URBAN POPULATION PRESSURE AND SOLID WASTE MANAGEMENT

(A CASE STUDY OF KADUNA SOUTH LOCAL GOVT. AREA)

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IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF POSTGRADUATE DIPLOMA
IN ENVIRONMENTAL MANAGEMENT.

APRIL, 2000

Certification

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To my loving mother, my father and to my wives.

TESTIMONY

Views expressed in this Dissertation are those of the author. Likewise the accuracy of facts and data presented are the responsibility of the author and not that of the Institution.

ACKNOWLEDGEMENT

Glory be to Allah the most High and the most supreme whose infinite mercy through His Prophet Muhammad (P.B.U.H) covers the whole universe, one of which is my ability to conduct the research work and come up with this piece.

I wish to express my profound gratitude to my parents who took it upon themselves to get me through to this level of my educational pursuit. I also wish to thank my Cousin brother (Buhari Munkail,) for his guidance and to my other brothers and sisters on their support and understanding.

My sincere appreciation goes to my able and hard working supervisor, DR, AKINYEYE who painstakingly went through the manuscripts of this write-up offering corrections and advises with ingenuity. Other members of staff of the department also played prominent roles especially the course Co-ordinator Dr, M.T Usman. To them all I say thank you.

I would not fail to extend my regards to the management and staff of the National Library, Kaduna and the National archives as well as the Ministry of Information, Sports and culture all in Kaduna for the opportunity to use their facilities for this

noble cause. Others to share this regard are the Household that responds to the questionnaires as well as respondents from the public.

This research work wouldn't have been possible without the support of my employer, for this I thank the Kaduna South Local Government Council for giving me the opportunity to undergo the training programme, under the then chairmanship of Alhaji Muhammad Ilu. My colleagues in the office also deserve a pat on the back for their encouragement and well wishes.

I shall not forget the contributions of my fellow classmates. My friends and well wishes, they deserve very special and reserved commendations. My friends in Minna town deserve mention also.

To all these people finally, I say a heart-borne thank you.

ABSTRACT

This thesis provides an insight into matters concerning solid waste management in the Kaduna South Local Government.

Comparison is made between accepted available methods of waste disposal and the processes actually being applied by the household.

The shortcomings identified and there resultant consequences to the environment have fully been digested and in the final part, recommendations on how best to handle the situation have been offered.

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CHAPTER ONE

1.1 INTRODUCTION:

Waste generation in several cities of both the developed and developing countries is on the increase. Generally, waste is either an asset or a liability depending upon our attitude to it. To some because of its menace, waste is more of a liability. However, the best and most rewarding attitude to waste, according to Falade (1998), is to see it as an asset. With this kind of attitude, waste can be better planned and managed as a valuable resource for man's benefits.

An efficient solid waste management system, with its many benefits, is critical to attaining sustainable human settlement development and management. This is to promote a safe, clean and healthy living environment, where the lives of urban dwellers will be prolonged. It is also critical for promoting environmental quality, aesthetics, and the enhancement of economic productivity of the people, through employment and income generation – 'from waste to wealth'.

In many instances, the management of urban solid wastes in many developing countries is far from satisfactory (schubeler 1996). In Nigeria, for example, the problem of waste management, is rather acute, as most cities with rapid population growth cannot boast of a workable system. To tackle the problems of solid waste management, the country pursued several programme. These includes the Institution of the environmental sanitation day programme, the promotion of waste to wealth measures and the passing of the National Environmental Policy as well as the pursuit of specific urban

action programmes for waste management. Nevertheless, these efforts, having not yielded the required results, are not sustainable (FEPA, 1989. 1991). Thus, proper planning and efficient management of urban solutions and strategies.

While the problems of waste management looms large in many developing countries, there is hope in that cases of successful experimental but sustainable approaches, leading to some tangible results have been undertaken in some of the developing countries of the world including Nigeria. These cases can be regarded as best practices that are not only sustainable but are also worthy of replication Falade (1998).

The aim of this paper is to discuss selected case studies of critical sustainable approaches to the successful planning and management of wastes. These cover the following areas.

i) Participatory approach to the planning for waste management at the city level;
ii) Participatory approach and the process of formulating national plan for waste management; and
iii) Sustainable approaches to reduction through waste recycling and waste minimization.

As a background to the various case studies, certain terms are defined in context.

The rapid urbanization of Kaduna metropolis and its suburb and the subsequent increase in its population has led in the past years to an unprecedented increase in the volume of waste generated.
The nature and volume of waste generated has completely overwhelmed whatever infrastructure was put in place in the past to handle the situation. The result has been heaps of uncleared refuse all over the metropolis.

The state of environmental quality of Kaduna South Local Government leaves much to be desired. Every environment – conscious person that looks round Kaduna South becomes disturbed with the alarming unhealthy scenes all over the place. Refuse dumps are noticed almost anywhere, and indiscriminate refuse disposal is done along natural water courses – the streams and rivers, in any available open spaces, in open drains, and in alleyways or sanitary lines between houses. This poor state of environmental quality calls for conscientious effort of all inhabitants of Kaduna towards upgrading the environmental quality of the metropolis, for a healthier, safer, more beautiful and more convenient livable environment for all. Consequently, health hazards like epidemics of cerebro spinal meningitis (CSM) broke out in most parts of Nigeria including Kaduna State as this assignment was being conducted.

To achieve the objectives of a proper environmental sanitation programme, there is need for strong and sustainable enforcement measures to be adopted for Kaduna South Local Government and other settlements in the state.

1.2 HISTORICAL BACKGROUND OF KADUNA SOUTH LOCAL GOVT.

1.1.2 INTRODUCTION:

The history of Kaduna town dates back to the end of the last century and the early parts of this (20^{th}) century. A lot of things have been said about the origin of Kaduna but, it is mostly believed that the name originated from the river that runs through the town dividing it into halves. At that time there used to be some rocks on the river bank at Kabala where crocodiles spent leisurely hours and hence the river was being called in Hausa: 'KOGIN KADUNA', meaning:- 'The river of crocodiles'. And subsequently people began to call the city KADUNA, a simplified Hausa plural meaning of crocodiles.

When in 1914 the then Northern protectorate (former name of Northern region) Governor Lord Luggard came from Zungeru, the capital at that in search of a better and more befitting capital for the protectorate, he found in Kaduna a place of his dream to serve as a substitute to Zungeru and thus work began in earnest to clear the vast Savannah forest to commence real construction. From then Kaduna became the capital of the North until 1968 when states were created. This development gave rise to the establishment of Kaduna Capital Territory (KCT) with landmass of about 27 square miles (m2) with a population of about 150,000 to serve as the capital of the then North – Central State. However, owing to developmental needs, two local governments were created out of the former Kaduna Local Government namely Kaduna North and South Local Governments in September 1991. Kaduna north and South Local Government with headquarters in Makera is discussed below.

1.3 DEFINITION OF TERMS

1.3.1 URBAN SOLID WASTE:

Urban solid waste includes refuse from house holds, non hazardous solid waste from industrial, commercial and institutional establishments (including hospitals), market waste, yard waste and street sweeping. While hazardous industrial and medical wastes are by definition not components of urban solid waste, they are normally quiet difficult to separate from urban solid waste, particularly when their sources are small and scattered. An urban solid waste management system should therefore include special measures for preventing hazardous material from entering the waste stream. And if this cannot be guaranteed, other effective measures must be put in place to counteract any side effects when they are included in the wastes to be collected. In addition, the debris from construction and demolition sites constitutes 'difficult' categories of waste, which also require separate management procedures.

However, urban solid wastes do not include semi-solids wastes such as sludge and night soil, which are considered the responsibility of liquid waste management systems.

1.3.2 URBAN SOLID WASTE MANAGEMENT SYSTEM:

This includes all phases of waste collection, transfer, treatment, recycling, resource recovery and disposal of solid wastes in urban areas. It is the inability of urban waste management agencies in developing countries like Nigeria to effectively manage the various phases of waste management in a systematic and integrated manner that is the crux of the matter.

1.3.3 PRINCIPLE OF MANAGEMENT:

Management is a cyclical goal oriented process. It involves setting goals and objectives, establishing long term plans, programming, budgeting, implementation, operation and maintenance, monitoring and evaluation, cost control, revision of objectives and plans.

Usually, the management of urban infrastructure service is a basic responsibility of the municipal government. Nevertheless, it is advantageous for municipal authorities to execute service provision roles in partnership with private enterprises and/or with users of services (facilitating a participatory approach). However, the final responsibility remains that of municipal waste management authorities.

As solid waste management involves many agencies and actors, the management principle should therefore embrace clear definition of roles, co-ordination of activities of the various agencies and ensuring co-operation between them, through networking and joint targeting activities.

TABLE 1: People's Identification of Urban Solid waste Management Problems in Kaduna.

Technical Problems	Institutional and Administrative problems	Political Problems
i) Lack of public Enlightenment	i) too many agencies involved in waste disposal	i) Political instability
ii) lack of landfill sites for waste disposal;	ii) no clear policies on recycling and non commitment of policy operators and executors;	ii) bad and inconsistent policies.
iii) lack of appropriate methods for waste disposal.	iii) inadequate times of collection of wastes;	iii) site acquisition at state government level;
iv)lack of adequate information regarding geological formations topography and settlement patterns	iv) inadequate planning	iv) irregular financial assistance
v) lack of adequate equipment for waste disposal	v) inadequate finance;	v) political differences
vi) manpower shortage;	vi) apathy on the part of waste management agencies	vi) absence of law enforcement mechanism;
vii) inadequate transport and non availability of spare parts.	vii) corruption	vii) overlap of the functions of the three ties of government.
viii)ineffective neighbourhood services and	Viii) poor management;	viii) misplacement of priorities;
ix) Limited funds.	ix) lack of effective monitoring and supervision	ix) poor leadership
	x) lack of administrative continuity;	x) lack of public awareness
	xi) no organized waste and collection system;	xi) lack of public co-operation, and
	xii) lack of public enlightenment on refuse transportation.	xii) boundary disputes
		xiv) mismanagement, misappropriation and embezzlement of funds and
		xv) wrong prioritization

1.4 THE IMPLICATIONS FOR WASTE PLANNING AND MANAGEMENT IN NIGERIA.

1.4.1 AN OVERVIEW OF WASTE MANAGEMENT PROBLEMS IN NIGERIA

Nigeria experiences most of the solid waste problems facing many developing countries as well as its own specific ones. These problems cover technical, socio-economic and political issues, apart from the growing accumulation of uncollected garbage in towns and cities (Cointreau, 1982; North et al, 1988; U, UCHS, 1996). Existing studies also showed that the solid wastes generation is several cities are increasing pari pasu with their population growth. The larger the city, the more the amount of solid wastes generated and the more complex is the problem of management. The volume of solid wastes is largest for metropolitan Lagos and smallest for Potiskum (Table 2). In 1983, some 9 million tonnes of wastes were generated in Nigeria cities. By the year 2000, it is established that the amount of solid waste generation in Nigerian cities will increase to 15 Million tonnes, amounting to an increase of 66.6% over 1983 figure.

Rising population, growth in cities due to rapid urbanization and industrial growth have fuelled the increases in waste generated. However, the removal of garbage in these cities has outstripped the capacities of most local government, such that garbage accumulation is the order of the day. According to NEST (1991), 'Every Nigerian city is afflicted by this malaise and its end appears not to be in sight'. Some of the problems or urban solid wastes disposal in the country as catalogued in several studies include the following.

i. Lack of regulations and guidelines for refuse disposal;

ii. Lack of central depots (landfills) where house holds can dump their Refuse, with only 23% of households dumping their refuse in proper Depots.

iii. Non collection of household refuse in most cities, with as high as 83% of households in Niger and Bauchi claiming that their house hold refuse were not collected at all;.

iv. Under funding of waste management agencies:

v. Inaccessibility of some housing areas of waste collection, especially the traditional core or indigenous cities like Kano, Kaduna, Bida etc as well organically develop new suburban areas; and

vi. The failure of the National Environmental Sanitation, which only works through the application of force.

These problems bother on inadequate institutional and legal frameworks, inadequate finance, and lack of technical and managerial capacities on the part of the various agencies.

.E 1: Estimated Solid waste generated in some Nigeria Cities (tonnes)

n Areas	1982	1985	1990	2000
s	625,399	681,394	786,079	998,081
n	350,823	382,224	440,956	599,882
	319,935	348,580	402,133	535,186
a	257,837	280,925	324,084	431,314
a	242,240	263,929	304,477	386,593
arcourt	210,934	229,821	265,129	352,853
gbo	131,903	143,712	173,720	253,841
	131,903	143,712	169,719	236,703
	99,871	111,905	135,272	197,660
i	67,477	75,607	91,396	133,660
au	44,488	48,471	57,243	133,531
skum	15,434	16,816	19,399	79,835
	12,508	13,628	15,721	28,347
ja	9,383	10,514	13,311	20,923
Bussa	5,690	6,200	7,152	9,518

rces: (I) Federal Ministry of Housing and Environmental; and

ii) NEST (1991) Nigeria's Threatened Environment: a national profile p. 231.

1.4.2 RELEVANCE OF CASES STUDIES

It is instructive to highlight the important lesson of the five case studies presented above to see their relevance to the Nigeria situation. Case study one is Nigerian based and it shows a pragmatic and result-oriented and participatory approach to formulating city wide waste management plan and strategies by involving the people, NGO's, stake holders and the organised private sectors. This case can be used a vehicle for reaching consensus with people and obtaining the commitments.

In the second case study, the US EPA, the apex national environmental protection agency, provides a scientific, highly analytical and participatory approach to the formulation of an integrated and dynamic National action plan for urban solid waste management. Since inadequate planning for waste management at the three tier Government level and the lack of effective co-ordination are among the problems facing the system, this case is relevant to the Nigerian situation. The National policy for Environment, which also stipulated the adoption of an integrated and holistic approach very robust (FEPA, 1989).

The first two of the remaining three cases presented above focus on waste on waste recycling techniques and strategies, while the third on focuses on waste minimization by a manufacturing firm. The success of waste recycling in Bangalore and port Novo shows that wastes, which are often regarded as public nuisances, can be turned into an economic asset for sustainable livelihood. These cases also show that for waste recycling to be successful it must involve all and sundry, including citizens, the industries, the waste pickers as well as the waste management authorities.

Going by the waste characterization in most developing countries, the build of wastes made up of vegetable (putrescible materials (of between 40% to 80% of total solid wastes generated) are suitable for recycling (see Table 3). Therefore, the case for recycling waste for composting, vermi composting and generation of biogas can therefore be made for the country.

TABLE 3: Waste Characterization for Both Developed and Developing Countries.

ndicators	Low-Income Countries	Middle – Income Countries	High Income Countries
Vaste generation Kg per person ear)	100 – 220	180 - 330	300 - 1,000
Moisture content % net weight at oint of generation)	40 – 80	40 - 60	20 – 40
Composition % by weight)			
Paper	1 - 10	15 - 40	15 – 50
Glass, Ceramic	1 - 10	1 - 10	4 - 12
Metals	1 - 5	1 - 5	3 - 13
Plastics	1 - 5	1 – 5	2 - 10
eather, rubber	1 - 5	-	-
Wood, bones, traw	1 – 5	-	-
extiles	1 – 5	2 – 10	2 – 10
egetables/Putres ible	40 - 85	20 – 65	2 - 10
Miscellaneous herts	1 - 40	1 – 30	1 - 20

Sources: (ii) Cointreau, (1982): Environmental management of Urban solid Waste Management in developing Countries, Urban Development Technical Paper No. 5: The world Bank, Washington, D.C.

