, plastic etc.). Collecting different types of waste separately or sorting them cheaply and effectively is the key in dealing with waste (Parker Steve, 1999).

Management of solid waste is a complicated task in view of its close and direct relationship with the behaviour of the people. Therefore, social awareness and initiation is a key factor for the long term solution

33

to this problem. Management of solid waste in developing a country like Nigeria where there exists, low level cannot be considered in isolation, it should therefore be analyzed in the context of community's involvement in waste management to reduce them at the source.

CHAPTER THREE

MATERIALS AND METHODS

3.0 INTRODUCTION

The various data required to achieve the objectives of these studies, will be discussed in this chapter, and will also discuss the data collection procedure, sample design and the techniques that will be applied for the analysis of data to be collected.

3.1 MATERIALS: PROCEDURE OF DATA COLLECTION

To achieve the objective of this study, primary and secondary sources are required.

The primary sources of data were obtained through the use of structured open-ended questionnaire, reconnaissance survey and informal interviews.

Secondary sources of data include published and unpublished documents. Substantial information on the study was gotten from past researches, from the University of Jos Library, especially from the past works on refuse generation and disposal in Maiduguri metro by Ahmed (2001), community participation in waste management in Nassarawa state by Adamu (2002) and industrial waste management of the Sharada industrial estate Kano by Fada (2005). At the Benue State Environmental Sanitation Authority, one Mr. Mathew Ibea was of immense help, as he briefed the researcher on the study area, and on Government role and participation and statistics in the disposal management of solid waste in the study area. Other major sources

were from the internet. And also the use of textbooks, journals, and maps obtained from the Lands and Survey unit (Ministry of Works) in Makurdi, Benue state.

Secondary sources were used for the literature review in chapter two, which covered some theories and studies of community participation in solid waste management in some parts of Africa and other parts of the world. In addition the researchers' personal observation was also used as source information.

3.2   METHOD OF DATA COLLECTION

Data was collected through the following methods:

- **RECONNAISSANCE SURVEY:** The author undertook a recognizance survey of the study area to familiarize her with the area and observed the present physical and environmental sanitary condition of the study area.

- **QUESTIONNAIRE:** The questionnaire is divided into three sections and administered on sampled population. The first section is on the socio-economic status of the household. The second is on information on the waste generated by the household and the third section contains information on the community's participation in solid waste management practices employed by the household.

- Informal interviews were held with relevant public agencies responsible for waste management/disposal etc.

- **SAMPLE FRAME:** The sample frame constitutes three areas selected using density of development as a criterion. Based on this, the three areas selected are; New GRA (Low density area), High level (Medium

density), and Wadata (High density area). New GRA has about 350 housing units; High level about 394 housing units, while Wadata has about 410 housing units making a total of 1154 housing units in the three areas. One household per house formed the sample and a sample size of 230 (20%) of the households was selected. Out of these, New GRA (Low density area) had 70; High level (Medium density area) had 78, while Wadata (High density area) had 82 respectively.

Table 3.2 Sample frame of the three areas selected

AREA	NO. OF HOUSING UNITS	SAMPLE SIZE	%
New GRA	350	70	27
High Level	394	78	34
Wadata	410	82	39
TOTAL	1154	230	100

Source: Field data

The systematic Stratified Sampling procedure was used to choose the sampling units. The first house was selected randomly, then numbers were given to all the houses, a table of random numbers was used, and the number of houses that correspond with the first number of random table became the starting point in each area.

- **FIELD WORK ACTIVITIES:** Three undergraduates were used in the administration of the questionnaires and they were briefed adequately, on how to carry out this task out. The exercise was carried out within a period of two months.

3.3 METHOD OF DATA ANALYSIS

The statistical technique used in testing the hypotheses of the research is the Chi-square (X^2).

Chi-square test was used to test for awareness of the dangers to public health on the carefree dumping of solid waste around compounds, the general perception of sanitary conditions in the neighbourhood and degree of participation in solid waste management.

3.4 PROBLEMS ENCOUNTERED IN THE FIELD

The most prominent problem encountered during the collection of field data was the non-cooperation/poor response of some household heads, who were suspicious of the exercise and thought this was some sort of ploy by the government to impose levies on them. On the whole though, efforts were made to ensure that the data collected was reliable, this was done by checking information collected at a time. Therefore the data collected is reasonably accurate.

CHAPTER FOUR

RESULTS

4.0 INTRODUCTION

This chapter presents all the data obtained on community participation in solid waste management in Makurdi, within the goals and objectives of this study which is to gain an understanding of urban waste management and the sanitary situation and also to identify and assess appropriate options, social, economic and institutional to encourage community involvement in the study area.

The sample area, includes three areas selected using density of development as the criterion. The three areas selected include: New GRA (Low density area), High level (Medium density area) and Wadata (High density area). The data analyzed was based on the information gathered from the three areas, with results presented using percentages, graphs and frequency tables to indicate the magnitude for each area.

4.1 SOCIOECONOMIC PROFILE OF THE HOUSEHOLDS

This section provides information on the socioeconomic and demographic characteristics of household heads.

Table 4.1 Sex of Household heads

	New GRA (LDA)		High Level (MDA)		Wadata (HDA)	
SEX	NO	%	NO	%	NO	%
MALE	42	60	49	63	62	76
FEMALE	28	40	29	37	20	24
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007.

Table 4.2   Age of Household heads

	New GRA (LDA)		High Level (MDA)		Wadata (HAD)	
AGE	NO	%	NO	%	NO	%
15 – 25	15	21	11	14	22	27
26 – 35	18	26	20	26	23	28
36 – 45	28	40	33	42	31	38
46 & Above	9	13	14	18	6	7
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.3   **Marital status of household heads**

	New GRA (LDA)		High Level (MDA)		Wadata (HDA)	
AGE	NO	%	NO	%	NO	%
SINGLE	20	28	17	22	31	38
MARRIED	42	60	57	73	40	49
DIVORCED	2	3	3	4	10	12
WIDOW	6	9	1	1	1	1
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.4: Household size

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
SIZE	NO	%	NO	%	NO	%
1 – 10	55	79	58	74	28	34
11 – 15	12	17	13	17	20	24
16 – 25	3	4	7	9	34	42
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.5 Educational attainment of household heads

