

THE GLOBAL PROBLEMS OF ENVIRONMENTAL POLLUTION:
A CASE STUDY OF WASTE MANAGEMENT IN NIGERIA,

A Thesis

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Faculty of Social Science

Department of Political Science

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In Partial Fulfilment

Of the Requirement for Masters of International Affairs and Diplomacy

Declaration

I hereby declare that this thesis titled "The Global Problems of Environmental Pollutions" (A case study of waste management in Nigeria) is a product of my independent research work. No part of this work has not been submitted to any institution for any academic award. All references made in the work have been dully acknowledged.

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ABSTRACT

Man has continually sought to improve the quality of life, transforming nature to provide food, better living conditions and a longer life. Technology has helped to accomplish this transformation and to achieve many of man's goal. It has however left a profusion of environmental problems in its wake.

The elimination of industrial and consumer waste is proving increasingly difficult and costly and is posing complex problems for all the municipal authorities concerned.

The ecological problems arising from industrial and consumer waste as well as the cost for their removal differs widely. In addition, the degree of pollution of the environment can vary considerably depending on how waste is treated.

ACKNOWLEDGMENTS

I would like to express my gratitude to my Supervisor Dr. Paul P. Izah for his guidance and suggestions, and to the rest of the lecturers that taught us in the pioneer session of Masters of International Affairs Diplomacy.

My sincere thanks to Mrs. Blessing Owunna for typing all the rough and final drafts of this Thesis.

A note of thanks to my friend Dr. Muhammad M. Abubakar, whose concern for the environment, made me interested to write this paper.

DEDICATION

To my late father and dear friend Bala Adamu and my mother Ramatu Ibrahim Iabbo, and the rest of my family for urging me on.

All the mistakes are mine and all the credits goes to Allah.

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Chapter 1

Introduction:

As we enter the 21st century, the space and computer age, we seem to be accelerating the history of our world. By this I mean, new products are coming out on the market daily, robots are manufacturing goods faster and more efficiently than humans, a month old computer system is now obsolete, and we can harvest certain crops three times a year, or even more, recently scientists can now grow marketable spinach without soil. These are supposed to make life more livable and comfortable by providing an abundance and variety of goods. But this is not without consequences. Part of the solid waste (trash, garbage) crises around the world today could be attributed to this technological success. Cities and nations especially in the developed world are running out of space to dispose their waste. Take for example the United States, it is estimated that the amount of garbage generated each year is enough to fill convoy of trash trucks reaching halfway to the moon. The U.S. and many other industrialised nations are now looking beyond their own borders to dispose their waste. (Miller living, in an environment second edition). Nigeria should be all too familiar with the solid waste crises because of the illegal dumping of hazardous waste in Nigeria in 1988 by an Italian vessel.

POLLUTION – what is pollution? Pollution can be defined as an undesirable change in the physical, chemical, biological characteristic of the air, water, or land that can harmfully affect health, survival, or activities of human or other living organisms (National Academy of Sciences) 1996b. Note that under this definition pollution does not necessarily have to cause physical harm. It may merely interfere with human activities. For example, a lake may be considered polluted if it can not be used for boating activities.

TYPES OF POLLUTION – From the biological view point we can recognize two major types of pollutants: bio-degradable and non-biodegradable.

A bio-degradable pollutant can be decomposed, removed, or consumed and thus reduced to acceptable levels either by natural processes or by human engineered system such as (sewage treatment plants) as long as the system is not overloaded. There are two classes of degradable pollutants: rapidly degradable (nonpartisans). Rapidly degradable pollutants, such as human sewage, animals and crop wastes, can normally be decomposed rather quickly. The decomposition process can be overloaded however, so that the rate of breakdown is slowed. For example a rapidly flowing river can normally cleanse itself of some human sewage fairly quickly, but this natural cleansing process can be overwhelmed by too much raw untreated sewage from a large city or a number of small cities or firms.