(ii) UNCH (1996): An urbanising World: Global Report on Human Settlements in 1996.

The implication of the case studies have been discussed with respect to the Need for an integrated approach to be adopted for urban solid waste management as well as other planning issues. Although, it is often difficult to import a technology from one country to the other, there is already elements or shades of planning and recycling of wastes in the country, which are yet to be as good as any of these cases described above and our existing practice can still benefit from these experiences for further improvement.

CONCLUSION:

The following thoughts and perhaps strands of philosophical argument have ran through this paper.

i. Waste problems and effective control is a question of an attitude, which can be both bad and good. That we are wiser to choose the good attitude to control waste and make it an economic asset rather than a liability.

ii. That waste problems in the country divide into the rising volume of waste generated coupled with the capacity gaps in the administrative, technical, financial as well as in R and D and the inability to carry along the people for whom the plan was intended.

iii. The cases of sustainable practices presented focus on using an integrated and participating approach to evolve flexible realistic strategies. In order to exploit waste as an asset, the best practice is to embark on waste recycling and waste minimization policies. This will lead to a drastic reduction in the volume of waste to be disposed off. All the cases presented are relevant to the Nigerian situation. But their replication should take into account the peculiar Nigerian Socio-economic characteristics.

1.4 OBJECTIVES OF THE STUDY

1. To assess the volume and characteristics of solid waste generated in the study of solid waste generated in the study area.
2. To identify the causes of population explosion in Kaduna south local Government
3. To examine the correlation between population growth and waste generation in the area of study.
4. To study the public Health implications of poor waste management in the area.
5. To identify roles of individual group and the community in solid waste management to the people and the government of Kaduna south local Government
6. To recommend the appropriate methods of solid waste management to the people and the government of Kaduna south local Government

6.4 LIMITATIONS OF THE RESEARCH:

This research work was primary designed to cover Kaduna south local Government area only. This is due to so many inhibiting factors that made it practically possible to widen the scope of the study further and which as well explain it is limited to the study area alone.

Distance between study area and researchers base played a limiting role, bearing in mind the several shuttles that had to be taken to and fro the study area for data and material collection and actual presentation of gathered material.

Contributory to this also is the time factor. The fact that little time was given within which to complete the work despite the complex nature of the research topic and the scope intended to be covered.

Financial constraint: The effects of Nigerian perennial economic predicament spare nobody in the country, the researcher inclusive. Consequently, the limited finances available militated immensely against broadening the scope of the study upon what is presented.

1.5 SCOPE OF THE STUDY

The research work is designed to cover Kaduna south local Government only. The area, which comprises of Tudun-wada, makera, Unguwan-sunusi would be carefully and systematically studied within the time frame allocated for the exercise.

Being the capital of Kaduna State, the metropolis is occupied by people of various educational and economic background and belonging to different social classes. All of which would be taken into good account in the course of the research

1.6 SIGNIFICANCE OF RESEARCH

In this era of globalization, information collection and dissemination on all spheres of life is indispensable. Information could come in various forms and through different means. At present, the environment is deteriorating through the indiscriminate disposal of solid waste at unassuming dimensions which if left unattached to, can generate to uncontrollable level.

Conducting research work of this kind is one of the avenues by which information can be collected especially on such a sensitive aspect of environmental management of this nature.

Facts and data so collected and presented can be used as a stepping stone for the assessment of government policies on solid waste management in order to identify cripping factors and how improvement can be introduced.

6.7 HYPOTHESIS

1. The high rate of urbanization in Kaduna, Kaduna south local Government is instrumental to the continues increase in the volume of waste generated.
2. Ignorance of the people in the study area contributes to their waste generation habits.
3. The rapid population growth of Kaduna south local Government makes waste management difficult in the area.
4. Poverty of the Government and individuals is responsible for the failure of waste management policies in the study area.
5. Poor legislation on effective waste management system contribute to the proliferation of refuse dumps in the area.

CHAPTER TWO

2.1 INTRODUCTION

Kaduna State is mainly an agrarian state. Therefore it depends on its natural resources to meet its people's social and economic needs.

Kaduna State has severe environmental problems like soil erosion and declining soil fertility, deforestation, pollution of water supplies and biodiversity losses which are as a consequence of economic activities like mining, industrialization and agriculture. The challenges, therefore, is for Kaduna State to:

i) Achieve food security through sustainable agricultural intensification;
ii) Influence migration towards a better population distribution especially in sensitive areas;
iii) Make urbanization sustainable by improving planning and services;
iv) Manage energy, water and other natural resources in an integrated fashion; and
v) Direct proceeds from non-renewable resources like minerals to the development of Agriculture, Education, Health and rural development.

2.2 LAND AND THE KADUNA STATE ENVIRONMENT

Land is perhaps the most vulnerable resource of man. Land consists of the soil and all that is in it and growing on it. Taken together with the atmosphere above the ground and the climatic conditions, we can speak of The "Environment". Soil and land are names interchangeable used. The soil supports the plants growing on it, when the vegetation cover the soil is

removed by man which allows the soil to be subjected to degradational forces. The speed of degradational depends on the method of removal and the extent of removal and this will determine the direction of environmental equilibrium. In nature, therefore, there is a permanent relationship between land, its environment and man. This relationship which is dynamic, determines the sustainability of the environment. The key factor in this environmental equation is man, his attitude and the way he exploits the land.

2.2. 1 LOCATION AND SIZE

Kaduna State occupies approximately the entire central potion of the northern Nigeria, extending approximately from 09,00 to 30 'N and from 06 00 to 0900'E. The population of Kaduna State now must be well over 3 million and it is a large approximating 42,00 Km^2.

2.2.2 CLIMATE

Kaduna is in the centre of the middle belt of Nigeria where the climate can be described as the best for agriculture in Nigeria with sufficient rains to last as long as 7 months (in the southern to middle parts) to 5 months (in the most northern region of the state) ample for rainfed agriculture. There are at least 5 clear dry months running from October/November to April/May. Proximity to the high Jos Plateau makes the south eastern part of the state the wettest zone in the state with a range of 1200m to 1700mm. Mean annual rainfall caused by the orographic lift given the rain-bearing southwest winds.

2.2.3 GEOLOGY AND SOILS

The entire Kaduna State is underlain by crystalline igneous and metamorphic basement complex, mainly of Jurassic to Pre-Cambrian age. In the south-eastern portion of the state, around Kafanchan, these old rocks are covered by the Quarterly flow of lava that descended from the Jos Plateau. Laterites capping closely associated with crystal sites, are common features in Kaduna State particularly in the north on virtually all rock types. The basement Complex rocks are mainly granites, gneiss, mimatites, schist and quartzite, the latter occurring as linear ridges while the granites and gneiss occur as Iselbergs and undifferentiated plains. These rocks are poor in basic cations (such as Mg, Ca) whereas the lavas in the southeast are rich in these (Ferro – magnesians) Minerals.

2.2.4 VEGETATION AND LAND USE

Three broad vegetation types are characteristic of Kaduna State, namely: Derived Savannah, Southern Guinea Savannah and Northern Guinea Savanna. Activities of man have greatly affected the various vegetation communities, modifying them to what they are today. These activities include bush burning, cultivation, grazing, fuelwood savenging and logging.

Fire-hardy species are the most common species, whereas fire-tender species are found only in the southern Guinea and Derived Savannah and these include Albizigia Zygia, Khaya Grandifolia, Uraria. chamae, Chlorophora excelsa.

Vegetation communities are associate with distinct ecological sites with particular regard to the nature of the soils. For example, degraded soils, such as well drained stony soils on iron pan have characteristic community of

woody plants and grasses, just as communities on deep well drained, deep poorly drained, flood-plain and rocky soils can be readily distinguished. Generally, however, degradation of these vegetation communities occur under intensive cultivation and grazing which are often associated with deforestation and bush burning. Inspite of this common trait and effects on the environment, these two land use types are in fierce competition for land in the intensively used areas north of Zaria.

2.2.5 SOILS AND LAND FORM TYPES

SOIL GENESIS

Soils are a product of their environment, the four physical parameters of which are the climate, the vegetation or biotic life, the parent rock and the associated relief. In Kaduna State, it is primarily crystalline Basement Complex, the two dominant relief features are gentle undulations (dominant in the state) and much lower frequency of rugged terrain which include associated Jos Plateau escapement that forms the boundary with Plateau state and isolated ranges of hills and inselbergs concentrated mostly in the mid-eastern Kaduna State (Saminaka and Kachia LGA's) and in the south western border with the Niger State around Sarkin Pawa.

These parent rocks weather into acidic quartzite rich residuum, almost devoid of phophatic minerals but rich in potassium. The strong seasonally of the climate is characterized by alternating wetting and drying of the soil solution system which favor the production of laterite in many areas, a situation accentuated by large scale deforestation and annual bush burning.

The net result of the interaction between the factors described above (of the climate, vegetation, the parent rocks and relief) have produced soils in

Kaduna state that are generally yellowish to reddish, deep, well drained fine to medium – textured. They are characterized by coarse – textured surface horizons and stone lines in the subsoil, often enriched in iron-concretions quartz fragment and mottles. The soils are, on balance, strongly weathered , poor in nutrients, have a thin easily erodible organic (stained) surface horizon. Surface ceiling or crusting is common (during the first rains of the rainy season) in soils rich in silt or fine sand which impede seed emergence and rain water penetration, causing runoff and severe sheet erosions.

Soil Patterns

The catenary association of soils, (with crest to valley floor sequence of soil types) coming on the hills of the soil forming physical parameters, described above, is repeated throughout the rock types and associated Land Systems defined for Kaduna State. The pattern is neither consistent neither within any land system nor between land systems, due to the intricate pattern of rocks within the Basement Complex. Slope wash tends to infill the valleys with materials from the interfluvial slopes.

Inspite of the complexity of the soil patterns, the following pattern of soil characteristics can be identified;

- Ironpan capping are common in the crest and upper slopes, the soils of which are shallow, interspersed with outcropping ironpan;
- Soils of the midslope positions are deep, well drained but are enriched with iron rubble, and
- Cemented iron pan may occur at the footsteps usually at the convex break of slope positions and are severally eroded. These occur extensively around Kaduna metropolis;

- Around outcrops of gneiss and schists occur very shallow soils with or without ironpan.
- Soils on iselbergs and granite nassifs are skeletal except in isolated pockets, where deep soils may occur;
- Valley heads, concave and amphitheatre – shaped, are characterized by soils of impeded drainage associated with clayed matrix colours or a large number of clay mottles;
- The valley bottom soils are varied in texture and drainage properties;
- In northern Kaduna State soils are locally very silty, coming as it were, from the harmattan transport from the Sahara desert. At depths of 30cm or more, these soils are uniformly coloured and textured, with a discontinuity between it and the more clayey and stony subsoil;
- The total area of iron pan capping and rock outcrops is estimated at less than 9% of the state;
- The natural fertility regime of the soils is medium to low with possible exception of some flood plain soils which have above average fertility;
- The clay fraction is low-activity clay presenting a picture of high saturation even with low nutrient levels;
- With the PH values of 5.0 – 6.0, soil acidity is near optimal for major nutrient availability.

The Land Form types

The above describes the genesis and patterns of soil formation in Kaduna State. The distribution of different soil types in the state can be known in a detailed soil survey exercise. The first stage towards achieving that goal is to map the physiographic units in a reconnaissance soil mapping exercise which procedure is the easiest for soil mapping of a large geographical area.

This has been done, as part of the mapping of the entire Central Nigeria by Bennett et al (1979). They identified the following physiographic units.

1. Unit (I) Hills on Younger granites
2. Units (ii-iii) Dissected zones on Basement complex: undulating plains, low rocky hills and extensive dissection.
3. Unit (iv-vii) Plans on Basement complex: occupy about 60% of Kaduna state; gently undulating with crystal ironpan capping some inselbergs; lower slopes with the steepest slopes; the major agricultural land area of the state.
4. Unit (viii) basement complex plains with unconsolidated deposits: undulating plains at the foot of the Jos Plateau as part of the piedmont alluvial plains built by rivers descending from the Jos Plateau to form every good agricultural soils on lava materials. Now being eroded, gullied and degraded with additional limited development or ironpan capping which processes are being assisted by land use.
5. Unit (ix) Plains with hills on Basement complex: inselbergs common; extensive laterite capping; lower slopes commonly eroded.
6. Unit (x) Plains on newer Basalt produced by the 5 lava flows poured down the escarpment from the Jos Plateau; nearly level plains being actively cultivated and now eroded with localized gullying.

Within these 10 physiographic units Bennett et al (1979) defined about 65 Land systems. A more detailed soil survey will identify and define the soil series that ordinary users of land can be familiar with, farmers, engineers, foresters e.t.c.

Soil Classification

The soils of Kaduna State fall into the following categories for the USDA Soil Taxonomy classification system:

(i) Alfisols
(ii) Utisols
(iii) Inceptisols
(iv) Entisols

2.2.6 IMPACT OF LAND USE ON THE SOILS OF KADUNA STATE.

From the point of view of soil conservation and environmental protection in the use of land, Kaduna State land appears to be one of the most protected in the northern Savannah grassland of the country. The state has a high population of forest reserves including the following:-

Fatika Forest Reserve
Kakang Forest Reserve
Rikau Forest Reserve
Mando Road North Forest Reserve
Kajuru "
Anara "
Kona "
Ribako "
Libere "
Anchau "
Kwogin Karam "
Limoro chokobo "
Gulma River "

Giwa "
Akwana West "
Akwana East "
Kagarko "
Maiido "
Kurmin Dawaki "
Kurmin Biri Forest Reserve
Doka Hills "
Nindam "
Kurmin Bi "
Raham Escapement"
K. Barkin Kogi "

Even though forest reserves are located on lands that are not good for agriculture (rocky, hilly, dissected or degraded lands generally), the fact that this has been recognised in Kaduna State and the lands protected as forest reserves, is an indication of a positive disposition to environmental management in Kaduna State.

Outside the forest areas, the land is intensively used for agriculture. Both large and small scale farmers are turning to tractorization, at least for seedbed preparation. Although predominantly dominated by undulating topography this practice Is having a great impact on the sustainability of the productivity of the agricultural lands as it will continue to accelerate sheet erosion, nonetheless. Grazing is also having comparable impact on the lands.

2.2.7 ENVIRONMENTAL RISKS IN THE USE OF LAND

Land has been defined as synonymous to the environment. Putting the land to use is therefore concomitant to the destabilization of the environment. Land is all that is contained in the soil system; the animal and plant life in the soil system and the climate of the given area.

Once the soil is subjected to any use, the equilibrium within the ecosystem or the environment is disturbed. Of all possible uses, the following are important in Kaduna State:

(a) Agricultural and related land uses

(b) Constructional uses:

- Settlement uses
- Road construction

(c) Mining – Prevalent in Kagoro and Birnin Gwari.

2.2.7.1 AGRICULTURAL AND RELATED USES

Because of the rather favourble terrain of just undulating terrain, except on the hilly and rocky areas, Kaduna State land is generally intensively used for agriculture. Also because of the widespread use of tractorization, the soil is suffering from severe sheet erosion except in the nearly level farmlands.

Most farmers, however still practice the traditional method of farming which, being mixed cropping, smallholding ad worked by traditional implements with some animal traction, is sustainable and cause minimal erosion.

Even so there need to adopt simple conservation methods such as ridging, planting of grass hedges across the slopes, good fallow regenerative system through crop rotation, accompanied by the use/planting of soil improvement

crops (e.g. legumes – cowpea, groundnut) and woody hedgerow through proper selection of adapted species.