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
PRIMARY SCH.	5	7	10	13	10	12
SECONDARY SCH.	15	22	13	17	15	18
TERTIARY	48	69	43	55	11	14
NON-FORMAL	1	1	2	2	18	22
NONE	1	1	10	13	28	34
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.6 Occupation of household heads

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
OCCUPATION	NO	%	NO	%	NO	%
FARMING	3	4	10	13	43	52
CIVIL SERVANT	35	50	40	51	10	12
TRADING	15	22	16	21	13	16
PRIVATE SECTOR	17	24	12	15	16	20
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.7 Approximate income of household heads

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
INCOME PER MONTH (₦)	NO	%	NO	%	NO	%
500 – 1500	6	9	10	13	29	35
15001 – 25000	8	11	13	17	22	27
25001 – 35000	8	11	11	14	14	17
35001 – 45000	22	32	30	38	9	11
45001 – 55000	14	20	9	12	6	7
55001 – Above	12	17	5	6	2	3
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

4.2 HOUSEHOLD WASTE GENERATION

This section presents data gathered on household waste generation in the three residential areas in Makurdi.

Table 4.8 Major type of solid waste generation in the household

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
TYPE OF WASTE	NO	%	NO	%	NO	%
DOMESTIC ASH	10	14	20	26	16	19
PAPERS	21	30	27	35	21	26
POLYETHENE	28	40	22	28	19	23
CROP RESIDUE & FOOD REMAINS	11	16	9	11	26	32
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.9 Types of containers used for waste collection in the household

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
TYPES OF CONTAINER	NO	%	NO	%	NO	%
PLASTIC CONTAINER	40	4	28	36	22	27
METALS BUCKETS	8	50	23	29	19	23
CARTONS	5	22	13	17	20	24
DISPOSABLE BAGS	17	24	10	13	-	-
NONE	-	-	4	5	21	26
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.10 Providers of waste collection containers

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
HOUSEHOLD HEADS	58	83	62	79	74	90
CARETAKER/LANDLORD	-	-	7	9	2	2
PUBLIC HEALTH AGENCY	4	6	3	4	3	4
BENUE ENVIRONMENTAL SANITATION BOARD	8	11	6	8	3	4
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.11 Frequency of refuse being cleared

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
DAILY	52	74	40	51	38	46
2–3 TIMES PER WEEK	8	12	16	21	21	26
WEEKLY	10	14	22	28	23	28
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.12 Method of solid waste disposal

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
DUMPED AT BACKYARD	11	16	12	15	9	11
DUMPED ON STREETS	9	13	10	13	10	12
DUMPED AT PUBLIC WASTE DEPOT	35	50	38	49	20	24
DUMPED ON OPEN SPACE/FIELD	15	21	18	23	40	49
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.13 Persons collecting solid waste from household

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
MALE ADULT	11	16	6	8	4	5
FEMALE ADULT	19	27	19	24	23	28
CHILDREN	26	37	42	54	48	58
WASTE VENDORS	14	20	11	14	7	9
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.14   **Frequency of Waste Collection by the Benue State Environmental Sanitation Authority**

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
DAILY	-	-	-	-	-	-
WEEKLY	15	21	6	8	2	2
MONTHLY	20	29	30	38	16	20
DON'T KNOW	35	50	42	54	64	78
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.15 Perception of households towards refuse disposal by the Benue Environmental Sanitation Authority

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
VERY GOOD	10	14	4	5	28	34
GOOD	15	21	10	13	17	21
FAIR	20	29	46	59	21	26
POOR	25	36	18	23	16	19
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.16 Awareness on the dangers to health on the carefree dumping of refuse around compounds

	New GRA (LDA)		High level (MDA)		Wadata (HAD)	
	NO	%	NO	%	NO	%
YES	59	84	51	65	30	48
NO	11	16	27	35	43	52
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.17 Frequency of the visits by health inspectors to households

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
WEEKLY	2	3	1	1	6	7
MONTHLY	5	7	3	4	9	11
YEARLY	10	14	8	10	10	12
NEVER	52	76	66	85	57	70
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

4.3 COMMUNITY PARTICIPATION IN SOLID WASTE MANAGEMENT

This section focuses on community participation in solid waste management within the framework of urban management. It also deals with information on activities of how urban areas develop with local residents acting as tools and means for development to improve their solid waste management condition.

Table 4.18 Perception on sanitation condition in the study area

	New GRA (LDA)		High level (MDA)		Wadata (HAD)	
	NO	%	NO	%	NO	%
GOOD	32	46	13	17	29	35
FAIR	20	28	47	60	25	31
POOR	18	26	18	23	28	34
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.19 Participation in solving waste disposal problems in the study area

	New GRA (LDA)		High level (MDA)		Wadata (HAD)	
	NO	%	NO	%	NO	%
YES	55	70	67	86	51	62
NO	15	21	11	14	31	38
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.20 Household engagement in communal environmental sanitation during the weekend

	New GRA (LDA)		High level (MDA)		Wadata (HAD)	
	NO	%	NO	%	NO	%
YES	38	54	50	64	44	54
NO	32	46	28	36	38	46
TOTAL	**70**	**100**	**78**	**100**	**82**	**100**

Source: Author's field survey, 2007

Table 4.21 Participation in community's solid waste collection and disposal problems in the study area

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
DAILY	10	14	13	17	6	7
WEEKLY	29	41	52	67	42	51
MONTHLY	13	19	9	12	10	12
NEVER	18	26	3	4	24	29
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.22 Types of sanitation activities carried out, in the study area.