Non degradable pollutants are not broken down by natural processes. Example of non degradable pollutants are Mercury, Lead, and some of their compounds (Enrichment study 5) and some plastics like slowly degradable pollutants, non degradable pollutants must either be prevented from entering the air, water, and soil or kept below harmful level by removal from the environment.

SOURCES OF POLLUTION:

Polluting substances can enter the environment as a result of natural input (such as volcanoes) or human activities (such as burning coal) the fact that nature is sometimes a polluter does not justify our adding extra pollutants that can cause threshold level concentrations to be approached or exceeded. In addition there is usually important difference between natural pollution and pollution produced by human activities. Most natural pollution except from volcanic eruptions is not concentrated in a particular area and is normally diluted or degraded to harmless level. In contrast, the most serious

human pollution problems occur in or near urban and industrial areas where large amounts of pollutants are concentrated in relatively small volumes of air, water, and soil. In addition many pollutant from human activities are synthetic chemicals that cannot be decomposed by natural processes.

THE ROOT OF POLLUTION – What causes pollution? The obvious answer is people. Thus we can conclude that an increase in pollution result from population growth. But population growth is not the only cause. Pollution occurs when people use matter and energy resources, thus pollution also depends on the quality of resources used by each person. The use of some type of resources creates more pollution than the use of other types.

Example, a throwaway aluminum can, waste more resources and create more pollution than a returnable glass bottle (since making the can requires about three times as much energy as making the bottle) in other words, pollution also depends on the type of technology used.

A crude model has been proposed to estimate the pollution, or harmful environmental impach, caused by people and their consumption activities (Ehrlich and Holdren 1971, 1972, Ehrlich et al. 1977, Holdren and Ehrlich 1974).

Total pollution depends on the product of three factors: the number of people, the amount of resources each person uses, and the pollution resulting from each unit of resources used.

We can use this three factor model to distinguish between two kinds of overpopulation. One kind is the result of too many mouth to feed.

This kind of overpopulation is called Malthusian overpopulation, after Thomas Robert Malthus, who in 1803 warned that population size tend to outrun food production until poor health and death from starvation and disease restore the balance. In this type of overpopulation, the population size factor tends to be too much more important than the other two factors (Resource and Technology) in the poor nations of the world, Malthusian overpopulation already means death for an estimated 4.4 to 20 million human being each year and bare subsistence for many millions more (Berg. 1973c, Dumont and Rosier 1969).

In affluent and technologically advanced countries such as the united state, we encounter a second kind of overpopulation called neo-malthusian overpopulation. In this type, the resources use and population factors are most important.

This type of overpopulation occurs when a relatively small number of people are using resources with relatively high pollution as such a fast rate that the resulting high level pollution can threaten the health and survival of human and other species and disrupt the natural processes that cleanses and replenish the air water, and soil. In this type of overpopulation, people do not sicken or die from lack of food but from contaminated air water and soil. From this perspective the United State can be considered the most overpopulated nation in the world followed closely by other heavily industrialized nations.

STATEMENT OF THE RESEARCH PROBLEM

The purpose of this research was to investigate the course and the problems of environmental pollution; i.e. solid waste generation and disposal and management in Nigeria as part of the global problem.

THE PROBLEMS OF POLLUTION 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 problems apart from the growing accumulation of mountains of uncollected garbage in towns and cities.

(Cointrean, 1982, Nath et al 1988, UNCHS, 1996 Existing studies) also show that solid waste generations in several cities are increasing pari-pasu with the population size of these cities. 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 waste is largest for metropolitan Lagos and smallest for Potiskum. In 1983, some 9 million tones of waste were generated in Nigerian cities. By the end of this century, it is estimated that solid waste generation in Nigeria cities will increase to 15 million tones amounting to an increase of 66.6% over 1983 figure. (Reference

- (i) Federal Ministry of Housing and Environment
- (ii) NEST (1991) Nigeria's threatened environment: a national profile P.231)

The increases in the waste generated have been fuelled by the rising population growth in cities due to rapid urbanization and industrial growth. However the timely and efficient renewal of these garbage has outstripped the capacities of most Local Government, such that, garbage accumulations 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.