Because of the high radiation and good sunshine hours, Kaduna State is ideal for the production of grains (sorghum, maize, millet, rice), tuber (yam) and normally insect – susceptible pulses (cowpeas) because of the rather kow Relative Humidity that limits insect and fungal attack.

Apart from erosion on agricultural lands, one environmental problem if agriculture is the pollution with agro-chemicals from runoff from farmland, especially large scale farms.

2.2.7.2GRAZING AND LIVESTOCK

Because of the natural grassy nature of the native vegetation, livestock is quite a popular agricultural venture in Kaduna State.

As a result of the existence of many natural and artificial planted forests, Glossina sp is a widespread animal pest. Nevertheless, there is still extensive tsetse free grassland, which is heavily grazed and overgrazed resulting in widespread land degradation. The nomadic system of livestock raising produces two unexpected environmental problems, namely;

a) The conflict between the crop farmers and the Fulani nomads and
b) The practice of bush burning which the nomadic think they need to spur grass shoots to reduce the waiting time for rain to make the ground green again.

The following ways of solving these problems can be listed:

(a) **Creation of Fodder Banks**

IICA, In collaboration with the Federal livestock Department (FLD) has tried creating fodder banks to improve the nutrient values of the grassland herbage, enhance the availability of livestock food and thereby encourage sedentarism among the Fulani nomads as one way of reducing their volatile interaction with crop farmers. But the project does not seem to have been sustained.

It is the best option, short of creating improved grassland for intensive livestock raising, to improving the livestock feeding regime in the Kaduna State grasslands. So an effort should be made to resuscitate the fodder bank system in Kaduna State to solve the environmental problems for raising livestock through the nomadic approach.

2.2.7.3 CONSTRUCTIONAL USES OF LAND

(a) **Settlement Uses**

There are expenses of sparsely populated areas in Kaduna State but the state is nevertheless well populated, the intensity of cultivation and land degradation being a good indicator of the density of population spread. So the best agricultural lands are also the most densely settled.

Settlements usher in agricultural activities and also deforestation with the need to open up the land for cultivation and obtain domestic fuel wood. As the latter need gets more severe the higher the population rises and there is no end to the demands, thus escalating the land degradation problem.

The solutions to this problem are:-

i) The productivity of the agricultural lands can be made more sustainable if a measure of agro-forestry is introduced in Kaduna

State as it has been adopted in the drier, far north states. This will mean planting adapted tree seedlings in a scattered fashion on the farmlands or along farm roads if the farms have been laid out, in addition to whatever species may have escaped the earlier process of opening up the land for agriculture.

ii) By planting woodlot in deliberately selected areas of the farm, e.g. in degraded parts of the farm, first for the purpose of conserving the soils and converting the land to a more economic use in addition.

In both cases, or the above the trees are available for harvesting and providing a more salubrious environment for the crops (in lowering the micro-climate, supplying organic matter from the litter fall and protecting the soil from rainsplash erosion that sets in motion the ubiquitous sheet erosion.

c) **Road Construction**

Because of the generally good terrain and the totally crystalline Basement complex nature of the geological formation underlying Kaduna state, the soils are generally stable and the state has not be experiencing any serious road construction related erosion. But this can quickly occur where contractors become careless in the management of their road construction.

d) **Natural Storage**

Dangerous pollution can occur if toxic chemicals are buried in the soil. There may not be many instances of this but one should worry about the pollution coming form the petrochemical facility south of Kaduna City.

e) **Natural Storage**

Water and minerals are naturally stored in the soil. Wherever they are, man often goes after them. The piedmont alluvial plains at the foot of the Jos Plateau escarpment south east of the state in Manchock-kagoro area may be good aquifers for good underground water.

2.3 GEOGRAPHY

The local government is bounded to the East by Kaduna North Local Government Area, Igabi Local Government Area to West while Chikun Local Government area forms the boarder to the south and south-west.

The Local Government occupies the southern part of Kaduna metropolis hence the name Kaduna South.

It is located on longitude 10, 31' North of the equator and Latitude 7, 30' East of the equator. Topography consists of vast open and flat land for future development and expansion.

2.4 CLIMATE/VEGETATION

The area has the Savannah type of vegetation; two seasons, the dry and the rainy. The dry season ensues from November to April with maximum temperature of 40 C at its peak in March/April while between November and January, a dull overcast condition (harmattan) is observed. The rainy season starts from April with small showers through to August/September when the peak rainfall is attained.

2.5 ADMINISTRATIVE AND POLITICAL SET UP

The local Government is being administered by a council whose members are elected councilors from the thirteen (13) electoral wards with one chairman, also elected. This Council which has the task of policy-information, is assisted by the local government staff with the Director of Personnel management as the administrative head.

The day-to-day activities are carried out by a committed workforce distributed into six (6) departments for efficiency, with each headed by a head of government. These departments are personnel; finance; and agricultural departments. Others are works; health and education departments.

Traditionally, the local government is administered by two district heads for Tudun-wada and Makera districts. There are several villages and wards whose traditional leadership are being held by village and ward heads respectively.

2.6 PEOPLES AND OCCUPATION

Tudun-Wada; Tudun-Nupawa; Tudun – Ilu; Sabon-Gari; Unguwar sanusi; Unguwar Mu'azu; Kabala (West); and Kurmin-Mashi are the villages under Tudun-wada district while Makera; Kakuri; Barnawa and Kurmin – Gwari make up the Makera District.

The area's three hundred and seventy-three thousand, five hundred and sixteen population (according to 1991 census) reside in these villages. There are however, wards under each of the named villages.

The liberality of Kaduna State is fully reflected in this area as people of different ethnicity both from within and beyond the shores of the country find in Kaduna South a befitting place to live in.

Ethnic groups include Hausa, Fulani, Gbagi, Kaje & Jaba. Others are Yoruba,. Igbo etc. Whereas the former are believed to be indigenous the latter are those that came from other places. Moreover, the Gbagis are said to be the earliest settlers.

The area has two major religions: Islam and Christianity with many mosques and churches where their followers worship, in the same way a few pagans and customary believers practice their beliefs freely.

The industriousness of the people of the area can not be over-emphasized as they undertake handiwork like carpentry, automobile repairs, painting and art work and several others alike. Every where workshops and showrooms are there. Boutiques, barbing and beauty saloons, road-side vulcanizing spots are common sight. Pottery, weaving and black smithing are widely practiced as well.

Aside from these some people earn their living by working in various formal institutions and offices and the industries. A section of them sustain their lives laying bricks and labouring in construction and quarry sites. They also practice fishing and subsistent farming producing both cash and food crops. A lot more occupations are being carried out.

7 COMMERCE AND INDUSTRY

Many industries are operating in the local government. Some of these include metal and aluminium fabricating companies, food and beverages plants, and a good number of textiles, industries for which it is referred to as the 'Manchester of Nigeria'. Others are Peugeot Automobile Nigeria Limited, Federal Superphosphate Fertilizers Company and a host of others.

Currently, the local government is the second biggest revenue generating local government in the country as a result of the high concentration of industries.

There are two major markets in the area, the famous 'Kasuwar Barchi' known for its versatility especially in clothes – making and selling – both native and western wears in Tudun Wada, and the Kakuri market. While these two operate on daily basis , the 'Monday Market' in Kurmin Gwari operates once a week.

Other markets of significance are the two 'Panteka' markets situated in Tudun wada District. While the new Panteka market is a centre of automobile spares merchandise, the old is a centre of excellence in trades – handy trades for that matter. Trades such are carpentry, pot-making and fabrication of tools using local technology are some of the hallmarks for which the market is well known. Apart from these markets there are several shopping outlets along the streets and roads in the form of supermarkets, stores, shops etc with variety of goods and products in stock for sale. Also very common are kiosks and corner shops that offer for sale soft drinks, fast food and other consumables scattered across the breadth and length of the local government.

Inspite of these however, there is constant demand for more market places as a result of which the local government council allocated stalls to individuals in the new Unguwar Mu'azu market site. The site which has been planned to accommodate thousands of stalls will also have a Bank, post office, clinic, police post, Motor Park and four numbers public sanitary conveniences – all features of a modern market. Construction work is in progress.

To facilitate business activities in the area, a number of financial institutions are available. These include prominently bank of the North, U.B.A., Afri Bank Plc etc whose branches cut across the local government area. There are two Community Banks: Mutunchi and Alheri Community Banks in Makera and Tudun Wada respectively. The latter was the first Community Bank established in the country.

3 TRANSPORTATION

Transportation as a tool of development to any society is a force to reckon with. In this direction, the area is accessible by road, rail and water, the only exception being air transportation.

In the area of road transportation, the accessibility of the area is very easy because of the availability of good road networks. Kachia road and Nnamdi Azikiwe Way (Western bye-pass) are the two highways which together with other trunk B and C roads serve as Intra and Inter Local government routes. Commercial buses, taxis, trucks, including private and corporate vehicles ply these roads to deliver goods and services as well as commute passengers within and outside the area.

Another form of road transportation that has gained acceptance is that in which Motorcycles/bikes are used. It is popularly known as 'GOING' or 'ACHABA'. The motor-park at Television village provides transit services from Kaduna to the Middle belt and Eastern States whereas the newly-built modern motor park in Kurmin Mashi is still left idle. Several other sub motor-parks are found useful e.g. Tipper – Garage, 'Kasuwar barchi'.

Automobile maintenance and repairs is an essential element of road transportation, to this therefore a lot of mechanical workshops render services throughout the area. Worthy of mention here, are the mechanical village at Kurmin Mashi and the old Panteka market mechanical village near the National Eye Centre.

9 HEALTH

Heath services are being rendered by both public and private institutions. There is the presence of all the three tiers of government. The national Eye Centre, the Nigeria Army Reference Hospital (known by the public as 44 hospital) both in Tudun wada district are run by the Federal Government.

The State government provides health care services in the area through two General Hospitals at Tudun Wada and Kakuri; and one family health unit, Tudun Wada; and a Psychiatric hospital in Barnawa. In line with the Primary Health Care Concept, there are several local government-owned PHC centres; clinics and health posts have been located in almost every village of the area. These include maternal and child health clinics and leprosy clinics. Preventive health services are also being rendered by the environmental health personnel of the local government who have been deployed to eight

health districts of the local government. Aspects of environment, market and food sanitation, industrial inspection are among the services rendered by the Heath Unit.

Complementary to these are the privately-owned hospitals and specialist hospitals which by far outnumber their public counterparts. Also available are diagnostic laboratories, patent medicine stores and diagnostic ultrasound outfits. Playing a vital role in the health care needs of the area are the traditional medicine practitioners who are being patronized by people.

0 EDUCATION

There are twenty-eight (28) primary and five (5) secondary schools owned by government. But the privately owned institutions are too numerous, found almost everywhere. Mostly seen in the nooks and crannies of the area are Nursery/Primary Schools with some of them establishing secondary sections. There are also the Nigerian Army Children (Primary) School Secondary Schools are a common sight.

Prominent among the tertiary institutions are the Kaduna Polytechnic (with three of its four campuses located in Tudun Wada, Barnawa and Television Village). School of Health Technology and the National Water Resources Institute. Others are the staff Development Centre, Kakuri and Nigeria Postal Services Plc (NIPOST) Training School, Kurmin Mashi. There are in addition to these, computer training institutions.

Moreover, Islamiyya Schools provide literacy on Islamic and Arabic language knowledge. There are secondary level Islamic institutions as well. Most of these are in Tudun Wada District. Mass literacy classes are available for adults.

1 AGRICULTURE AND NATURAL RESOURCES

Although the area is cosmopolitan which implies that only a small percentage live by Agriculture, yet it has a good number of 'FADAMA' farmers who take the advantage of Kaduna river and its adjoining streams to irrigate their plantations mostly vegetables and fruits. Besides irrigation, wet season cultivation is also widely practiced. Crops such as groundnut, maize, millet, guineacorn, rice including such fruits as mangoes, oranges and vegetables are being grown. Sugar – cane is also grown very well.

There are two livestock markets: the one in Tudun Wada (Zangon Shanu) being the biggest offer for sale cattle, sheep, goats and camels whereas that in Makera is largely stocked with goats. By these two livestock markets are an abattoir and a slaughter house respectively which are within close quarters for convenience. Remarkably the Tudun Wada abattoir provides about 70% if not more of the total Meat consumption need of the whole metropolis. Other slaughter slabs compliment the abattoir and the slaughter house. Poultry-farming is also widely practiced. There is a vetenary clinic at Zangon Shanu and several vetenary and Agro-Allied products shops catering for the needs of this sector. Marble and granite are the minerals found in the local government area.

2.12 SOCIAL SERVICES

The area is connected to the National Grid for power supply and each village enjoys electricity and pipe-borne water supplied by the Kaduna State Water Board. River Kaduna and its adjoining streams, bore holes and wells are supplementary sources.

Sports is one area in which the area has firmly established itself taking into consideration the numerous talents that abound who have won laurels for themselves and the local government both locally and at the National level in different fields.

There are sporting arenas speed throughout but, the most common are football pitches that are virtually more patronized than others are. This is not to say that other sports like volley and basketball are neglected. Being a Cosmopolitan local government, Kaduna South receives visitors from different walks of life either on official, business or pleasure trips as such there are a lot of hotels, motels and guest houses to cater for their needs. Some of the notable hotels include M.I.A, Zakariya and Polygate Hotels among others.

There are night clubs that offer variety of music alongside restaurants of quality standards that serve mouth-watering local and continental cuisine's in addition to the-seen-everywhere eating house popularly referred to as Food hotels. Bakeries both local and modern, together with snacks centres (eat and take-away) and the inviting 'SUYA' (roasted meat) spots are a delight to the visitors.

One can also while-away time watching movies in one of the two cinema houses in the nights while the newly-opened Galaxy amusement park opposite the Army Reference (44) Hospital is a good relaxation spot for couples and families especially the younger ones.

Social and Youth Clubs are some of the organizations that render services such as community development projects, cultural performances and drama presentations among others but, are mostly found in Tudun Wada. Others include the Boys' Scout, the Aid Group of Jama'atu Nasril Islam (J.N.I) and that of IZALA (J.I.B.W.S). Two centres namely Rehabilitation centre, Kakuri and Workshop for the disabled, Tudun Nupawa owned by the state and local government respectively cater for the destitutes.

2.13 MISCELLANEOUS

The government house now named Sir Kashim Ibrahim House located behind Kaduna Polytechnic is one of the oldest colonial establishments in Kaduna. It has been serving as the Governor" lodge since pre-independence era. Numerous Federal and State agencies have their offices in the area.

Two military barracks, Police Stations and posts provide security for the inhabitants of the area in addition to the community vigilante groups while one magistrate, two upper Area Courts and five Area Courts preside judgements over Civil and Criminal cases.

In the area of communication, there is one Newspaper house the Democrat, two functional post offices, several posting agents and Nigerian Telecommunications Plc, Northern headquarters and Call Stations.

Television and Radio Broadcasts are received in the area though there is no single broadcast house.

Festivities observed are the Eids i.e. Kabir, Fitri & maulud and Christmas among others.

Lingua Franca is English, and Hausa is widely spoken.

CHAPTER THREE

Literature Review

It is now generally acknowledged that out of the intricate web of factors influencing development in Nigeria, environmental population consideration are of great important. The increase in urban population, combined with other factors, such as per capita consumption of resources and increasing level of technology, is causing severe pressures on ecosystem. Urban population density has an influence on the relationship between living space, other natural resources and waste generation.