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
COLLECTION OF WASTE FROM THE STREET	8	11	20	25	14	17
CUTTING GRASS IN THE OPEN SPACE/FIELD	9	13	24	31	16	20
COMPLAIN TO BESA AUTHORITIES	29	42	10	13	28	34
TOTAL	**70**	**100**	**78**	**100**	**82**	**100**

Source: Author's field survey, 2007

Table 4.23   Contribution of money towards solving solid waste problems in the neighbourhood

	New GRA (LDA)		High level (MDA)		Wadata (HAD)	
	NO	%	NO	%	NO	%
YES	5	7	13	17	52	63
NO	65	93	65	83	30	37
TOTAL	**70**	**100**	**78**	**100**	**82**	**100**

Source: Author's field survey, 2007

Table 4.24 Solid waste management practices

	New GRA (LDA)		High level (MDA)		Wadata (HAD)	
	NO	%	NO	%	NO	%
TAKING SOLID WASTE TO COMMUNITY DEPOTS	40	57	64	82	38	46
TAKING SOLID WASTES TO FINAL DEPOTS	30	43	14	18	44	54
TOTAL	**70**	**100**	**78**	**100**	**82**	**100**

Source: Author's field survey, 2007

Table 4.25 Degree of participation in solid waste reported by the households in the neighbourhood

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
FULL PARTICIPATION	10	14	20	26	13	16
LOW PARTICIPATION	54	77	55	70	58	71
NO PARTICIPATION	6	9	3	4	11	13
TOTAL	**70**	**100**	**78**	**100**	**82**	**100**

Source: Author's field survey, 2007

Table 4.26 Commitment towards solid waste management in the neighbourhood

	New GRA (LDA)		High level (MDA)		Wadata (HAD)	
	NO	%	NO	%	NO	%
YES	45	64	48	62	51	62
NO	25	36	30	38	31	38
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.27 End uses/end products of solid waste

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
AGRICULTURAL INPUTS	24	34	28	36	6	7
INDUSTRIAL RAW MATERIALS	32	46	38	49	4	5
DO NOT KNOW	14	20	12	15	72	88
TOTAL	70	100	78	100	82	100

Source: Author's field survey, 2007

Table 4.28   Assistance from public agencies in solid waste management

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
YES	9	13	6	8	14	17
NO	61	87	72	92	68	83
TOTAL	**70**	**100**	**78**	**100**	**82**	**100**

Source: Author's field survey, 2007

Table 4.29 Types of assistance received

	New GRA (LDA)		High level (MDA)		Wadata (HDA)	
	NO	%	NO	%	NO	%
FINANCIAL ASSISTANCE	-	-	-	-	-	-
MATERIAL ASSISTANCE	9	15	6	8	16	20
NO ASSISTANCE	61	85	72	92	66	80
TOTAL	**70**	**100**	**78**	**100**	**82**	**100**

Source: Author's field survey, 2007

TEST OF HYPOTHESES

1. Ho: Solid waste management is not a severe problem in all three residential areas

    H1: Solid waste management is more severe in the high density area, than in the medium and low density area.

Data on perception of sanitation conditions under community participation in solid waste management on page 44 was used to test these hypotheses.

Observed frequency:

	LDA	MDA	HDA	CT
Good	32	13	29	74
Fair	20	47	25	92
Poor	18	18	28	64
TOTAL	70	78	82	230

Expected frequency:

LDA	MDA	HDA
22.52	25.09	26.38
28.00	31.20	32.80
19.47	21.70	22.81

Chi-square $(X^2) = \Sigma \dfrac{(O - E)^2}{E} = 24.14$

$X^2 \infty\ 0.05\ (d/f = 4) = 9.48$

Where "c" represents the column of the cell, "r" represents the rows of the cell, $d/f = 4$ is the degree of freedom and "0.05" is significance level.

Therefore the calculated value of X^2 is > critical value hence we reject Ho 24.14 > 9.46, this means solid waste management is a severe problem in all the three residential areas.

2. Ho: Awareness of the dangers to public health from the carefree dumping of solid waste around compounds is the same in all three residential areas.

H1: Awareness of the dangers to public health from the carefree dumping of solid waste around compounds is higher in the medium and low density area than in high density area.

Data on the awareness of the dangers to public health from the carefree dumping of solid waste around compounds is higher in the medium and low density area than in high density area.

Observed frequency:

	LDA	MDA	HDA	CT
	59	51	30	140
	11	27	43	81
TOTAL	70	78	82	230

Expected frequency:

	LDA	MDA	HDA
	42.60	47.47	49.91
	24.65	27.46	28.87

Chi-square $(X^2) = \Sigma \dfrac{(O - E)^2}{E} = 28.98$

$X^2 \infty\ 0.05$ (d/f = 2) = 5.99

For calculated X^2 value is > critical values therefore reject Ho i.e. 28.98 > 5.99, hence awareness of the dangers to public health from the carefree dumping of solid waste around compounds is indeed higher in the medium and low density areas than in the higher density area.

Plate XXXVIII waste van arriving with waste for disposal at the final depot in Makurdi

CHAPTER FIVE

DISCUSSION, SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 INTRODUCTION

In chapter four, results of community participation in solid wastes management in Makurdi were presented and analysed. Three areas were selected for the study, one each from high, medium and low density areas of Makurdi. Also three hypotheses were postulated and tested to obtain the results. This chapter summarises the work, draws conclusions and makes recommendations for further improvements on the community's involvement in solid waste management in Makurdi.

5.1 DISCUSSION

This research on the community participation in solid waste management that was conducted in three areas in Makurdi has made it possible to learn more about the need to encourage social action amongst people living within a community and also to improve urban waste management in Makurdi.

Decentralized, participatory management is the only viable strategy for tackling environmental degradation.

The following are findings of this research: The socio-economic characteristics of household heads in the three areas differ a lot in terms of sex, levels of income, marital status, household size, level of educational attainment, occupation etc. The high density area has the highest average family size of about 42% which is between 16 – 25 persons per household; this is within the average national family size in most parts of the world. These differences calls for the differential way

people perceive refuse disposal problems in the neighbourhoods studied.

From the above analysis, it was found that all the major types of municipal solid waste are generated in all three areas and most of the household heads in the areas either use plastic containers, metal containers and disposable bags to collect and dispose their solid waste.

Out of the number of household heads interviewed, an average 67% percent are males. The increase in the female percentage in the medium and low density areas could be attributed to occupation, since most of them are civil servants as seen on Table 4.1.1.

Table 4.1.2 shows that most of the household heads fall within the "26 – 35" and "36 – 45" age bracket; this is within the economically active population range. The table also shows that quite a large proportion of the "15 – 25" age group are found in the high density area i.e. 27%, this is due to cultural and socio-economic reasons. It also shows that there is an acute social dislocation where the household heads are too young to assume/handle all such social-economic responsibilities with regards solid waste management efficiently, hence the poor management of solid waste in the areas.