LITERATURE REVIEW

Few attempts have been made in Nigeria towards effective and appropriate management of solid waste since 1970⁹ to the current time. All the attempts have been fraught with problems because of institutional rigidities and lack of adequately trained manpower. The Lagos state waste management is still existing with complex problems that is rocking the foundation; In Port-Harcourt and Abuja the Government Agencies set up to handle the fabrics of waste management have not reared their head convulsively. The case of Imo State environmental sanitation authority, which was the first in Nigeria, is better discussed than being written down in any paper. SOUCES (MR. O.C. NWOSU M.Sc, Env. Health Sciences): MRSH (London). In the paper presented at Stakeholders Consultative Workshop Organized By the Petroleum (Special) Trust Fund With the Urban Development Bank of Nigeria (PLC). Sustainable/Affordable Funding Strategy for Solid Waste Management in Nigeria.

In all these cases, both the Local Government and the State Governments who are expected to compliment each others efforts find it difficult, if not impossible, to come up with the required funds to make desired improvements in their solid waste management systems.

Private enterprises have tried to fill this void but have been only targets of various Government who will rush to setting up of ad-hoc groups as a way of siphoning funds in pretence for "Clean-ups". These are the given situations any where in Nigeria, with the singular fact arrived at by all the literature written or presented that solid waste is capital intensive, but can pay for itself, if properly managed over a period of time, but Government have relegated solid waste management projects to the background in Nigeria.

Most of the literature written on solid waste in Nigeria are concerned with Generation, Storage, Collection and Disposal and funding by the Government and until recently the private sector participation, and external support agencies. Many bilateral and multilateral agencies support urban solid waste management in developing countries. Some of those agencies such as UM/IBRD have

acquired some capacities in the area of waste management. Some of them have granted such support within the broader development programme aimed at improving urban management capacities or urban environmental protection.

Some of the literature written on Solid Waste Management like, the following:-

Waste Generation in Nigeria (1975 Industrial directory) published by the federal government of Nigerian.

According to the review, Industrial Wastes constitute over ninety percent of the local waste generated in the country. Establishment generating these solid wastes include the mining and Quarry industry, wood and wood products including furniture, paper and paper products, machinery industry, fabricated metal products, rubber and plastic products (tyres and tube industries). Electrical and communication equipment and repair services for motor vehicles and motor-cycles repairs.

The determiners of solid wastes generation according to the review are population growth, urbanization and social development, income class composition, diffusion of technical competence, commercial growth, and development. These determinants are not autonomous or mutually exclusive. They tend in-fact to be interlocking and to impinge one on the other. The resultant impact on solid waste generation is some times not unambiguous. Indeed, it is possible to see the effect at one time slowing down the rate of generation and at another time, accelerating it.

Waste Refuse and Recycling (by Engr. (Prof) A.K. Oyinlola. Department of Metallurgical Engineering Ahmadu Bello University Zaria.

A paper he presented at the Petroleum Trust Fund Stakeholder Technical workshop Abuja, November 1998.

According to the paper he presented on Waste Refuse and Recycling. In the paper he stressed that the elimination of industrial and consumer wastes is proving increasingly difficult and costly and is posing complex problems for all the municipal authorities concerned. One positive alternative he said is the utilization of solid wastes raw material for the manufacture of useful products. This technique would not only reduce the amount of waste needing disposal, but would conserve our natural resources. The paper further argue, that the use of solid waste as raw material for production of useful products will depend primarily on the successful application of chemical and

engineering technology to waste disposal problem. The reuse and recycling of various types of waste which can be a lasting solution for solid waste disposal problems and a means of conserving our natural resources and the creation of a pollution free environment are the highlight of his paper.

Experimental growth of the waste problem in our affluent, disposal – oriented society, now make it obvious that recycling should be our goal, and it is necessary, therefore, for scientist and technologist to examine all aspects of fabrication and processing techniques to facilitate the reuse.

Here are more statistics –compiled by the United Nation University in Tokyo about the gathering Global Water Crisis.