An examination of the development, structure and dynamics of the Nigerian urban system shows that the number of cities with 500,000 and more inhabitants grow from a mere two in 1963 to 14 in 1984. According to Onibokun (1985) the national population grew annually at 3.0 per cent and five per cent. Accelerated urbanization in the country, accentuated by multiplication of new administrative centres following the creation of new states and local government areas, coupled with diversification of occupation and trade, educational needs and production of a wider array of goods encouraged population pressure in many urban centres (including Kaduna).

The result of all these are that in large urban areas, there is degradation of environmental quality, and the larger the urban area, the lower the quality. Informed opinions suggest that the quality and concentration of wastes generated rises with urbanization and human population. Highly putrescible materials – leaves, garbage, food remnants and paper, characterize the waste, particularly the solid variety. From industries, hazardous materials like gases, lead, mercury and arsenic compounds are continually being produced as wastes. Unchecked, the wastes

pollute the air above the cities, enter water and soil, and through many pathways contribute to poor health and environmental norms, this portends great dangers ahead (especially with acute urban poverty prevalent in the Country's urban centres).

The World commission on Environment and Development (WCED) defined sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). While there is still no universally accepted definition of sustainable development, the concept implies a new evaluation of the relationship between people and nature, a movement away from the domination of nature to working with nature, and reassessment of the methods used for the transformation of natural resources into useful products. This calls for a combination of effective action regarding environmental conditions and requirements at national and international levels.

As pointed out over two decades ago by Mabogunje (1968), the current pattern of rapid urban growth, and the attendant quantum of solid wastes are serious constraints to sustainable development of Nigerian cities. For purposes of definition, sustainable cities are cities where achievements in social, economic and physical developments occur in synergy and are made to last. A sustainable city has a lasting supply of natural resources on which its development depends and a lasting security from environmental hazards which may threaten development achievements (HABITAT, 1991).

In this context, a feature that is characteristic of the cities of the developing countries (including Nigeria) is the rapid and uncontrolled rate of growth of these

cities, largely resulting from lack of planning. The rapid and uncontrolled population growths invariably over-stretch whatever facilities that are available.

Experience all over the country confirms that the existing public sector strategy on solid waste management is problem ridden. First, the rapid growth of the urban population means that many cities have now over-flowed their boundaries. Consequently, it is difficult for the city authorities to plan properly for urban service provision and urban development. The management of solid waste (SW) which falls under the exclusive list of local Government Authority (LGA) functions is of critical concern. SW is an ubiquitous entity constituting a serious human and environmental hazard if properly managed.

Second, the consequence of rapid urbanization, population pressure and the proliferation of agencies in the urban centres have implications for proper urban governance and sustainability. For instance the creation of numerous poorly co-ordinated agencies at the state and local levels engender complex relationships and confusion, apart from their ineffectiveness and resource misallocation.

It is now common knowledge that in most cities, service agencies have over the years been subjected to frequent structural changes and functions have been transformed from one agency to another. In Kaduna for instance, the responsibility had changed hands more than six times within the last ten years. Sample of respondents in Kaduna claimed that nobody was responsible for collecting their garbage.

Equally critical, is the fact that Public sector facilities for SW and the machinery are either unserviceable or idle. The situation worsened with the introduction of the Economic Structural Adjustment Programme (SAP) in 1986, with the attendant

devaluation of the Naira to abysmally low levels, thus making the purchase of the imported high technology vehicles and equipment virtually impossible. The introduction of high technology for SW management by the public sector itself is questionable, considering the poor maintenance culture, cost of maintenance, and spare parts replacement in the face of more appropriate ones like wheel barrow, hand charts, small tippers and animals. Indeed, most of the trucks can either not easily move or manoeuvre on the narrow roads. The urban core with high population density is highly inaccessible, thus making the residents to depend on self collection and disposal. The situation is just a little better in the new and government planned residential areas, because of improved accessibility.

Financially, the SW management system on a cost recovery basis is virtually impossible under the present dispensation coupled with the pervasive payment default by real and potential beneficiaries. However, the potential recovery and re-use of SW materials is yet to be fully realised and tapped. So also is the inherent opportunities and advantages available in the communities themselves, if they are properly mobilized, sensitized and involved in SW management agencies, scavengers, enterprises using recovered SW materials, community based and some non-governmental organisations are involved in various aspects of SW management. A major issue is the absence of properly articulated policy on it ad its implementation.

Yet, participation in SW management by households and NGO's can be a catalyst in community development work, since it gives the citizens a feeling of self-esteem. Moreover, it can lead to the generation of income through recycling which will also Reduce the quantities of material that have to be transported for disposal.

Against this background, there is a need to augment government environmental management service delivery capacity in the face of increasing urban population pressure. What untapped and under tapped elements of the potential resource base exist, and how could they be better organised and utilised to facilitate better SW management? There is a need to characterise the pattern of SW generation and to assess/evaluate the present roles of those new elements and to estimate their potentials in a new, improved urban SW management arrangement.

Against the above background, the overall aim of the present study is to use the Kaduna case to explore the potentials of individual community and non-governmental organization in boosting and augmenting local government capabilities and capacities for managing urban solid wastes. Specifically, the study will identify and characterize solid wastes generated as these vary across zones of different population densities in Kaduna metropolis; identify the problems associated with existing solid waste management practices in Kaduna; and identify, characterise and assess the current and potential roles of households and non governmental organizations in solid waste management in Kaduna. On the basis of the findings, the mix of individual actions, community mutual aid and public intervention required to tackle SW management problems in Kaduna will be proposed.

It is the responsibility of all inhabitants of Kaduna to maintain their environment. People are aware of the detriment of filthy environment, yet most of them contribute in deteriorating their environment quality and expect the Government to sanitize the places for them. It is on this premise that household heads and compound leaders are made to enforce sanitation regulations in their various houses and compounds in Kaduna. All property owners are to be made to provide refuse collection bins in order to stamp out indiscriminate refuse disposal and its consequential problems in

compliance with section 3 (2) of the Kaduna State environmental sanitation Edict, 1991 which states thus: "The owner or occupier of a tenement shall provide and maintain proper drainage in his tenement in such a manner as to avoid the blockage of the drain and shall in addition provide a covered dustbin to be used for deposition of refuse of any description." In this regard, KEPA needs to provide standard refuse bins in all tenements at subsidized prices. And the purchase of such bins has to be enforced just like KEPA has started with waste baskets in buses. The use of waste bins has also to be introduced in taxis and private vehicles, for people feel frier eating in these vehicles. It is only when the entire environment is maintained that indiscriminate throwing of waste can be checked. The household heads and compound leaders are to ensure that their immediate environments are being maintained whenever they are dirty. They have to keep all parts of their houses and compounds clean, including the frontages, backyards, alleyways or sanitary lines between houses, adjoining roads, and drains in compliance with section 3 (1) of the Kaduna state Environmental Sanitation .Edict, 1991, which states thus: "Every owner or occupier of any tenement shall clear and keep the streets at the front, back or either sides of such tenement and drains gutters or channels by such streets free from filth, and refuse of any kind of description."

The household heads and compound leaders are to be held responsible when their immediate environments are found filthy and charged by environmental court for violating the environmental sanitation edict of the state.

Also, heads of public and private institutions such as offices, schools, hospitals, religious centres, garages, workshops, recreational areas, barracks, estate, commercial areas, industrial areas and other land – based activity areas are to be in charge of keeping and maintaining their premises, including the frontages backyards, adjoining roads and drains, whenever they are due for maintenance.

Most of these institutions have units under different unit heads, who would be charged the responsibility of maintaining their units, yet one finds such institutions in very poor environmental conditions, with their chief executives sitting comfortable in their offices. It should therefore be realised that such leaders contribute adversely to deteriorating health conditions of the people, and so are to be held responsible for violating section 30 of the environmental sanitation edict of the state which states that: "Where offence under this Edict is committed by a body corporate, a fine to be imposed by the Court on conviction shall not be less than one thousand naira, and in addition, the Director, the Manager and the Secretary of the body corporate shall individually be liable to a fine of not less than two hundred naira or imprisonment." Owners of buildings under construction, undeveloped plots, farmlands and gardens have to maintain their properties regularly, or else the properties are confiscated, for constituting a serious nuisances and potential breeding grounds for harmful pests and insects, which transmit diseases to people living in the areas (Lagos state ministry of Environment and physical planning is soon to embark on similar measure). In this respect, the Bureau for Lands, Survey, Town and Country planning should be discharging one of its duties of revoking undeveloped plots, after the stipulated periods for development of such plots. Also, in conjunction with Kaduna state Urban planning and Development Authority (KASUPDA), the Bureau has to establish the actual land requirements of any public and private institutions, before allocating land to them, in order to guide against the misuse of land by such institutions. The right of way of railway line constitutes a serious environmental problem in Kaduna south LG. This could be turned into a potential in the metropolis if KASUPDA properly plans the entire corridor to private recreational areas, ornamented gardens, buffer zones, public toilets, commercial ribbons and other suitable land use activities as it may deem necessary.

CHAPTER FOUR

THE STUDY AREA AND DATA COLLECTION PROCESSES
THE RESEARCH METHODOLOGY

e study area (Kaduna South Local Government)

ıe study concentrates on Kaduna South Local Government area. The Local overnment covers the indigenous core areas Tudun Wada. Also the local overnment covers the medium density of Makera, also has within its area of risdiction Panteka market.

n earlier study on Kaduna revealed that a large portion of the populace was ngaged in Agriculture/fishing, Trading and Crafts, while a substantial proportion vas also engaged in administration/professional and other occupations. The trend ıas not changed much except that the proportion of those engaged in agriculture ıas reduced drastically due to development in Secondary and tertiary activities especially since 1970's.

n all the areas of the local government, secondary and tertiary activities are common pre-occupations of the inhabitants. In the indigenous core of areas like T/Wada, trading, trading activities predominate.

This is also true of Makera to some extent. A substantial proportion of the residents of Badiko and majority of those in Kakuri are engaged in administrative and professional activities.

DATA COLLECTION PROCESSES

The main survey instrument used in these residential areas was a structured household questionnaire, a copy of which was administered on the head of each sampled household or on his spouse. Where neither head of the house nor his spouse was available, the questionnaire was administered on available adult member who has sufficient knowledge about the nature of refuse generation and disposal in the household. Two hundred copies of the household questionnaire were administered.

Additionally, both primary and secondary data were collected from institutions involved in SW collection and management in Kaduna. The primary data from the institution, which included Local Government Councils, Kaduna State Environment Protection authority, Kaduna State, Market Associations, Industrial Estates, and Waste Collection and disposing firms, were collected using an interview schedule. Here, data were collected in diverse areas such as existing SW management practices; types of SW generated, collected and/or disposal and generally – issues in SW management practices by each Institution.

SURVEY FINDINGS

Findings of the Household's Survey

Composition of Solid Waste Generation

Habitat (1986), observes that refuse from affluent communities contain large proportion of paper, plastics, metals and glass while the wastes in low income. Communities are predominantly organic in nature, owing to the use of fresh and unprocessed vegetables. Our findings confirm this pattern as can be seen from Table 1, which indicates that majority of those in T/Wada (a high density core area) generate leaves (33 per cent) while most of the respondents in Makera generate plastics and paper as wastes (28 per cent each). It is pertinent to mention that this

composition of refuse is quite similar to that found by PAI (1982) indicating that there is a stable relationship between the composition of refuse and level of affluence.

Table 1: Composition of Refuse Generated in the Study Area (In Percentages)

Refuse Type	T/Wada	Ung/Sanusi	Makera
Leave	33	15	18
Nylon	19	30	12
Food	15	30	12
Plastics	12	1	28
Metal Scraps	1	1	-
Ceramics	1	5	2
Paper	19	18	28
Total	100	100	100

Sources: Field Work,

Method of Storing Solid Waste

Turning to the methods of storing solid waste by the households, Table 2 shows that buckets are the most popular in T/Wada closely followed by drums and sacks. Notice that quite a few of the Makera respondents simply dump their refuse on the floor. In Ung/Sanusi buckets are preponderant while drums are the most popular in Badiko. Notice also that, contrary to expectation, about three per cent of the Makera respondents behave like those in Ung/Sanusi by dumping refuse on the floor. While this may be significantly insignificant, it occurrence should be a cause for concern, especially, if it reoccurs in future studies.

Table 2: Methods of Storing Refuse (In Percentage)

Method of Storage	T/Wada	Ung/Sanusi	Makera
Pile on Floor	9	0	3
Drums	26	7	61
Buckets	36	84	36
Baskets	6	4	0
Sacks	23	5	0
Total	100	100	100

Sources: Field Work, Table 3 indicates that 42 per cent of the respondents in use their refuse containers for more than 18 months. It is not that these people use durable containers, it only means that they cannot afford frequent replacement. This often leads to the use of worn out containers, which leak wastes and litter the premises. About half of the respondents in Ung/Sanusi also use their refuse containers for over 18 months but this is understandable since people in this area use mainly durable containers such as drums (Table 2). Notice that about one third of the T/Wada respondents replace containers within less than three months reflecting the facts that about 29 per cent of them use durable refuse storage material that is, baskets and sacks as shown in Table 2.

When this analysis implies is that replacement of containers becomes less frequent as one moves from the core to the periphery. This may be due to two reasons. First, the durability of the containers used improves as one moves from the core to the periphery. Second, the bio-degradable contents of solids wastes in the core

area is higher than those of the solid wastes generated in other residential areas and they tend to have adverse effects on containers during the decaying process.

Table 3: Frequency of Refuse Container Replacement (In Percentage)

Study Area	T/Wada	Ung/Sanusi	Makera
Less than 3 months	33	16	-
3 – 6 Months	12	27	16
7 – 12 Months	9	27	18
13 – 18 Months	4	7	16
Above 18 Months	42	23	50
Total	100	100	100

Sources: Field Work.

Collection of Solid Wastes:

As indicated in Table 4, most the respondents in T/Wada (86 per cent) and Ung/Sanusi (91 per cent) have household members collecting their refuse for them. However, majority of those in Makera (163 percent) employs private waste collection firms. One further observes that only two per cent and one per cent of the respondents in each of T/Wada and Ung/Sanusi employ private firms for refuse collection.

Table 4: Who collects Refuse

	T/Wada	Ung/Sanusi	Makera
House hold members	86	91	27
Street Sweeper	4	2	2
Private Firm	2	2	2
Govt. Agency	8	5	8
Others	-	-	-
Columns Total	100	100	100

Sources: Fieldwork

This finding is not surprising as Ung/Sanusi is inhabited by the affluent and educated people who appreciate the ideals of sanitation and can afford to pay the price. Correspondingly, Table 5 indicates that overwhelming majority of the T/Wada and Makera respondents pay nothing and less than N50 for refuse collection respectively while those who pay between N50 and N200 are mainly found in Ung/Sanusi. Moreover, street sweepers who are usually employed by Kaduna South local government.

Table 5: Monthly Cost of Refuse Collection

Row Percentage Column Percentage Total Percentage	T/Wada	Ung/Sanusi	Makera
None	-	-	-
Less than N50.00	-	7	61
N50 – N100	28.6	-	71.4
N101 - N150	2.5	-	6.3
N151 - N200	6	4	-
Over N200	23	5	-
Columns Total	100	100	100

Source: Fieldwork, One of the strong determinants of waste management is population size. It is believed that the larger the household, the larger is the quantity of wastes generated and the more intractable the problem of solid waste management. However, certain developments enhanced the evolution of solid waste problem. One of such developments is rapid population increase as observed by Mabogunje (1968). The population of Kaduna was 627.380 in 1963 (1963 census). This increased to 1,119,280 in 1973 (by estimation) at a growth rate of 6.0 per cent.