Averages of 61% of the household heads are married. This then implies that household sizes would be significant, indirectly influencing the volume and amount of waste being generated, as see in Table 4.1.3

Household size of between "1 – 10" persons is the highest in the medium and low density areas as seen in Table 4.1.4. This is most probable because of the high level of education and awareness on family planning/control. This is consistent with the national average

family size of between "8 – 10" per household. In contrast 42% in the high density area have very large family sizes of between "16 – 25" persons, this may be due to the low level of educational attainment, cultural and socio-economic factor of most of the residents in this area where many are unemployed, many have more than one wife and family control practices are more less non-existent or very low.

Given the differential family sizes, it is expected that the amount of waste generated in the high density area will be definitely higher than in the medium and low density areas.

Table 4.1.5 shows that 34% of respondents in high density area have no form of formal/non-formal education compared to the 10% in the medium density and 1% in the low density area. Consequently, more educated persons are found in the medium and low density areas. These were either civil servants or private sector employees who possessed tertiary educational qualifications. There is therefore the tendency for high level of environmental awareness and consciousness in the medium and low density areas than in the high density area and this has implications on waste management.

In the high density area most heads of household are engaged in farming and fishing activities, while in the medium and low density areas we have more of civil servants. This Table (4.1.6) clearly shows that most household heads in the medium and low density areas depend on the government to earn their living. 3% who make up farmers in the low density area are mostly security guards who engage in urban agriculture.

Table 4.1.7 shows that the income of heads of households in the three areas of most of the residents, fall between the N35000 – N45000

income range and are concentrated in the medium and low density areas. Those on incomes of between N15000 and N25000 dominate in the high density area. This is not surprising as table 4.1.6 indicates that civil servants who are salary earners are dominant in the medium and low density areas, whereas in the high density area, they are mostly farmers/fishermen.

Table 4.2.1 shows the major types of solid waste generated in the study areas. In the high density area, crop residues and food remains dominate by 32%; this could be because most of the residents are farmers. Paper and polyethylene (white, black polyethylene bags) dominate in the low and medium density areas. This may be due to the nature of activities and consumption patterns in the low and medium density areas.

Table 4.2.2 shows that plastic containers (broken, cracked or whole) are the most used for waste collection in the three areas. In the low density area disposable bags are the next most used means of collecting waste, while metal buckets are widely used in the medium and high density areas. Only a small percentage of household had no container at all. The reason may be due to a sense of responsible attitude towards waste disposal or the awareness of health implications of carefree dumping of refuse around the compounds in the medium and low density areas, except for 26% in the high density area that had no container at all and this probably is due to the level of educational attainment and awareness and attitude.

An average of 84% of household heads provides waste collection containers for their compounds. This show's an indication that household heads are interested in managing solid waste at source level.

The Benue environmental sanitation authority provided just 8% of waste collection containers, these are the 1.5 cubic plastic containers scattered around different locations within the study area, this show's that they are in adequate to cater for the amount of waste being generated and gathered.

An average of 57% of household in the three areas say they clear their refuse daily, while another 24% clear theirs on a weekly basis. With these results, it is expected that the environmental condition in terms of solid waste should be either good or fair but the reverse is the case, why? The reason for this may have to do with the method of disposal, where a lot of waste never gets carried to the final waste disposal destination, nor is it properly treated or managed. This is shown in Table 4.2.4.

Table 4.2.5 shows that, majority of household's in the three areas dump their waste at the public waste depot, this is the most acceptable means of waste disposal at the community levels, even though the waste, most times remain at these locations for a very long time before being cleared.

Table 4.2.6, shows that collection and disposal of waste is done mainly by children who are assigned to do this by their parents or guardians, other members (mostly the womenfolk) are also involved in waste collection and disposal. All members of the family are involved to different degrees on household waste removal or disposal.

Inadequacy in solid waste disposal is wide spread throughout the three study areas as seen on Table 4.2.7. This is marginally better in the low density area where only 21% of respondents say that waste was being

collected weekly. The Benue state environmental sanitation authority (BESA) has only nine functional trucks with about three of them being deployed to hotels and clinics for waste collection and the remaining six for the other land uses, this is definitely inadequate for the whole town.

About 55% of households in the high density area perceive waste disposal by the Benue environmental sanitation authority to be either very good or good compared with 35% from low density area and 18% from the medium density area as shown in the Table 4.2.8. The perception of good performances in the high density area could be due to the low level of educational and environmental awareness in the area, whereas the reverse is the case in the low and medium density areas where about 65% and 82% for the low and medium density area respectively, rated the boards' performance fair or poor.

The Table 4.2.9: shows that majority of household heads are aware of the dangers to health on the carefree dumping of refuse around the compounds. This is higher in the medium and low density areas because of the high level of education and environmental awareness.

The information on Table 4.2.10 revealed that an average of 76% of household heads have never seen a health inspector in their neighbourhood. This shows that there is no strict implementation or enforcement of sanitation laws, maybe due to the lack of adequate and skilled manpower to carry out this function, probably negligence.

35% of the households in the high density area see the sanitary condition as being good. In the medium density area most of the household heads see the sanitary condition as being fair i.e. 60% while 46% in the low density area perceive it as being good. See Table 4.3.1

A total of 62% of the household in the high density area from Table 4.3.2, participate in solving solid waste disposal problems in the area, while 38% of residents in the same area do not participate at all. Perhaps the reason for this could be due to the low level of education and environmental awareness. The reverse is the case in the medium and low density areas where majority of residents are found to be participating in solving the problem; this can be attributed to the high level of education and environmental awareness.

Most of the households engage in communal environmental sanitation on weekends as seen in the above table, the highest being in the medium density area (64%) and this reason is because they tend to mobilize their residents enmass during such exercises, and the awareness of sanitation problem in their area.

Table 4.3.4 shows that, 58% of households in the high density area participate in community solid waste collection and disposal either daily or weekly. In the medium density area, 84% of households participate either daily or weekly in the collection and disposal of solid waste in the area. And in the low density area, 55% participate in the exercise. The reason for the high percentage participating in the medium density is most likely due to mass mobilization of residents in the collection or disposal of waste in that area.

Table 4.3.5 shows that majority of households in the high density area participate in preventing people from littering the area and making complaints to the Benue environmental sanitation authority on the state of sanitation in the area. In medium density area, results show that, majority of households participate in cutting of grasses in the

open space/fields and around their houses; preventing people from littering the area and making complaints to the relevant authorities on the state of sanitation in their area. The low density area households also engage in cutting of grasses in open space; preventing people from littering the area and making complaints to the relevant authorities on the state of sanitation in their area.