Every 8-second a child dies from water related diseases.

More than 50% of people in developing countries suffer from one or more water related diseases.

80% of diseases in the developing world are caused by contaminated water.

50% of people on earth lack adequate sanitation.

20% of fresh water fish species have been pushed to the edge of extinction from contaminated water. Klans Toefer, head of the UN environmental programmed reveled that women and girls in developing countries spend more than 10 million person –year in the aggregate each year fetching water from distant, and frequently polluted sources.

As much of the developing world becomes urbanized, its water crisis will deepen. Large cities already bursting at the seams – Mexico city, Lagos, Dhakar and Cairo rely largely on ground water, but aquifers takes decades to recharge while the population growth in such cities is exponential.

By this century, 20 cities in the developing world will have population exceeding 10 million. And as urban demands for water increase, supply for developing world already water – starved agricultural areas will be further affected, thereby creating a potentially monumental food security crisis.

All these suggest that in an increasingly globalize world, a more coherent strategy for economic and social development is urgently needed. Hydrologists say that the world's water supply is Finite -less than a million cubic kilometer that according to the United Nations is not sufficient for the days Global population, which is growing at the unsustainable rate of 100 million people annually.

United Nations Environmental programmes head Toepfer told Newsweek "my fear is that we are headed for a period of water wars between nations. Sources (world view page in the International New-week Magazine of March, 29th 1999.)

However in most of the literature reviewed on environmental degradation (Pollution) few had mention the encouragement of pollution by the Industrialized Nations through international trade (Export) of obsolete used goods and materials, such as Secondhand clothes, Bed sheets, Towels, Pants, Braziers, Shoes, Refrigerators, Cars and General junk-yard discarded rubbish etc. Some of which are *non-bio degradable and highly toxic pollutants into Nigeria.*

Definition of Terms

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Reference: (Berg 1973^c Durmont and Rosier 1969)
 Miller George Tyler 1931 (Living in the environment Second edition
 Ehrlich and Holdren 1971, 1972
 Ehrlich et al 1977, Hodren Ehrlich 1974

JUSTIFICATION FOR THIS RESEARCH

On a national scale in Nigeria, the solid waste problem is simply a waste management situation totally out of control. Solid Waste Generation is rapidly increasing and our means to cope with problem are becoming totally impossible. The resultant non-action could become the most severe environmental challenge during this century. Solid Waste Generation is increasing more rapidly than the growth of our population because it is dependent not only upon population growth, but also upon the amount of waste generated by each person and the inability of the pre-independence government to provide an answer.

Presently the constitution of the nation defines disposal as a responsibility of the third-tier Local Governments. Professionally, to take it and accept it as contained therein, there is no further definition of who should be responsible for planning, collection and transportation of solid waste. On this level, the situation still remains bleak and ugly.

Around the world, people are increasingly concerned about the quality of the environment. In the Nigerian case, the issue of greatest environmental concern is undoubtedly the management of solid wastes. Indeed, the vision 2010 Report (see Main Report, page 96), the management of municipal solid waste was accorded top priority. Clearly, solid wastes represent the most visible sign of our

inability to manage our environment properly. In city after city in this country, hills, if not mountains, of uncleared solid waste are to be seen along streets, in backyards, in and by markets as well as in many other open spaces. These wastes to say the least, disfigure the city image and not only create an eyesore but, also infact, pose tremendous environmental and health hazards, not to talk of constituting a drag on our drive for over-all economic development.

Yet things have not always been this bad. During the colonial days, the problem of solid waste was far better managed. For those of us old enough during that era, the memory of sanitary inspectors enforcing sanitation laws on the street and in homes is very fresh. At some point during the last three decades or so, however, we seem to have lost the ability to take the problem of solid waste solidly in hand. What happened? Unless we understand the factors accounting for our worsening solid waste problem, we may never be in a position to proffer proper solutions or make meaningful reforms that could make a difference.