The phenomenal increase has been due to two reasons: First is improvement in the health sector, which increased the rate of natural increase. Second, the rural-urban migration, which began on the heel of the attainment of independence in 1960. All of these factors combined to congest the city, resulting in overcrowding of residence and generation of significant amount of solid waste in the city. Since most of the immigrants into cities are unemployed and without reliable means of livelihood, they cannot contribute to the resources needed for coping with waste management problem.

This problem still prevails in the core area today. Table 6 shows that household sizes in T/Wada and Ung/Sanusi are quite large with 40 and 30 per cent of the respondents of these areas having more than eight persons in their households. This is in contrast to just 10 percent of the Makera respondents with household size exceeding eight persons.

Table 6: Household Size

Row Percentage Column Percentage Total Percentage	**T/Wada**	**Ung/Sanusi**	**Makera**
Less than 2 persons	1.0	4	0
2 – 4 persons	15.0	26	10.0
5 – 8 Persons	44.0	40	80.0
Above 8 Persons	40.0	30	10.0
Columns Total	100	100	100

Source: Field work,

This results in congestion and overcrowding. It should, therefore be expected that waste generation rate in T/Wada and Ung/Sanusi should be higher than in Makera. Thus, the problem of solid waste management should be more serious in the core area and should improve as one approaches the low security area of Ung/Sanusi where population pressure is lower.

Apart from household size household income and educational background of the head of the households can influence the attitude towards proper solid waste management.

It can be seen from Table 7, about 70 per cent of T/Wada respondents had no more than primary education. The corresponding figure for Ung/Sanusi is 72 per cent while none of the Makera respondents has less than secondary education. Clearly, the low educational status of Ung/Sanusi and Makera respondents is likely to strife efforts towards effective solid waste management.

Table 6: Household Size

Row Percentage Column Percentage Total Percentage	**T/Wada**	**Ung/Sanusi**	**Makera**
No Education	1.0	4	0
Primary School	15.0	26	10.0
Secondary School	44.0	40	80.0
Post Secondary Schools	40.0	30	10.0
Columns Total	100	100	100

Source: Fieldwork

Turning to income, Table 8 shows that about 52 per cent of Makera respondents earned at most N1,000 per week and the corresponding figure for Ung/Sanusi is 79 per cent. On the other hand, 97 per cent of T/Wada respondents earned over N2,000 per week. The low income of Makera and Ung/Sanusi respondent implies that they will be unable to afford high cost of refuse storage materials and collection method. This explains the relative popularity of bucket, baskets and sacks in T/Wada and Ung/Sanusi areas while drums are more popular in Badiko Table (2). The same phenomenon explains the almost total reliance on family members as

refuse collectors in T/Wada and Ung/Sanusi compared to the heavily reliance on private firms by Makera respondents shown in Table 4.

Table 6: Household's Weekly income

	T/Wada	Ung/Sanusi	Makera
Less than N500	37	40	-
N500 – N1,000	33	32	3
N1,001 – N1,500	28	23	-
N1,501 – N2,000	2	5	-
Above N2,000	10	9	97
Columns Total	100	100	100

Source: Field work

Findings on the Roles of Scavenger Survey

Scavenging, in the sense that it is used in the study, involves the selective picking of recyclable; reusable or saleable materials from waste. Such materials include glass products, metal scraps, rags, plastics, and papers. Indeed, in Nigerian cities, as in several cities in the developing countries like manila, Nairobi and Mexico City, there is a growing number of scavengers, who now play a significant part in the chain of solid waste collection, sorting and disposal. In Cairo, for instance, the traditional scavengers (Zabbalean) have grown so large that they have constituted themselves into private companies and are contractually in charge of the collection, transportation and recovery of wastes. Besides, the selective extraction of reusable

materials from wastes by the Zabbalean is so thorough that only about 15 percent of the original volume is discarded at the dump sites (UNCHS, 1986 P.6).

Elsewhere, such as some cities in Mexico, Brazil and Columbia, Scavenging is a serious and thriving business which even involves the carving and fighting for territories at dump sites by rival groups (Ola Ore et. Al, (1993) p.12). It is worth noting that the activities and the roles of scavengers in solid waste management have been well recognised in countries like Egypt and China among others, whereas scavenging is still treated with scorn and/or given little recognition in others. Nonetheless, the growing debate on 'greener cities and environment'. Public participation and sustainability may bring some changes in the negative ideas that some people still have about scavenging.

On the whole, poverty which remains a key issue of concern in many Third World cities (itarris, 1992), is an important factor that has been behind and is still encouraging scavenging in many urban centres. Thus, financial reward, rather than a conscious attempt still largely drive scavenging at waste management. However, the growing awareness of the importance of scavenging in waste recovery, reuse or recycling, has given it a new impetus. Besides, since scavenging can occur at different stages of the waste collection and disposal process, it could be viewed as a critical factor in the reduction of the cost burden of waste management. Borne by municipal governments as well as a way of involving members of the public or private agencies in waste management. Therefore, an attempt is made to gain better insight into the activities and roles of scavengers in waste management. Therefore an attempt is made to gain better insight into the activities and roles of scavengers in waste management in Kaduna south through the analysis of survey data and informal discussion with scavengers.

A total of 56 scavengers who were randomly selected were interviewed on scavenging sites in residential refuse collection depots, road-side rubbish skips and large dump sites at Ung/Sanusi, all in the Kaduna South Local Government area.

Out of the 56 scavengers that were interviewed, the highest proportion (51.8 per cent) fell within the age group of 21 – 30 years. Those within the age group of 15 and 20 years represented 21.4 per cent of the respondents, while 12.5 per cent of them were between 31 and 40 years of age. Only 5.4 per cent of the respondent were below 15 years of age and 8.9 per cent were above 40 years. This result shows that a sizeable proportion of the respondents (73.2 percent) were relatively young people of between 15 and 30 years of age. In respect of sex of respondents, there were more males (67.9 per cent) than females (32.1 per cent).

Given ages of the respondents, it is not quite surprising that 55.4 per cent were single, while 37.5 percent of them were married. 5.4 per cent and 1.8 per cent of the respondents were divorced and widowed respectively. With regard to educational qualification of the respondents, 46.4 percent of them had no education or did not go beyond primary school level. It is rather surprising to find that over 39 per cent of the responding scavengers have secondary school. Given our value system and expectations, those with secondary school education and above are expected to be gainfully employed in white-collar jobs, and should not be going about picking materials from refuse dump sites. This situation could indeed be a reflection of the current economic hardship being faced by many Nigeria families and the high-unemployed rate among school leavers.

Activities of Scavengers

Given the widespread and haphazard distribution of refuse collection points and dump sites in Kaduna south two types of scavengers were identified by their methods of operation and the size of the areas where they operate. Some scavengers are intinerant, they move from one residential neighbourhood to the other searching and extracting usable material from bins, skip and refuse collection depots. The other type of scavenges are large dumpsites scavengers who operate mainly at specific dumpsites such as the one at Ung/Muazu. Nonetheless, most scavengers do not travel far away from their residences. Table 9 shows, for example, that only two per cent of the responding scavengers go beyond 10 kn from their residents.

Table 9: Distance between Scavengers' Residence And Farthest Area of Operation.

Distance	No of Respondents	Percentages
Less than 1 Km	12	21
1 Km – 3 Km	14	25
4 Km – 5 Km	24	42
6 Km – 10Km	5	10
Above 10 Km	1	2
	56	100.0

Source: Field work,

The tendency of scavengers to stay close to their residents may be a reflection of the impact of the prevailing high cost of transport.

From Table 10, it is apparent that only 12.5 per cent of the respondents had been involved in scavenging by the end of 1988. Between 1989 and 1992, 60.7 per cent o f the respondents entered into the business. The indication is that as the economic situation of Nigeria grew worse and unemployment became a serious problem, more people go into the business a serious problem, more people go into the business of scavenging.

Table 10: Year of Entry into scavenging Business.

Period	No of Respondents	Percentages
Before 1985	4	7.1
1985 – 1988	3	5.4
1989 – 1990	18	32.1
1991 – 1992	12	28.6
1993 – 1994	9	26.8
	56	100.0

Source: Field work

Correspondingly, financial reward is a principal factor that drove these people into scavenging. A cursory look at Table 11 shows that 16.1 per cent were involved in Scavenging in order to raise additional income. Whereas 42.8 per cent of the respondents indicated that the income generated was to be used in either supporting their parents or spouse. This result reinforces the scavengers, about their role in waste recycling, rather the search from financial gains is more important to them.

Table 11: Reasons for Respondents' involvement in the Scavenging Business.

Reason	No of Respondents	Percentages
To generate Additional income	9	16.1
To assist Spouse	10	17.8
To Assist Parent	14	25.0
To Raise capital	23	41.1
Above 10 Km	56	100.0

Source: Field work

In order to find out whether or not the respondents had been in some form of regular employment prior to taking up scavenging, they were asked what they were doing before joining a scavenging group. Furthermore, the respondents were also asked to provide information on their other sources of income (besides the income from scavenging).

From the responses, it was clear that 44.6 per cent of the respondents were previously unemployed before they were engaged in the scavenging business. Some of the respondents, consisting of 17.9 per cent were either still serving their apprenticeship or had dropped out because of the inability of their parents or guardians to pay the necessary apprenticeship fees or their inability to buy the necessary equipment needed to set up their own businesses. A further 25 per cent of the respondents were either students who had dropped out of school before joining the scavengers' group and 12.5 per cent of the respondents were found to be combining scavenging with other jobs (Table 12).

Table 12: Occupation of Respondents' before joining the Scavenger's Group.

Occupation	No of Respondents	Percentages
Unemployed	25	44.6
Apprentice	10	17.9
In School	14	25.0
Others	7	12.5
Above 10 Km	56	100.0

Source: Field work

In terms of the other sources of income that accrue to the respondents, 84 per cent of them did not have any other source of income. The should be expected, given the fact that a sizeable proportion of the respondents took up scavenging because they were unemployed (Table 12) and needed money in order to meet some fundamental needs. There were also a reasonable number of school drop out and apprentices among the respondents who had no other sources of income, except what they generate from the sale of material extracted through scavenging.

Nevertheless, 8.9 per cent of the respondents were previously in wage employment, while another 7.1 per cent had other paid jobs. The results show that a preponderance of the respondents had no other sources of income aside from what they realized from scavenging. This is not surprising since sizeable proportions of the respondents were either previously unemployed or had just dropped out of school.

TYPES, SALES VALUE, USES AND COST OF EXTRACTED MATERIALS

Scavengers usually extract or search for materials that have reasonable monetary value and are saleable. The survey results show that the respondents collect different items ranging from glass product, plastic wastes to metal scraps and some of respondents were found to scavenge for more than one item. That not withstanding majority of the scavengers surveyed collected metal scrap although rubber waste, plastic waste and glass products were also collected. None of the respondents collected items like food waste or leftovers, waste paper and rags/textile wastes; although those are materials that scavengers do also search for.

The bulk of the respondents (85.7 per cent) indicated that the extracted materials were sold directly to middlemen, who will eventually sell the extracted item to their end-users. Only a few (8.9 per cent) sold the collected items directly to manufacturers, while 3.6 per cent of them sold the items collected to artisans such as tinkers, plastic menders and owners of metal workshop.

The type of materials collected should indicate the use to which they could be further put. Based on this survey, 57 al per cent of the respondents indicated that the extracted materials were for commercial re-use, while 19.6 per cent and 17.6 per cent of the respondents indicated that the collected items were meant for industrial re-use and domestic re-use respectively of the respondents, 5.4 per cent were not of the use to which the extracted materials are put. The response to this question needs to be interpreted with caution, given the fact that the respondents may not be quite certain of the end-use of the extracted materials, since most of them sold the materials collected to middlemen.

With regard to the average monthly sales value per individual from the sale of the material collected through scavenging, not less than 60 per cent of the respondents earned below N400 per month; 21.4 per cent of them realised between N401 and N600 per month and only 1.8 per cent of them usually realised more than N1,000 per month and from the sale of extracted solid waste item. (Table 13).

Table 13: Average Monthly Revenue Generated from the sale of collected Materials.

Amount	No of Respondents	Percentages
Less than N200	7	12.5
N200 – N400	27	48.2
N401 – N600	12	21.4
N601 – N800	4	7.2
N801 – N1,000	1	1.8
Above N1,000	56	100.0

Source: Field work

Scavenging, in the way in which it is presently carried out in Kaduna and perhaps other Nigerian cities, carries serious health risks. Most of the scavengers are exposed to poisonous gases, smoke, dust broken bottles and heavy stench among other dangerous things. From this survey, some of the injuries and health problems suffered by respondents as a result of scavenging included general body weakness, which was regularly suffered by up to 33.9 per cent of the respondents.

16.1 per cent of the respondents indicated that the suffered regularly from body and muscular pains, while 23.2 per cent of them suffered mainly from stomach upset and vomiting. 17.9 cough and/or catarrh affected percent of the respondents, and

body wounds, which were sustained during scavenging, affected another 1.8 per cent. Only 5.4 per cent of the respondents pointed that they had not suffered from any health problem or injury as a result of scavenging.

In the course of carrying out their business, scavengers suffer from a multiplicity of problems. The most prominent problems included transportation problem (35.7 per cent) and harassment from people (37.5 per cent). Police harassment was seen as a major problem by 12.5 per cent of the respondents. Whereas, 7.1 per cent of the respondents said local government officials often harassed them when working at the dumpsites.

One interesting finding in this regard is that only 5.4 per cent of the respondents pointed out that they often suffering harassment from fellow competing scavengers. This is an indication that scavenging is still a growing business in Kaduna, which is yet to reach the proportion of scavenging in Cairo and some Latin American Cities, where competing groups of scavengers fight over "Waste territories".

CHAPTER FIVE

Improper Waste management

In Kaduna South, the industries have developed legislation on industrial pollution control. Breweries, slaughtering factories, sugar refineries, mining industries, etc. all discharge raw, untreated and liquid effluent into open gutters, drains, streams, channels and rivers. The effect of uncontrolled pollution renders surface water and the underground waster systems dangerous for human, agricultural and recreational use, destroys biotic life, poisons the natural ecosystems and causes severe threats to human life.

Industrial water pollution, if uncontrolled, could represent a significant technical problem for the future management of the public water supply system. Not only is the treatment of such water costly, but in addition, the quality of this water, even after treatment, is frequently unsatisfactory from the point of view of health, odour and taste. Secondary and often dangerous pollutants are also formed during treatment of low quality intake of water, since in many cases chlorine which is used for disinfection, results in the formation of organo-cholorine and other respected carcinogens.

It is very important that industries install treatment facilities. The Kaduna SEPA is legally charged with the responsibility of environmental monitoring and control.

Inadequate municipal solid-water management poses a serious health threat to people living in urban areas and some rural communities. Solid wastes are present every where, blocking drainage systems and increasing flooding and water related diseases. Municipal solid wastes are present everywhere, blocking drainage

systems and increasing flooding and water-related diseases. Municipal solid waste generation in Kaduna is higher than industrial solid waste generation. Kaduna has no sanitary landfill. Given the high social costs of improper disposal of municipal solid wastes, the future benefit of intervening is commensurably high.

On sanitation, adequate toilet facilities are rare in Kaduna south. In the past, low population densities limited the magnitude and extent problems associated with traditional sanitation practices, but increasing population has overwhelmed their efficacy and exceeded waste assimilation thresholds. In stagnant area, water becomes septic from human excrement and household waste dumping. No municipal wastewater treatment facilities exist in the Local government area. Urban residential wastes are directly discharged to the nearest open drains, water body or soaked into the ground. In the rainy season, the runoff capacity of the drainage system is insufficient causing flooding in densely populated areas.
When the drainage systems are filled with waste, the environment is intolerable during heavy rainfalls, and hazards from water related diseases are high. Construction of waste water treatment plan especially in Kaduna will help to increase water quality in adjacent water bodies. Privatization of refuse disposal is another option for efficient waste disposal and management.