63% of household heads interviewed in the high density area have been contributing money towards solving solid waste problem in the area. In contrast only 17% in the medium and low density areas respectively have contributed money towards solving the waste problem in their neighbourhoods. The reason for such variation could be due to the level of solid wastes in the areas and its evacuation. The author as seen on Table 4.3.6 observed that households sometimes pay wheelbarrow boys to convey their waste or dump same on the streets and open spaces.

Table 4.3.7 shows that, 54% of household heads interviewed in the high density area disposed their waste in the final depots. The reason here may be due to lack of regular clearing of wastes in the areas by tippers which encourage them to dispose in any depots created by the community as final depots. In the medium and low density areas, the situation is different because household heads take their wastes to community collection centres and some have their wastes collected from their houses. The reason may be due to accessible roads for easy movement of waste vehicles into and out of the areas. In some low density areas, because of the large open fields and spaces near the residences, the residents tend to use this as a temporal final depot pending when the authorities come to collect the wastes.

The Table 4.3.8 shows that the degree to which the household heads participate in solid waste management is low; this may be due to lack of an organized community organization and mobilization by residents in the neighbourhood for solid waste management.

Table 4.3.9 shows that there is relatively not much difference on whether the neighbourhoods are committed to solid waste management or not, however an encouraging average of 63% of the respondents show commitment towards tackling the problem. Perhaps with better organisation, proper mobilization and technical assistance more people would get involved in solid waste management and the communities would be a lot better.

Table 4.3.10 shows that 88% of respondents in the high density area do not know the end products/ end uses of solid waste generated, this is probably due to the low level of education and awareness. In the medium and low density areas the situation is quite different most likely due to the high level of awareness and educational attainment.

Table 4.3.11 shows that more 70% of households reported that there was no form of assistance given to them by the public agencies or government for solid waste management and less than 30% indicate that they receive assistance from the public bodies for solid waste management, this may be the reason why each area tries to participate in solid waste management on their own.

Table 4.3.12 indicates that most of the household heads have not received any assistance either financial or materially from the public agencies or government in their areas. 14% though say they have received assistance from the government and this may be the 1.5 cubic

meter containers (as seen in plate) provided in scattered locations in Makurdi by Benue environmental sanitation board for waste collection.

Averages of 80% of the households have their waste containers provided for their compounds by their household heads, with 57% of households in the three areas saying they clear their refuse/waste daily. It would be expected that with these results environmental conditions with reference to solid waste management should be either good or very fair, but this is not the case, the opposite is the case in the three areas, this may be due to failure of waste management at the community level and the inefficiency/ineffectiveness of the Benue environmental sanitation authority.

From the results of the analysis, it shows that 41% of the households dump their waste at public waste depots which for them is the most acceptable means of waste disposal at the community levels. However most of this waste disposed, remains at these sites for a long time before being cleared or are turned into large heaps of garbage or solid waste that are left there almost permanently. There are only nine functional trucks or solid waste collection vehicles available to Benue environmental sanitation authority which is meant to service the whole of Makurdi LGA; this is totally inadequate for the town considering the size of the town and the large amount of solid waste being generated by households around the town.

The results have also shown that an average of 77% of household heads have not seen health inspectors in their neighbourhoods. In the low density area where there is a high level of education and awareness their perception of environmental conditions is either fair or poor.

It was also reported from the analysis that the degree of participation is very low because there is no central organization or groups for solid waste management in Makurdi unlike places like some parts of Lagos and Onitsha where communities organize within their neighbourhood to collect and dispose solid waste on their own, and where every household will have to pay certain amount to be used in keeping the neighbourhood clean.

The information from the analysis also shows that people are interested in the development processes of their neighbourhoods as can be seen in the level of participation and contribution shown particularly in the high density area where a large percent of the household contribute money towards solving the problem. In the medium and low density areas however, it is more of organized labour than financial contribution.

The analysis also shows that majority of the household have reported that they have not seen waste pickers or scavengers visiting their compounds. In comparison to what is obtained in the Terrain belt in India where scavengers or waste pickers visit people door to door and pay certain amount for their waste materials.

5.2   SUMMARY

The purpose of this research has been to examine and analyse community participation in solid waste management in Makurdi using density of development as criteria. An analysis of the variables that involve community participation was thoroughly undertaken. Examinations of various approaches of community actions were also attempted.

Environmental problems are very difficult to tackle particularly solid waste management in urban centres. Achieving a comfortable and conducive environment is a difficult task; this has to take into consideration all actors including the communities. Management of solid waste can be transformed by planning for waste reduction, the promotion of recycling, reuse and stakeholder co-operation. Although the physical and political problems of overflowing dumps and lack of adequate sites for new ones are real and often very urgent, even the pressing needs of neighbourhoods, waste removal have only prompted effective action in scattered instances.

Good environmental planning should take into consideration the above mentioned problems, the neglect of these problems by the necessary planning bodies will definitely result in serious environmental problem of solid waste which not only affects the aesthetic nature of the environment but the health of the inhabitants.

5.3 CONCLUSION

Towns and cities in Nigeria are expanding at an alarming rate in terms of population and waste generation which has now led to intractable environmental problems and quality. Makurdi has witnessed a large inflow of people into it that has also increased the solid waste problem just like in other towns in Nigeria. Three density areas within Makurdi that make up the high, medium and low density areas were studied and their results revealed the following:

- There is a remarkable difference in the socio-economic characteristics of household heads in the three areas; solid waste management is a problem in all three areas, with a high percent in the high density area.

- Majority of households dump their solid waste at open spaces and public depots which for them is the most acceptable means of waste disposal at the community levels. However, most of the wastes disposed remained at these sites for a long time before being cleared.

- There are inadequate waste collection/disposal vehicles available with the BESA (Benue Environmental Sanitation Authority), which has only nine functional trucks or waste collection vehicles these are totally inadequate to service a town like Makurdi.

- Visits from public health inspectors to households are very infrequent, which indicates that there is no strict enforcement of sanitation laws.

- The degree of participation in solid waste management in the three areas is low because of lack of proper organisation by groups and communities for solid waste management.

Environmental problems are difficult to tackle. Collective efforts is needed by all stakeholders i.e. government, private agents, household heads, community leaders, etc, as successive efforts by government alone to combat this problem have often failed.