Because of the continued environmental degradation of our environment, time old epidemics and diseases such as Cholera, Malaria, Diarrhea, River blindness dengue fever, schistosomiasis, infection by intestinal worms and trachoma (which alone causes almost 6 million cases of blindness annually in Africa. These epidemics and diseases long been eradicated in Europe and America, but are still the common highest killer diseases in Africa. The death from water related disease account for almost 6 million each year.

PROPOSITION / HYPOTHESIS – Environmental Pollution is one of the most serious common global problem the world is facing today. In and increasingly globalize world a more coherent strategy for a pollution free environment, economic and social development is urgently needed to protect and safe-guard our environment. Government, Private and non-Government Organizations (N.G.O.) have an important role to play in order to achieve this objective.

DATA COLLECTION

Most of the data collection on this research are from secondary data. I relied mostly on the data collection by the Urban Development Bank Plc., in conjunction with the (PTF) Field survey on Solid Waste Generation in the country. The survey covered the whole country every detail of waste generation in Nigerian Urban Centres. Another's secondary data sources I used are the Federal Environmental and State Environmental Protection Agencies. These are Institutional Organization responsible for solid waste problem in Nigeria.

Chapter 2

SOLID WASTE GENERATION, STORAGE, COLLECTION AND DISPOSAL IN NIGERIA: AN OVERVIEW

Most Nigerian urban centres are facing problems of effectively collecting and disposing the solid waste generated in these settlements. Waste is generated at faster rate than what the authorities could collect and properly dispose of. As a result there are heaps of uncleared solid waste in many cities, constituting serious aesthetic, health, and environmental hazard. (Reference: NEST) 1991 Nigeria's threatened environment: A Nations profile, Ibadan Nigeria.

The Federal Environmental Protection Agency (FEPA) and some State Governments are making efforts to remedy the problem through the establishment of State Environmental Protection Agencies. Other efforts include enacting new National Environmental Policies and legislation, giving waste management a sectoral prominence in the Development Plans, organizing workshops, conferences and seminars. In spite of all these efforts, little progress has been made due to institutional, financial and technological constraints.

1.1 WASTE GENERATION:

Waste Generation is an indicator of level of economic activity and the pattern of consumption in a particular country. The rate is influenced by climate, cultural habits, economic status and to some extent population size and level of economic development. However, personal income has been found to have the most significant effect on waste generation due to its impact on individual consumption pattern. It has been noted that the rate of solid waste generation per capita increases as the standard of living improves (UNCHS Habitat 1984).

The relationship between income and waste generation rate has been well documented by the World Bank. For instance, data for thirty countries compiled by the Bank shows that per capita waste generation ranges between 0.4 and 0.6 kilogram/capita/day for low-income countries and between 0.7 and 1.8 kilogram/capita/day for industrialized countries.

Studies in some Nigeria settlements indicate that personal income has influence on waste generation rate. High income households at the low density parts of the settlement generate higher quantities of waste per capita than low income households.

The average waste generation rate for some selected Nigerian settlements is given in Table 1.1. **Table 1.1** **Waste Generation by Weight**