1) Lack of Public Awareness on General Environmental Issues:

Environmental awareness and education is very important is sustainable development. All stakeholders in the society i.e. government, local governments, individuals, private sector and training institutions have different roles to play in environmental protection. For example, the policy envisaged that the private sector should take into consideration the environment anytime they are making any new investments. Environmental responsibility therefore, should be the hallmark of any private sector initiative. The role of training institutions in environmental protection

requires the raising of public awareness and promotion of essential linkages between environment and development. Its role will also include the encouragement of individual and community participation in environmental improvement efforts. They should also be involved in research for the benefit of present and future generations. The public sector should be involved in implementation of the policy on environment through legislation, sanctions, regulation and enforcement.

Fig. 14: Role of public sector in human health as it relates to environmental sanitation in Kaduna.

ROLE OF PUBLIC SECT. IN HUMAN HEALTH AS IT RELATES TO ENVIRONMENTAL SANITATION IN KADUNA SOUTH.

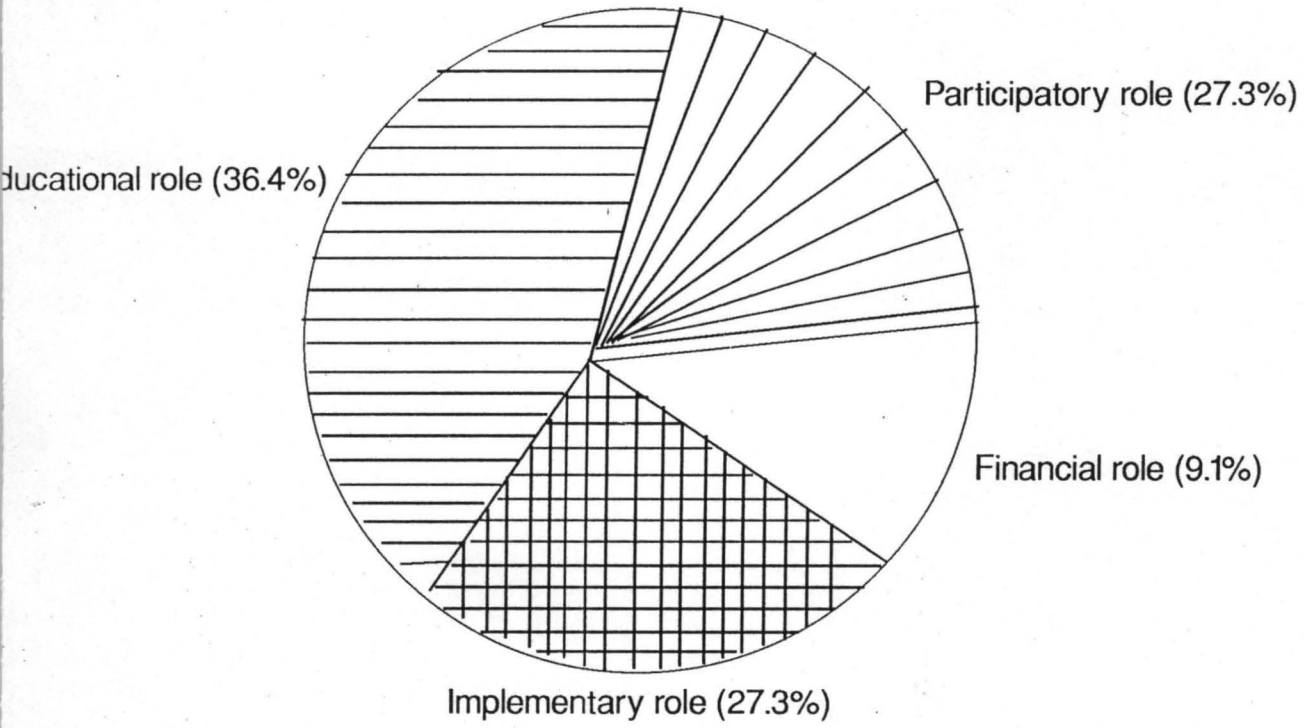

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Fig. 14: Role of public sector in human health as it relates to environmental sanitation in Kaduna.

ROLE OF PUBLIC SECT. IN HUMAN HEALTH AS IT RELATES TO ENVIRONMENTAL SANITATION IN KADUNA SOUTH.

The analysed data from the public health dept of the local govt. revealed that public toilets do not exits in all the local government, of the state but pit latrines are the most commonly sued. Out of the 333 samples, 275 use pit latrines, 45 use VIP, 7 uses water closet and 6 uses communal toilet. For every 10,795 people there is 1 public toilet. Considering the types we have an average of 13,072 people per pit toilet, 513,528 per water closet, 599,166 per communal toilet and 79, 882 per VIP. On percentage basis as summarized in fig 13, 44.8% use pit latrine, 31% use VIP toilet, 13.8% use community toilet and 10.3% use water closet.

The toilet facilities are grossly inadequate. The implication on the health of the people is obvious. The perceived role of public sector as summarized in figure 14 shows that most prefer educational role i.e 36.4%. Industrial role in human health as it relates to environmental sanitation showed that 66.67% confirmed participatory role; implementation and financial role has 22.22% and 11.11% respectively. The summary is shown in figure 15.

3) **Human Settlements and the Environment of Kaduna South Local Govt.**

The shelter crisis in the state has reached a distressing dimension. The negative effects of defective human settlements in urban and sub-urban areas on the environment are clearly visible. Urban dwellers and urban workers suffer from the poor state of sanitation, congested traffic, air and water pollution, and inadequate feed and energy needs. The absence of proper physical and environmental planning in Kaduna south calls for a thorough review in urban and regional planning strategies to meet the rapidly growing population and the deteriorating situation in most of the towns ad cities.

From the data wood/mud, zinc roof houses are the most prevalent in the local govt. with 36.17% followed by 34.05% for modern cement block/brick/zinc roof. There are 21.28% of people who have combination of wood/mud, thatched with zinc roof. 17.02% have wood/mud thatched roofs. It is summarized in figure 16.
In essence, the vast majority of the people still live in old/ancient buildings despite modern day civilization. The increased use of wood which is used in most of the housing also has implication for deforestation and wood pricing.

As regards the private sector survey in relation to human settlement, all of them believed that industries have a role to play in urban and rural planning. Their role, they believe should be to adhere to town planning rules.

Actually, it is the function of government to plan and make rational use of space in development of human settlements as well as re-invigoration of existing cities as settlements for a desirable national goal. The government is also to provide appropriate infrastructure and services for the protection of human health and the environment, including the preservation of monuments and other cultural property which promote the quality of life. The government's role is also educating, advisory and can also sanction law offenders. As implementations, the Local Government is supposed to:

a) Provide guidelines for the establishment and maintenance of recreational space and green belts.
b) Maintain an acceptable balance in the allocation of land use function, including and containment of urban sprawl on prime agricultural land.
c) Initiation urban renewal plans and measures

d) Provide advice and technical advice to measures and other cultural institutions concerned with the establishments of parks, game reserves and other recreational facilities.

e) Identify and designate areas of historical and cultural importance monuments.

f) Provide guidelines for environmentally sound master plans for urban development, industrial and rural settlements.

g) Develop and implement a phased and systematic programme for the enhancement of the aesthetic appeal and living conditions of the people in Niger State through tree planting and related anti-erosion landscape management measures.

h) Prepare and implement plans for the development of model villages and cities.

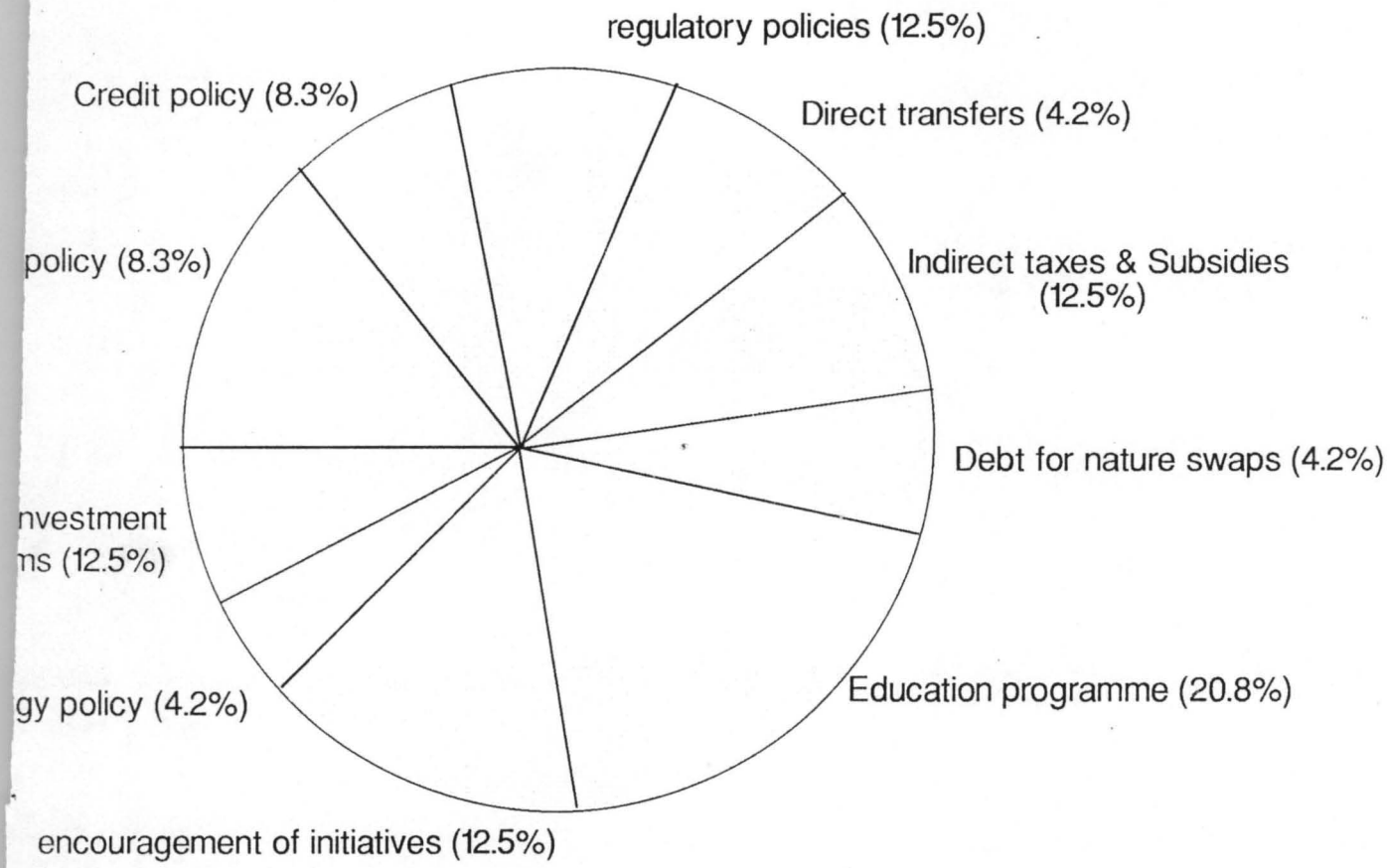
i) Privatization of forests as revenue yielding enterprises should be encouraged

j) Controlled grazing should be part of the agricultural system taking into consideration the carrying capacity of the land.

k) Landscape horticulture in industries must be employed.

Fig. 23: The Economic policy initiatives that would be supported by the public sector in Kaduna State.

ECONOMIC POLICY INITIATIVES SUPPORTED BY SECT. ON ENV. PROTECTION.



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4 Pollutant Emissions from Different Sectors of Kaduna South

Table 8 shows the pollutant emission from different sectors in Kaduna State, the economy is dominated by subsistence agriculture, mining and an emerging industrial sector. There are fast growing urban centres occasioned by an extremely high rate of rural-urban migration leading to inadequate public services including housing and waste disposal systems and drainage.

From the table, the pollutant emissions in Kaduna South that are grave are NOX, CO, PM, VOC, CO2 and to a lesser extent CH4. The contributions of each of these sectors to the critical emissions are summarized in figures 24 – 29.

5. Household sector:

Most emissions from household sector are due to the generation of wastes and their disposal. From the table, most emissions from household are CO, CO2 and to a lesser extent, VOC. Emissions from open burning of wastes release CO2 and CO. Burnable waste components are leaves, paper, rags, garbage, wood and plastics. Burning of polyethylene products like plastics also releases VOC.

In the method of land disposal, sanitary landfill and open dumping are the two primary methods of land disposal of domestic wastes in use. In the sanitary landfill, tightly packed, anaerobic environment is created as compacted waste is spread over the active area of the landfill and covered with some type of non-porous soils. However, since open dumping exposes the wastes to atmospheric oxygen, the anaerobic conditions found in sanitary landfills are not created in the majority of open dumps, thereby resulting in a much smaller level of methane and CO2 generation usually from the inner-most layers of the refuse. At the moment, nearly all domestic wastes in Nigeria are disposed by the open dumping system.

Also, most sewage is not treated and the direct disposal into streams and rivers is still in vogue.

6. Agriculture/Forestry:

A wide variety of land use changes contribute to the generation and/or uptake of pollutant into/or from the atmosphere. Some of the most important of such land use changes to environmental degradation are related to forest conversion to non-forest ecosystems. These include: forest clearing for conversion to permanent pasture or cropland; shifting cultivation and slash and burn farm practices; forest thinning from fuelwood extraction projects, irrigation and other activities; abandonment of managed lands leading to land degradation and associated loss of organic matter content; air pollution induced forest thinning and plantation establishments. The contribution of Agric./Forestry is mainly in the emission of Co and to a lesser extent PM, VOC and CH4.

7. Industry

The contribution of industries to pollutant emission is minimal. This may be due partly to the nature of wastes which is mainly organic in nature and partly to the low industrial activity in the state. The noticeable emission is CO2.

8. Transportation

The most notable emission by transportation sector is CO2 and to a much lesser extent PM. Emissions from the transport sector is mainly contributed by fuel combustion and from fugitive dusts and evaporative emissions from paved and unpaved roads, and vehicle refueling and withdrawal emissions, both at the filling stations and from individual vehicles.

9. Energy Conversion:

The major contributors NOX, CO2 and to a lesser extent VOC and CO. For example, in the industries, production processes which chemically transform physical materials from one state to another have some accompanying emissions. A typical example is cement production, where significant amount of CO2 is emitted directly from the kiln process. Processes that occur in combination with energy combustion and leading to emissions that are directly as a result of the energy that is combusted are best included as energy emissions.

10. Primary Energy Exploration

There is no evidence of primary energy exploration in Kaduna State that could cause emissions.

11. Natural Sources:

The major emission is PM and to a lesser extent VOC and CO2. The major contributors are these processes;

i) Termites in the denudation of range lands termites such as Odontotermes sp and Macrotermes subhalinues aided by Macrotermitae produce a lot of CO2.

iii) A lot of VOC is produced through natural forest emissions. The major emissions are terpene and isoprene. Methane emissions are also estimated to be of the order of 30% of the total VOC emissions.

iv) Wind blown desert dust is the major source of PM.

Table 8: Pollutant emissions from different sectors in Kaduna State in Gigagrams (Gg).