5.4 RECOMMENDATIONS

This study has attempted to evaluate community participation in solid waste management in Makurdi. It is obvious that the existing solid waste generation, collection, processing and disposal in Makurdi has not been very effective due to various factors i.e. and with emphasis,

low participation/inadequate involvement of community members in the process, ineffective government policies, lack of equipments e.t.c. In light the of these, therefore it is recommended that:

i.   The efforts of the government agencies in charge of solid waste should focus on participatory approaches to improve the prevailing conditions and sharing decision making process with neighbourhoods, groups, and organization at the grassroots level in Makurdi. It is also recommended that private agents/agencies be encouraged to play active roles also in participatory, decision making and management process.

ii.   Greater participation of populace should be achieved particularly at community level through mobilization and education. There is the need to form community based organization specifically for solid waste management. They should be involved in all deliberations and activities connected with all aspects of solid waste management in their communities.

iii.   Privatisation or a combination of both privatisation and commercialisation must be embarked upon. Levies should be charged on all residential polluters towards meeting the cost of waste generated, collected, transfer and disposal and the actual collection/processing management should be handled by licensed private firms rather than by quasi-public agencies. Therefore an effective fee collection system should be set up, with a precondition that the fees are appropriate to local income levels and that the waste service is in accordance with the demands of the community or else the willingness to pay will be very low.

iv.   The attitudes of the general public towards solid waste management, needs to change and they (the public) will have to accept the fact that it is better to pay for the services rendered, that guarantee the quality of life for all, towards ensuring sustainable development including the quality of the environment than sticking to the belief that government has to provide everything even where the resources are not available.

v.   The government should as a matter of urgency encourage public, private and community partnership in solid waste collection, transfer and disposal in Makurdi. Township roads should be constructed and rehabilitated particularly in the high density area and in the parts that are narrow and are therefore inaccessible for large garbage trucks. As an alternative, hand-pushed carts or tricycles can be used to collect waste and to transfer it to secondary collection points. Adequate equipments should be provided (vehicles, manpower, materials etc) to ensure easy clearing of solid waste in all the areas. There should be mechanisms put in place or bodies created for the sole reason of requesting and purchasing recycled content materials.

vi.   Women play a determinant role in waste management and they form important channels of communication. In many projects, the important role of women is overlooked and often they are not listened to or their needs and circumstances are not sufficiently taken into consideration. In most situations, women are the managers of households and thereby they are responsible for cleanliness within and around the home and for taking care of waste. In some societies, this task also involves paying for waste collection and therefore it is vital to include women in determining the fees for waste services. Apart from domestic tasks, women can be active

members of Community based organisations, can stimulate participation of other women or community members and may be the key interlocutor that projects have among the community.

vii.   The promotion of recycling/reusing solid waste materials by modern devices such as composting and generation of methane gas through anaerobic decomposition; starting up businesses that utilises local waste materials; working with another business to establish a use for your own waste material/by product should be encouraged. In addition, active participation in the promotion of segregation of wastes materials at the source at household levels and streamlining the operations of the waste pickers and scavengers through proper training upgrading of techniques and the requisites health protection should be embarked upon.

Finally this research is limited in scope in terms of coverage and it is hoped that further research can be undertaken on this very important matter. There is the need to explore in more details and widely too, methods and techniques for community participation in solid waste management in Nigerian cities for this has the promise of tackling the increasing scale of solid waste management Nigeria.

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APPENDIX A

QUESTIONNAIRE SURVEY ON COMMUNITY PARTICIPATION IN SOLID WASTE MANAGEMENT IN MAKURDI TOWN.

Department of Geography
FUT Minna,
Niger State.
July, 2007

Dear Respondent,

I am a post graduate student of the department of geography, FUT Minna. I am currently carrying out a research on community participation in solid waste management in Makurdi local government area, Benue state.

I will very much appreciate it, if you can assist me by completing the attached questionnaire honestly and correctly. This research is purely for academic purpose and all information provided will be treated confidentially.

Thank you very much for your anticipated cooperation.

Ikurior Mimi
M.TECH/SSSE/2005/1454

APPENDIX B

SECTION A: SOCIOECONOMIC STATUS OF HOUSEHOLD

1.   Sex: Male (   )   Female (   )

2.   Age: (   )

3.   Marital Status: Single (   )   Married (   )   Divorced (   )   Widow ( )

4.   Household size:...

5.   Educational Qualification:...

6.   Occupation of Household: Farming (   ) Trading (   ) Civil servant (   )
      Others (   )

SECTION B: HOUSEHOLD WASTE GENERATION

7.   What is the major type of waste generated in your house?

      (a)   Domestic ash:...

      (b)   Papers: ....

      (c)   Polythene materials:..

      (d)   Crop residue and food remains:...

8.   What container is used for solid waste collection in your house?

      (a)   Plastic container (   )   (b)   Metal bucket (   )   (c)   Cartons
             (   )
      (d)   Iron and plastic drums (   )   (e)   None (   )

9.   Who provides the waste collection containers in your house?

      (a)   Household heads:..

      (b)   Caretaker and landlord:..

      (c)   Public health agency:..

      (d)   Benue environmental sanitation authority:.................................

(e)   Others:..

10.   How often do you clean refuse in your house?

(a) Daily (   )   (b) 2-3 times a week (   )   (c) Weekly (   )

11.   How do you dispose domestic solid waste?

(a)   Dump at backyard:...

(b)   Dump on streets:...

(c)   Disposed on open space:...

(d)   Dumped in pits/gutters:...

(e)   Collected by environmental agency:..

(f)   Others:...

12.   Who undertakes the collection of solid waste from your house?

(a) Male adult (   )   (b) Female adult (   )   (c) Children (   )   (d)

Waste carrier (   )

13.   Does the environmental sanitation authority collect solid waste from your area?

....

14.   How would you describe the way people feel towards refuse disposal by the environmental sanitation authority in your area?