Sectors	SO_2	NOX	CO	PH	VOC	C O_2	CH4	PB	N_2O
useholds	0.13	1.14	100.03	3.46	36.68	239.11	4.37	0.00	0.14
ic/forestry	1.46	0.36	113.43	35.66	35.66	0.02	29.86	0.00	0.12
vices Sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ustry	0.32	0.11	0.02	0.09	2.53	110.57	0.00	0.00	0.01
nsportation	0.70	4.82	6.16	50.86	10.20	854.94	0.25	0.16	0.01
ergy nversion	6.72	240.80	78.88	0.79	88.54	109.06	0.02	0.00	0.01
mary Energy oloration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
tural Sources	0.00	0.78	0.00	887.47	178.88	53.38	0.94	0.01	0.00
	9.33	248.01	298.51	955.46	352.50	1367.07	35.45	0.17	0.29

- PH = particle matter
- VOC = Volatile Organic Compounds

Source: Environmental Research Laboratory, Obafemi Awolowo University, Ile-Ife, Nigeria. Environmental Research Monograph Series No. 1, 1995.

CHAPTER SIX

SUMMARY OF FINDINGS, RECOMMENDATION AND CONCLUSION

SUMMARY OF FINDINGS

Roles of Households

An Interplay of several factors usually determines the extent and the types of waste generated. These factors include population size and density, cultural habits of the people, their level of affluence and land use characteristics among others from this pilot study, the types of solid waste generated varied from areas of different population densities and, to a reasonable degree, the wastes generated varied with the level of affluence of individuals resident in a particular residential neighbourhood. For instance, most respondents in Tudun Wada generated more of nylon and paper. In Ungwan Sanusi, plastics and paper wastes were the most generated solid wastes by the respondents. Far beyond our expectation, though, was the fact that many respondents generated food wastes in T/wada and Ung/sanusi tha in Makera. One expects residents in the high-income area of T/wada to generate more food waste than those in the low-income area of Makera.

In terms of the types of container used in the storage of solid waste, buckets are the most widely used, followed by drums. Majority of the respondents in T/wada and Ung/sanusi used buckets and drums respectively. In high density and low income area of Makera, most of the respondents used sacks and baskets for refuse storage; and at times, refuse was simply piled on the floor.

Given the relatively high cost of storage container, especially drums, it is not surprising that their users were mainly residents in the high-income area of T/wada. The users of baskets as storage containers were found to be mostly low-income earners residents in

Generally, one expects more durable containers to be costlier and require longer time for replacement. Thus, as expected and found out in this pilot study, most respondents who were using galvanized iron buckets and drums in T/wada and Ung/sanusi do not replace them constantly. However, in the core areas of Makera, the replacement of the most used storage containers that is, plastic buckets and sacks, is not very frequent. Indeed the reason for this is not the level of durability of such storage containers, but the inability of the people to afford the cost of changing such container frequently.

With regard to the collectors of refuse, it was discovered that household members were largely responsible for waste collection in the core area of T/wada and the medium density area of Ung/sanusi. Whereas the services of private collection firms were employed by the bulk of the respondents resident in Back. Again, this trend is a reflection of the amount of money spent on waste collection. As expected, those in areas where the services of private waste collection firms were employed, such as T/wada, paid between N50.00 and N200.00 per month. Most respondents in Ung/sanusi paid little or nothing for their waste collection largely because they depend on municipal was a collector who seldom charge any fee.

The population factor remains a very significant contributor to the solid waste management problem in Kaduna as in any other settlement. Indeed, some characteristics of a given population, including the level of education, income; level of overcrowding; and household size among others, can influence individuals'

attitude towards waste management, their rate of waste generation and the types of waste generated. In Makera, where there is a preponderance of low-income people, where house hold sizes are relatively large and where the response to municipal waste collection agencies has been slow, the problem of solid waste management is becoming quite grave. In where the generality of the respondent are relatively more educated, one expects a more positive response by the residents towards solid waste management issue.

From the foregoing, it is clear that households have an important role to play in solid waste management, given the constraints of manpower, logistics and finance which often face the municipal governments in Kaduna, and elsewhere in Nigeria. It is, therefore, crucial for the government to find ways of involving households in the chain of refuse collection and disposal.

Role of Scavengers

The role of scavengers, especially in items of resource recovery and waste management, is widening generally in Nigerian urban centres, including Kaduna. Our survey results suggest that a sizeable number of the scavengers were young makes between 15 and 30 years of age. Majorities of those interviewed were also found to have little of no education, but it was unexpected that a reasonable number of them (14.3 per cent) would have had post secondary school education. This situation is partly a manifestation of the growing rate of hopelessness and unemployment which is driving many people into all sorts of jobs - including scavenging, which many Nigerians will feel a strong contempt for. It was also discovered that by scavenging within walking minimise the cost of transporting themselves and extracted items.

The most significant factors which were found to have driven many of the respondents in scavenging included unemployment (as earlier pointed out) and financial difficulties. There seems to be a strong indication that the general worsening economic conditions in Nigeria, especially the problem under employment and unemployment are forcing young people into scavenging as a coping mechanism. This explains the finding that more than 44 percent of the scavengers were previously unemployed before taking to scavenging. Nevertheless, it was quite apparent from the scavengers' responses that, although the gather and sell reasonable items, their level of awareness about the role they play in resource, recovery or recycling remains quite low.

In the course of carrying out this assignment, the following emerged as it's findings:

1. Presently, it is the constitutional responsibility of Local Governments to collect and dispose refuse. This, they have been doing as enshrine in the 1979 suspended constitution section:
2. The various Local Government Councils that make up the metropolis have little or no working tools to cope with the volume of solid waste being generated-like Tippers, Tractors, Pale-loaders etc.

   An illustration of what is obtainable as working tools at the various Councils concerned is hereby presented:

EQUIPMENT	KD.NORTH LG.	KD SOUTH LG	CHIKUN LG.	IGABI LG.
Tippers	4(f) 3 (s)	1 (f)	1 (s)	1 (s)
Pale Loaders	1 (f)	2 (s)	-	-
Tractors	2 (s)	-	-	-
Skipcarrier	-	2 (f)	-	-

KEY

F – Functioning

S – Scrab

-- Nil.

3. Most people have non-challant attitude towards observing public Health and sanitary regulations. They erroneously believe it is the Government responsibility to handle refuse collection and disposal free of charge.

4. It discovered that there is sufficient number of trained man power in the field of public health at the local Government Councils. However, the inactivity of these Public Health inspectors is largely responsible for the fallen standard sanitary condition.

5. The Kaduna State Environmental Sanitation Edict No. 2 of 1991 and the State Environmental Protection Agency Edict No. 1 of 1994, have direct relevance to solid waste management. However, there are fundamental roles that need to be explicit to avoid conflict between the local Governments and KEPA.

6. It has been noted in the affirmative that previous attempts of tackling refuse problems ignored the inputs of the grass root inhabitants. Consequently, all previous approaches failed because they were not people oriented.

7. It has been discovered also that lack of a workable system for proper refuse collection and disposal contributes to the present situation where refuse is indiscriminately dumped in the metropolis.

8. It was found that all Local Government Council hardly remit the required monies to be Sanitation component of the Primary health Crae – thus, refuse collection normally suffers.

ESTIMATES OF SOLID WASTE GENERATED IN KADUNA METROPOLIS AND COST EVALUATION

1. Estimated population of the metropolis 1.3 Million
   Rate of Waste Generated per person/day
   (Source – United Nations) 0.4 Kg

   Total weight/Volume of refuse generated
   = 0.4 x 1,300,00 kg
   = 520,000 kg
   = 520 Tonnes

2. Assuming using 5 tonnes tippers
   = 520 / 5 = 104 Trips
   Assuming also that 1 tipper can perform 5 trips/day

$\frac{104}{5}$ = 21 tippers/day.

3. The metropolis is divided into 5 operational zones

Each zone will have for convenience

5 tiipers

1 Pale Loader @ N18,000/day

The 5 zones can share 1 grader @ N30,000/day

Working at 12 hrs/day.

5 zones will expand on plant hire

5 Pale Loaders	@	N18,000	=	N90,000.00
1 Grader	@	N30,000	=	N30,000.00
				N120,000.00

4. Running cost of tippers:

Assuming that all drivers and mates are on Govt. payroll.

Each tipper will require:

i.	50 litres of diesel @ 9.00/litre	=	N450.00
ii.	4 litres of engine oil	=	N550.00
iii.	Other incidentals sum	=	N500.00
			N1,500.00
21 Tippers will requie N1,500 x 21		=	N31,500.00

Total Financil requirement for 1 day

i.	Pale Loaders 5	=	N90,000.00
ii.	Grader 1	=	N18,000.00
iii.	Tippers 21	=	N31,500.00
			N139,500.00
iv.	10% Contingencies	=	N 13,950.00
	Total Requirement	=	N153,450.00

KADUNA SOUTH LOCAL GOVT. MAKERA
EXPENDITURE

HEAD 2007 HEALTH DEPARTMENT

Classification Code	Over Head Costs	Provision		Revised Estimate 1996	Actual Expenditure 1997
		1998 1999	1997		
	Service material (Sanitation)	4. 5 million	-	-	-
		600,000	100,000	-	104,325.00

OBSERVATIONS

From the above findings, to male the following observations:

1. Despite the fact that refuse collection and its disposal is the Primary responsibility of Local Governments, it was observed with dismay the inability by the council to effectively carry out this duty.

2. I also wishes to observe that despite the presence of the professional trained sanitary inspectors, working tools constitute the main obstacle to effective refuse collection and disposal.

3. Closely associated with '2' above, is the high tendency and indeed, it came out to be true that where these vehicles are made available they would not be use for the purpose of which they were meant for. I.e. the question of abuse.

4. I personally note and wish to observe that both the state Environmental Sanitation Edict and the State Environmental Protection Authority Edict need to be review. This should be done with a view of being specific in functions and spelling out penalties to defaulters of sanitary regulations.

5. Since the task of refuse collection and disposal is enormous any agency assigned the responsibility of doing so be back up with the required finances alongside working tools.

A Glossary look at the financial requirement to handle refuse collection and Disposal within the Local Government in a day:

5 No. Plate Loader	@ 18,000	=	N90,000.00
1 No. Grander	@ N18,000	=	N18,000.00
21 No. Tipper	@ N1,500	=	N31,500.00
10% Contingencies		=	N13,950.00
			N153,450.00

Thus, the sum of N4,470,000.00 will be required to evacuate solid waste in a month.

6. The committee being mindful of the character of our people and the effects of the Economic down turn, wish to make the following projections which can be generated from the respective Government Agencies, Companies and the general Public:

a.	State Govt. Contribution	-	N500,000.00 Monthly
b.	South LGC N250,000 each	-	N250,000.00 "
c.	Industries 100 Nos. x N1,000	-	N100,000.00 "
d.	Residences		
	i. Low density 30,000 No. x N50	-	N1,500,000.00 "
	ii. High density 100 No. x n20	-	N2,000,000.00 "
e.	Commercial Houses 1,000 No. x N100	-	N 100,000.00 "
f.	Govt. Establishments 200 No. x N100	-	N 20,000.00 "
	TOTAL	=	**N4,470.000.00**

7. I also note the presence of uncompleted structures, undeveloped plots and farmlands, which encourage the indiscriminate dumping of refuse.

8. I also observe the failures of the state committee on environment the state sanitation committee and the Local Governments standing committee in stimulating environmental consciousness to members of the public.

RECOMMENDATIONS

Having had an in-depth study of the problem of solid waste management within the Kaduna South, ranging from its generation, collection and subsequent disposal and after a careful consideration of the options available to Government; I wish to recommend thus:

1. That the task of refuse collection and disposal be assigned to a Unit under the Kaduna State Environmental Protection Authority (KEPA) in view of similarity in functions as contained in the Edict establishing it;

2. That the responsibility of street cleaning and refuse collection/disposal at market squares be handle by the respective Local Government Councils concerned except otherwise;

3. That the Kaduna State Environmental sanitation Edict No. 2 of 1991 be review and a permanent sanitation court be establish or direct the existing one to be accommodated at the Premises of KEPA to try defaulters. Also, the review of KEPA Edict should incorporate the proposed additional responsibility.

4. That the following Financial Contributions be observed and strictly enforce to sustain the function and continued existence of the authority:

a.	State Government	-	N500,000.00	Monthly
b.	Kaduna South	-	N250,000.00	"

While this has mutually been agreed to by the representation of the state and local government involved, deductions should be at source and paid into KEPA's Account.

5. To ensure the effectiveness of the Kaduna Environmental Protection Authority (KEPA) in discharging the new dispensation, I personally recommend the following working tools:

a.	Grader	-	1 No
b.	Tippers	-	21 Nos
c.	Tractors	-	5 Nos
d.	Pale Loaders	-	4 Nos.

These equipment and indeed funds for their procurement should be internally source by the Authority or from either the Urban Development Bank or United Nations Development Programme (UNDP).

6. I strongly recommend the pooling of relevant professional staff from Kaduna South local government councils concerned and the state Ministry of Health. Also, these categories of staff should be engaged on special posting, secondment, or transfer of service as may be desired by the individual staff.

7. For the public to feel being part of the refuse management team, a massive enlightenment campaign be mounted through the reactivation of Environmental Sanitation Committees comprising of all relevant authorities.

8. Considering that a number of L.G.'s have been indisposed to provide sanitary services in these past weeks of transition to a new L.G. Councils, a lot of waste has accumulated. To remove this, a task force be set up by KEPA an the L.G's , to evacuate these refuse dumps. To do this, at least the sum of N3.5m be made available for this urgent exercise.

ENFORCEMENT MEASURES FOR EFFECTIVE REFUSE DISPOSAL IN KADUNA SOUTH LOCAL GOVERNMENT.

For an effective refuse disposal in Kaduna South, there has to be a sound enforcement team that would be sustained at all places and at all times. The proposed enforcement team is to comprise of household heads, compound leaders, street leaders (masu ugwuwani), local government council members and Kaduna State Environmental protection Authority. The role of household heads and compound leaders has already been pointed out in section two. However, compound leaders are to be selected among the household heads in each tenement compound by street leaders, who work hand in hand with them. Community leadership structure has been established in the entire local government council member constituting kaduna south. The hierarchy of this structure includes: Street leaders Ward heads and district heads. Each of them excises certain powers over their areas of jurisdiction.

In addition, the Kaduna South local Government council are to maintain all markets in Kaduna South. In this respect, the working schedule for sanitary workers in markets and busy streets needs to be restricted to include the hours of 6:00p.m to 8.00 p.m, after the closure of markets, and the early hours of 6:00 a.m to 7:00 a.m before daily activities begin in earnest.

The Kaduna State Environmental protection Authority is to assist the local government in managing refuse collection and disposal in Kaduna South in line with section 5 (q) of Environmental Protection Authority Edict 1994, which states that "without prejudice to the provisions of the existing Edicts relating to refuse disposal the Authority shall establish operational mechanisms for refuse collection

transportation and disposal in conjunction with federal and/or local government or any other agencies as may be necessary."

KEPA and the Local Government are to work hand in hand to ensure compliance with environmental sanitation regulations of the state. KEPA is to determine rates to be charged for refuse collection. Appoints, refuse collection contractors and pays the contractors based on their performance. In managing refuse disposal, KEPA may wish to consider the following techniques: composting, recycling and land filling.

Composting is used to produce natural manure for use in farmlands and other plantings. The use of compost manure presently needs to be seriously considered in view of the effect fertilizer has on our soils. In this regard, KEPA is to liase with Ministry of Agriculture, and Kaduna State Agricultural Development project (KADP) to work out possible ways of mass production of manure with a view to using it as a better alternative to fertilizer. Recycling of refuse needs also to be embarked upon by KEPA. Already some companies and individuals have embarked upon recycling paper, rubber, bottles and other waste materials, KEPA needs to identify such organisations and individuals to work out modalities of working co-operation with them.