(a) Very good (   )   (b) Good (   )   (c) Fair (   )   (d) Poor (   )

15.   Do you know the danger posed to public health due to carefree dumping of refuse around the house?

(a) Yes (   )   (b) No (   )

16.   Do health workers visit your house? (a) Yes (   )   (b) No (   )

17.   How often do they visit? (a) Weekly (   )   (b) Monthly (   )   (c)
Yearly (   )   (d) Never (   )

SECTION C: COMMUNITY PARTICIPATION IN SOLID WASTE MANAGEMENT

18. What is your perception of sanitation condition in the area?
(a) Good (   )   (b) Fair (   )   (c) Poor (   )

19. Do you think that solid waste disposal in your neighborhood could be solved?
(a) Yes (   )   (b) No (   )

20. Does your household engage in communal environmental sanitation at weekends?
(a) Yes (   )   (b) No (   )

21. How often have you been engaging in communal solid waste collection or disposal in your area?   (a) Daily (   )   (b) Weekly (   )   (c) Monthly (   )   (d) Never (   )

22. What type of sanitation have you engaged yourself in, in the neighborhood?
(a) Collection of waste from the street (   )   (b) Cutting grasses in the open spaces/fields (   )   (c) Preventing people from littering the area (   )

23. Have you contributed money towards solving solid waste problems in your area? (a) Yes (   )   (b) No (   )

24. How often do waste pickers visit your area? (a) Daily (   )   (b) Weekly (   )   (c) Monthly (   )   (d) Never (   )

25. Which of these solid waste management practice have you or your household participated in? (a) Taking solid waste to community collection centre (   )   (b) Taking solid waste to final depot (   )

26. What is the degree of participation in solid waste management observed in the area? (a) Full participation (   )   (b) Low participation (   )   (c) No participation (   )

27. Are the members committed towards solid waste management problem in your area? (a) Yes (   )   (b) No (   )

28. What are the end uses/end products of solid waste?
(a) Industrial raw materials (   )   (b) Agriculture input (   )   (c) Don't know (   )

29. Do you receive any assistance from public agencies in managing solid waste in your area? (a) Yes (   )   (b) No (   )

30. What are the types of assistance? (a) Financial assistance (   )   (b) Material assistance (   )

APPENDIX C

Ho: Solid waste management is not a severe problem in all the three residential areas

H1: Solid waste management is a severe problem in the three residential areas

Data on perception of sanitation conditions was used to test the hypothesis.

Observed frequency:

	LDA	MDA	HDA	CT
Good	32	13	29	74
Fair	20	47	25	92
Poor	18	18	28	64
TOTAL	70	78	82	230

NOW $\dfrac{RT \times CT}{GT}$

Where RT is round total, CT is cumulative total and GT is grand total, therefore:

$$\frac{70 \times 74}{230} = 23$$

$$\frac{70 \times 92}{230} = 28$$

$$\frac{70 \times 64}{230} = 19$$

$$\frac{78 \times 74}{230} = 25$$

$$\frac{78 \times 92}{230} = 31$$

$$\frac{78 \times 64}{230} = 22$$

$$\frac{82 \times 74}{230} = 26$$

$$\frac{82 \times 92}{230} = 33$$

$$\frac{82 \times 64}{230} = 23$$

Expected frequency:

LDA	MDA	HDA
23	25	26
28	31	33
19	22	23

Chi-square $(X^2) = \Sigma \dfrac{(O - E)^2}{E}$ therefore,

$$\dfrac{(32 - 23)^2}{23} + \dfrac{(20 - 28)^2}{28} + \dfrac{(18 - 19)^2}{19} + \dfrac{(13 - 25)^2}{25} +$$

$$\dfrac{(47 - 31)^2}{31} + \dfrac{(18 - 22)^2}{22} + \dfrac{(29 - 26)^2}{26} + \dfrac{(25 - 33)^2}{33} +$$

$$\dfrac{(28 - 23)^2}{23} =$$

$$\dfrac{81}{23} + \dfrac{64}{28} + \dfrac{1}{19} + \dfrac{144}{25} + \dfrac{256}{31} + \dfrac{16}{22} + \dfrac{9}{26} +$$

$$\dfrac{64}{33} + \dfrac{25}{23} =$$

$$3.5 + 2.3 + 0.05 + 5.7 + 8.3 + 0.7 + 0.3 + 2 + 1.1 = 24$$

$$X\square = (d/f) = (c - 1)(r - 1)$$
$$= (3-1)(3-1)$$
$$= 2 \times 2 = 4$$

Therefore, $X^2 \approx 0.05 \ (d/f = 4) = 9.48$

Where "c" represents the column of the cell, "r" represents the rows of the cell, $d/f = 4$ is the degree of freedom and "0.05" is significance level.

Therefore the calculated value of X^2 is > critical value hence we reject Ho 24 > 9.48, this means that, solid waste management is a severe problem in the three areas.

2. Ho: Awareness of the dangers to public health from the carefree dumping of solid waste around compounds is the same in all three residential areas.

H1: Awareness of the dangers to public health from the carefree dumping of solid waste around compounds is higher in the medium and low density area than in high density area.

Data on the degree of participation in solid waste management was used to test this hypothesis.

Observed frequency:

	LDA	MDA	HDA	CT
	59	51	30	140
	11	27	43	81
Total	70	78	82	230

NOW $\dfrac{RT \times CT}{GT}$

Where RT is round total, CT is cumulative total and GT is grand total, therefore:

$\dfrac{70 \times 140}{230}$ = 42.60

$$\frac{70 \times 81}{230} = 24.65$$

$$\frac{78 \times 140}{230} = 47.47$$

$$\frac{78 \times 81}{230} = 27.46$$

$$\frac{82 \times 140}{230} = 49.91$$

$$\frac{82 \times 81}{230} = 28.87$$

Expected frequency:

LDA	MDA	HDA
42.60	47.47	49.91
24.65	27.46	28.87

Chi-square $(X^2) = \Sigma \dfrac{(O - E)^2}{E}$

$$\frac{(59 - 42.60)^2}{42.60} + \frac{(11 - 24.65)^2}{24.65} + \frac{(51 - 47.47)^2}{47.47} + \frac{(27 - 27.46)^2}{27.46} +$$

$$\frac{(30 - 49.91)\square}{49.91} + \frac{(43 - 28.87)^2}{28.87} =$$

$$\frac{268.9}{42.60} + \frac{186.3}{24.65} + \frac{12.46}{47.47} + \frac{0.211}{27.46} + \frac{396.4}{49.91} + \frac{199.6}{28.87} =$$

$$6.312 + 7.557 + 0.264 + 0.007 + 7.942 + 6.913 = 28.995$$

Therefore, Chi-square $(X^2) = \Sigma \frac{(O - E)^2}{E} = 28.995$

$X^2 \approx 0.05$ (n = 1) = 3.84

For calculated X^2 value is > critical values therefore reject Ho i.e. 28.995 > 3.84, hence awareness of the dangers to public health from the carefree dumping of solid waste around compounds is indeed higher in the medium and low density areas than in the higher density area.