Landfilling is used to reclaim land previously exploited for building materials, road construction, mining etc. KEPA could liase with Kaduna State Urban Planning and Development Authority (KASUPDA) and Bureau for land, survey and country planning, to identify such sites and reclaim them for more meaningful developments. A permanent environmental court needs to be established in KEPA to handle cases of environmental degradation promptly. The present mobile Court is ineffective.

4.00 ENLIGHTMENT METHODS TO RE-AWAKEN SANITATION CONSCIOUSNESS OF INHABITANTS OF KADUNA.

Massive enlightenment campaign to re-awaken the sanitation consciousness of Kaduna inhabitants is to be embarked upon jointly by KEPA, Kaduna State Environmental Sanitation Committee Local Government Council of Kaduna South.

Ministry of Health, ministry of information, the directorate of Mass Mobilisation for orientation agency social justice and Economic Recovery, Family Support Programme, National orientation Agency and media houses, considering the essence of sanitation to the society.

KEPA and Ministry of Health are to organize joint seminars and workshops for local government chairman and councilors re-awaken their sanitation consciousness. They are to be enlightened on how to ensure proper maintenance of their areas of jurisdiction. Similarly, the local government chairmen and their health departments are to hold dialogues with district and ward heads to enlighten them on the new approach to sanitation and the roles they and street leaders are expected to play. Ward heads are also responsible for enlightening street leaders and community development associations in their wards. While the street leaders and community development associations' carry the enlightenment campaign to the remaining members of the society. In this light KEPA is to introduce competition on environmental sanitation exercise among all settlements, schools and similar institutions in the state.

Ministry of Information, MAMSER directorate, electronic and print media houses are to be fully involved in all stages of the enlightenment campaign to succeed.

5.00 KEEP KADUNA CLEAN EXERCISE:

For a smooth take-off of the new approach to environmental sanitation, a special sanitation exercise to keep Kaduna clean needs to be embarked upon, to complement the effort started by KEPA. This time, the campaign should aim at reaching every nooks and corners of Kaduna metropolis. A standing Task Force Committee on environmental sanitation needs to be established to replace the dormant state sanitation committee. The membership of the task force committee is to involve a cross-section of the community like the armed forces, police, community leaders, and business communities professional and social associations. Due to the importance of the exercise, His Excellency, Kaduna State Military administrator, Colonel [redacted], needs to hold series of dialogues with members of the Task Force, members of associations and individuals expected to play major roles like transport owners and transport workers. For the clean up exercise to succeed and be sustained, all members of the society have to be vanguards and vigilant, to control people with poor environmental habits of throwing refuse indiscriminately. Members of the War against Indiscipline and Corruption (WAC) brigade, members of National Orientation Agency the traffic wardens on streets, members of Road Transport Workers Union and other Aid groups should be mobilized and educated, on how to combine their duties with monitoring the maintenance of proper environmental sanitation habits by members of the public.

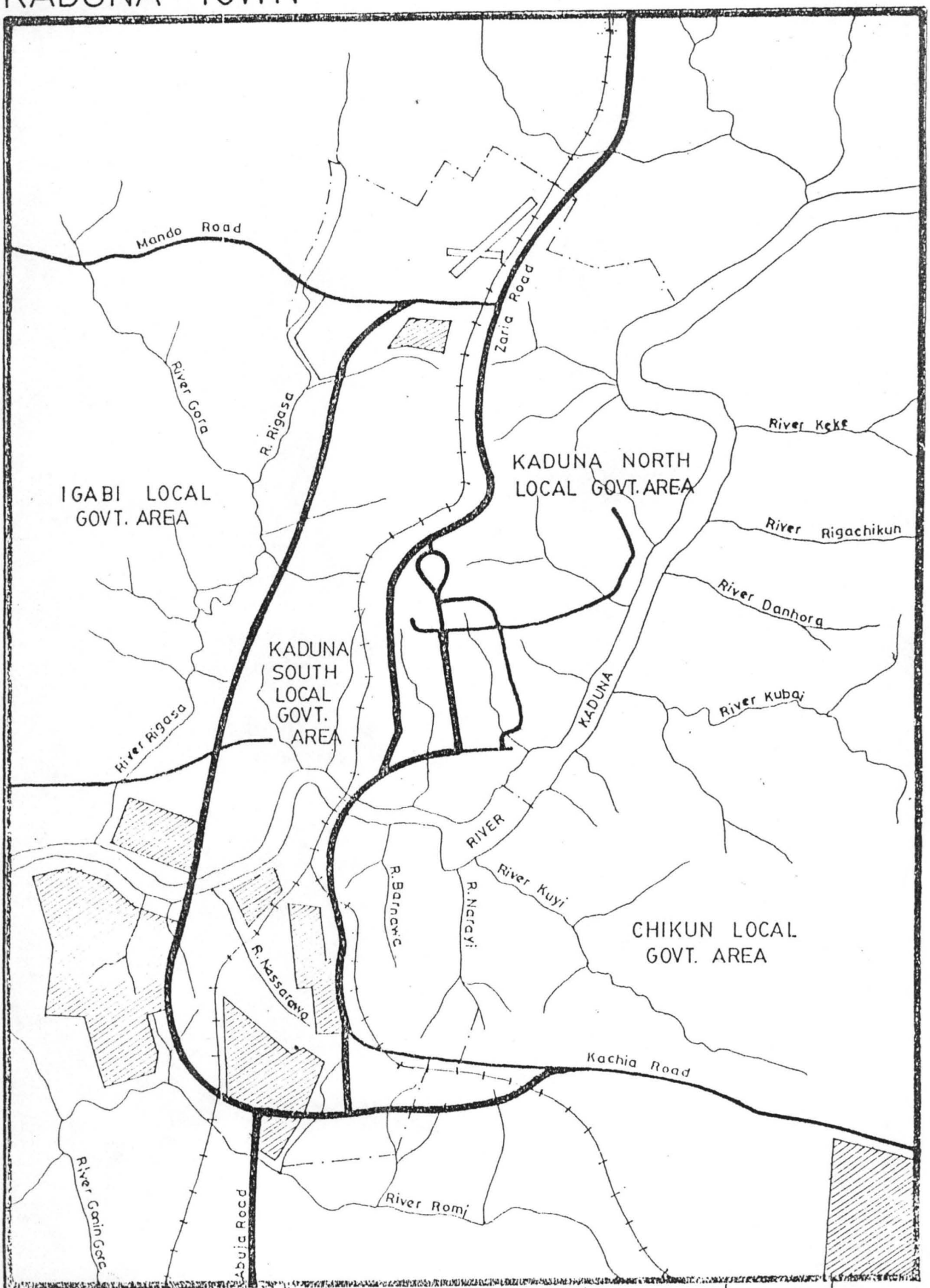
EVACUATION OF REFUSE WITH THE AID OF HEAVY PLANT MACHINES

EVACUATION OF HUGE DUMP OF REFUSE AT T/WADA

LOADING OF REFUSE BY THE AID OF P. LOADER

HUGE DUMP OF REFUSE

DRAINAGE SYSTEM & INDUSTRIAL AREAS IN KADUNA TOWN



Prepared by the Department of Inspectorate- KADUNA STATE ENVIRONMENTAL PROTECTION AUTHORITY - KADUNA.

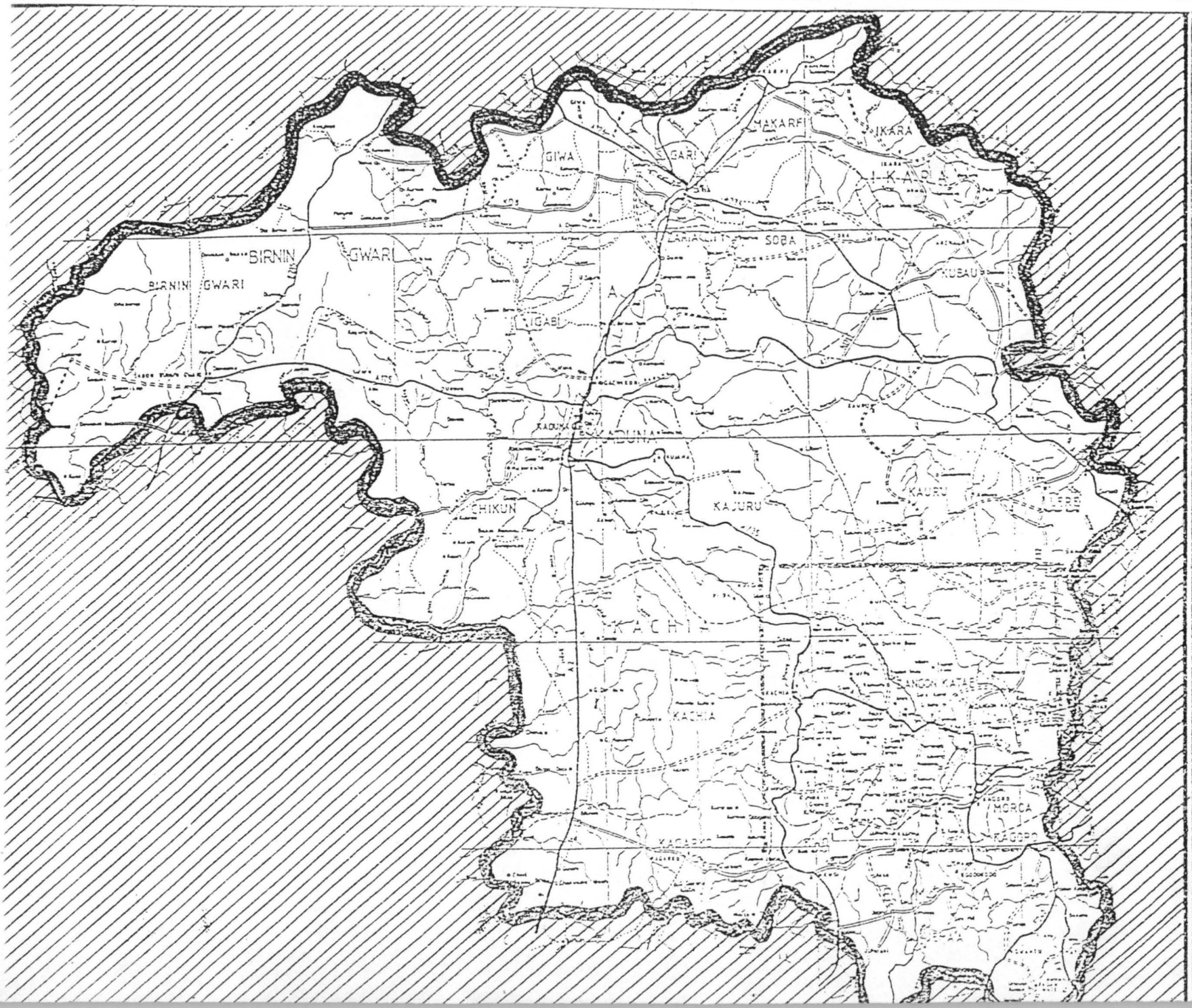


fig. 1.3
KADUNA ST
SHOWING THE
DRAINAGE PAT

LEGEND

Federal

State R

Feeder (
Roads

Motorab

State Bo

L.G. Bou

Rivers, S

Railway

Scale: 1:30

Produced by
KADUNA STA
ENVIRONMEN
PROTECTION

NIGERIA - POLITICAL

LOCATION OF KADUNA STATE IN RELATION TO THE 36 STATES AND ABUJA THE FEDERAL CAPITAL TERRITORY

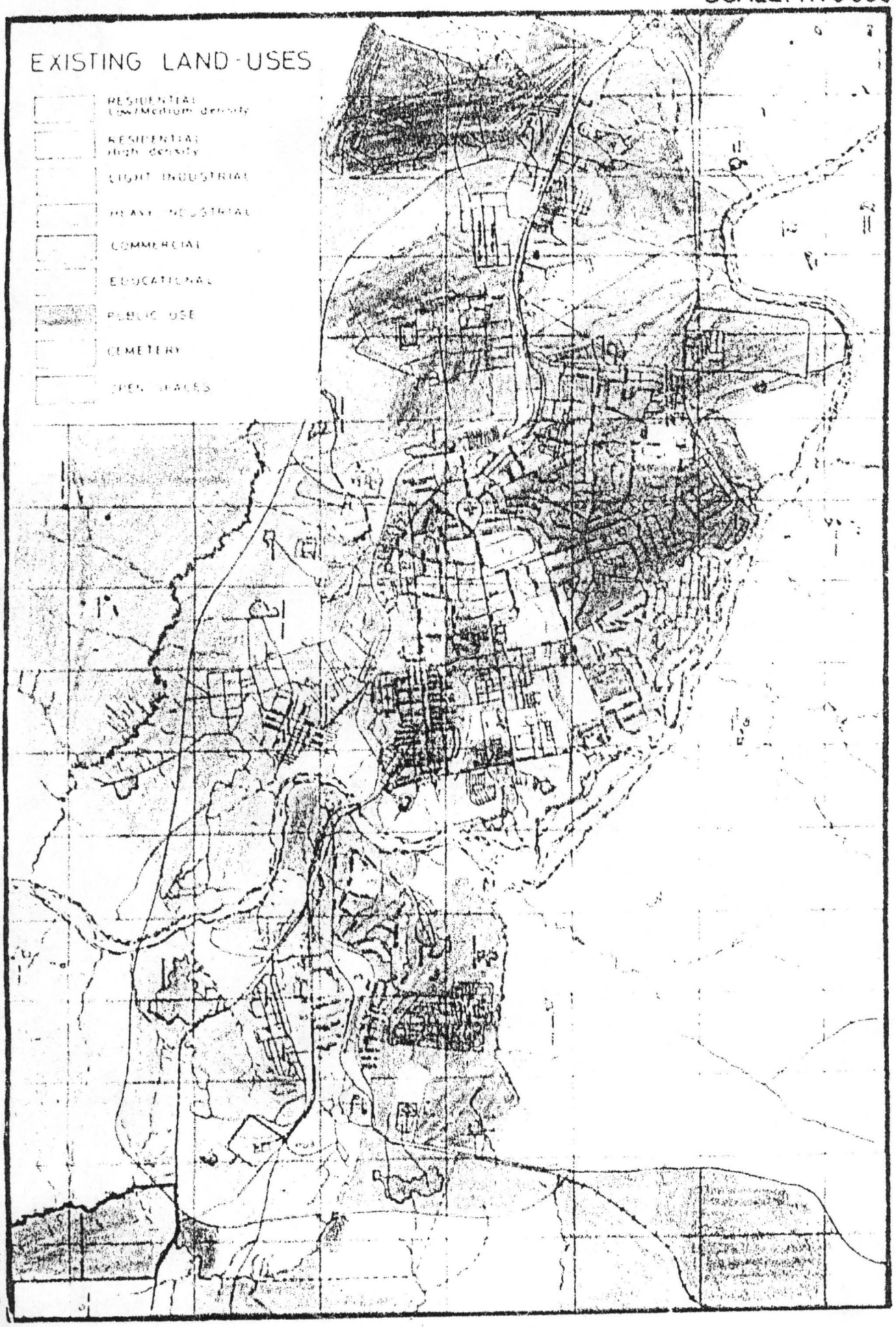
FIG. 1.1

SCALE : 1 : 1 000 000

40 30 20 10 0 40 80 120 KMS

KADUNA METROPOLIS & ENVIRONS

FIG. 1. 4
SCALE: 1:70000



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