3. Ho: The degree of participation in solid waste management is not low in all the three residential areas.

    H1: The degree of participation in solid waste management is low in all the three residential areas.

Data on the degree of participation in solid waste management was used to test the hypothesis.

Observed frequency

	LDA	MDA	HDA	CT
	54	53	58	165
	10	20	13	43
	6	3	11	20
Total	70	78	82	230

NOW $\underline{RT \times CT}$

$\qquad$ GT

Where RT is round total, CT is cumulative total and GT is grand total, therefore:

$$\frac{70 \times 165}{230} = 50.21$$

$$\frac{70 \times 43}{230} = 13.08$$

$$\frac{70 \times 20}{230} = 6.086$$

$$\frac{78 \times 165}{230} = 55.95$$

$$\frac{78 \times 43}{230} = 14.58$$

$$\frac{78 \times 20}{230} = 6.782$$

$$\frac{82 \times 165}{230} = 58.82$$

$$\frac{82 \times 43}{230} = 15.33$$

$$\frac{82 \times 20}{230} = 7.130$$

Expected frequency

LDA	MDA	HAD
50.21	55.95	58.82
13.08	14.58	15.33
6.086	6.782	7.130

$$\frac{(54 - 50.21)^2}{50.21} + \frac{(10 - 13.08)^2}{13.08} + \frac{(6 - 6.086)^2}{6.086} + \frac{(53 - 55.95)^2}{55.95} +$$

$$\frac{(20 - 14.58)\square}{14.58} + \frac{(3 - 6.782)^2}{6.782} + \frac{(58 - 58.82)\square}{58.82} + \frac{(13 - 15.33)^2}{15.33}$$

$$\frac{(11 - 7.130)\square}{7.130} =$$

$$\frac{14.36}{50.21} + \frac{9.486}{13.08} + \frac{0.006}{6.086} + \frac{8.702}{55.95} + \frac{29.37}{14.58} + \frac{14.28}{6.782} + \frac{0.672}{58.82} +$$

$$\frac{5.428}{15.33} + \frac{14.97}{7.130} =$$

2.859 + 0.725 + 0 + 0.155 + 2.014 + 2.105 + 0.011 + 0.135 + 2.860 + 1 = 9.004

Therefore, Chi-square $(X^2) = \Sigma \frac{(O - E)^2}{E} = 9.004$

$X^2 \approx 0.05$ (n = 1) = 8.99

For calculated X^2 value is > critical values therefore reject Ho i.e. 9.004 > 3.84,

we therefore conclude that the degree of participation in solid waste management is low in all three residential areas.

3. Ho: The degree of participation in solid waste management is not low in all the three residential areas.

H1: The degree of participation in solid waste management is low in all the three residential areas.

Data on the degree of participation in solid waste management was used to test this hypothesis.

Observed frequency:

	LDA	MDA	HAD	CT
	54	53	58	165
	10	20	13	43
	6	3	11	20
Total	70	78	82	230

Expected frequency

LDA	MDA	HAD
50.21	55.95	58.82
13.08	14.58	15.33
6.08	6.78	7.13

Chi-square $(X^2) = \Sigma \dfrac{(O - E)^2}{E} = 28.98$

$X^2 \infty\ 0.05\ (n = 2) = 5.99$

For calculated X^2 value is > critical values therefore reject Ho i.e. 28.98 > 5.99,

We therefore conclude that the degree of participation in solid waste management is low in all three residential areas.

Plate III Waste dump in soil eroded gutter in the high density area

Plate IV Solid waste dumped near wall of the old bridge in the high density area

Plate V Solid waste dumped just behind residence on an undeveloped plot in the high density area

Plate VI Solid waste being dumped on open space around school premise in the high density area

Plate VII Un-cleared waste in around shanties in the high density area

Plate VIII Accumulated waste at the community collection
center located near the road in the high density area

Plate XI Uncleared dumped along the road in the high medium density area

Plate X Waste disposed on an empty plot being picked
by a scavenger in the high density area

Plate XIII Waste being picked by scavengers on an open space
created as final depot in the high density area

Plate XIV Final waste depot along the river bank created
by the neighbourhood in the high density area

Plate XI Accumulated waste along the road being cleared by the
environmental sanitation board staff in the high density area

Plate XII Abandoned car dumped along with waste, by the
roadside in the high density area

Plate XV & XVI Waste bins at the community collection center
in the high density area, yet to be cleared

Plate XVII & XVIII Waste bins overflowing with waste spilling onto the ground yet to be cleared in the high density area

Plate XIX WAste being picked by scavengers in the medium density area

Plate XX Uncleared solid waste on an open plot created as
final depot in the medium density area

Plate XXI   Waste dumped along the road yet to be cleared
in the medium density area

Plate XXII Uncleared waste dumped on an empty plot beside
residence in the medium desity area

Plate XXIII Uncleared waste being dumped in an open space
beside the railway in the medium density area

Plate XXIV Waste being disposed on the ground rather than in
empty waste bin in the medium density area

Plate XXV Solid waste being carted away from the medium
density area to the final waste depot

Plate XXVI & XXVII Solid waste being cleared away in the medium
density area

Plate XXVIII Waste dumped in an eroded gutter created as
final waste depot in the low density area

Plate XXIX Uncleared waste disposed on an empty plot in the
low density area

Plate XXX Waste dumped near residence on an open space in low density area

Plate XXXI Waste being disposed by an eroded gutter near residence close to the road in the low density area

Plate XXXII waste bins overloaded with waste spilling onto the ground
yet to be cleared at the collection center in the low density area

Plate XXXIII   Waste dumped in an open space near a fence in
the low density area

Plate XXXIV Waste being disposed off at the final depot in Makurdi

Plate XXXV Scavengers looking on as waste is being disposed
off at the final depot in Makurdi

Plate XXXVI Final waste depot in Makurdi

Plate XXX Final depot located very close to the main road