Per Capita

Settlement	Vegetable Matter	Food Re-Mnants	Paper	Textiles	Plastic	Metals	Glass	Bone s	Wood	Ash/ Dust	Moist-urre	Misce laneo
Mangrove Swamp												
Badagry	25.40	2.20	6.24	7.03	8.24	1.70	1.66	0.48	3.16	32.34	9.76	1.76
Lagos	18.39	22.02	13.06	6.92	10.62	4.09	2.33	1.59	2.83	4.46	10.84	2.85
PortHarcourt	16.12	4.11	14.87	4.23	9.51	5.63	5.86	1.70	3.05	16.27	8.01	10.6
Sapele	8.63	7.01	7.95	3.00	13.74	5.63	4.50	2.00	12.85	11.55	0.31	22.8
Warri	6.62	7.04	6.46	2.43	11.09	18.90	5.24	4.62	5.20	11.76	0.42	19.4
Avg.	15.03	8.48	9.72	4.72	10.64	7.39	3.92	2.08	5.42	15.28	5.82	11.5
Tropical Rain Forest												
Asaba	19.31	2.56	17.57	5.56	8.36	2.03	0.72	4.25	0.42	11.53	10.49	17.1
Benin	16.18	2.04	7.60	1.91	11.15	2.10	1.43	0.83	1.51	23.12	4.23	27.9
Calabar	20.60	2.99	9.95	6.55	5.18	3.92	3.85	2.02	1.79	20.22	11.41	11.5
Oshogbo	35.32	2.48	15.30	2.21	9.40	3.19	2.12	2.55	1.05	11.21	9.76	5.43
Owerri	35.03	0.95	13.75	4.30	11.55	8.52	1.91	0.91	2.24	16.66	3.65	0.53
Avg.	25.29	2.20	12.83	4.11	9.13	3.95	2.01	2.11	1.40	16.55	7.91	12.5
Guinea Savannah												
Abuja	40.23	2.53	6.12	1.52	8.98	2.10	4.43	0.00	1.28	13.94	15.69	3.19
Enugu	39.96	2.24	14.09	1.61	10.28	5.89	3.97	0.47	0.65	12.89	7.42	0.53
Ibadan	39.20	1.31	10.71	2.42	9.25	5.19	3.54	1.10	3.02	7.79	11.61	4.79
Jos	34.58	6.64	9.18	2.02	5.02	2.68	3.72	0.36	0.53	16.20	11.95	7.13
Makurdi	32.94	8.05	3.81	1.11	3.50	1.04	1.29	0.20	0.49	39.63	7.09	0.84
Minna	21.56	1.40	5.43	1.99	7.67	1.57	0.75	1.07	4.92	35.61	11.63	6.40
Zaria	37.36	2.01	6.28	2.19	6.23	4.73	2.07	0.38	0.37	34.72	2.70	0.96
Avg.	35.12	3.45	7.95	1.85	7.28	3.31	2.82	0.51	1.61	22.97	9.73	3.41
Sudan Savannah												
Gombe	22.00	11.76	17.18	10.98	2.26	4.41	1.28	0.51	0.67	16.44	0.00	12.5
Kano	28.50	0.48	4.01	4.27	4.85	0.84	0.47	0.00	3.15	44.54	8.28	0.60
Maiduguri	17.61	1.95	15.31	4.09	3.37	1.40	1.36	0.28	0.40	32.30	0.00	21.9
Sokoto	27.17	0.70	6.55	2.13	5.48	1.22	2.87	2.18	7.43	36.89	2.37	4.71
Yola	18.65	1.06	13.89	3.34	1.25	1.97	5.69	0.27	0.88	17.94	0.00	35.0
Avg.	22.79	3.19	11.39	5.02	3.44	1.97	2.33	0.65	2.51	29.62	2.13	14.9
Nat. Avg.	25.52	4.25	10.24	3.73	7.59	4.08	2.78	1.26	2.63	21.27	6.70	9.94

Source: Urban Development Bank Nigeria Limited (UDBN) Field Survey, April 1997

From the table, the national average per capital waste generation is 0.45Kg/ca/day. The maximum figure was 0.77kg/ca/day recorded in Jos.

1.2 WASTE STORAGE

Waste generated either at the household or place of work is temporarily stored before it is collected disposed of. Waste storage facilities are often classified as *primary*, for household and individual storage and *secondary* for communal storage. Primary storage units are made up of household containers – which are either standardized or non-standardized. The choice of container size depends on the quantity and quality of waste being disposed and the frequency of collection. Communal storage units may either be stationary or portable. Stationary units are enclosures with or without roof made of steel sheets, reinforced concrete or sandcrete blocks. Portable units include steel drums, liftable metal containers and roll-on-roll-off metal containers.

Primary refuse storage containers in use in households in Nigeria include cartons, plastics, metal drums and other make-shift items such as cellophane bags and baskets which are mainly unstandardised. The survey by UDBN reveals that on the average, 57.8% of households adopted plastic containers of varying sizes, 27.4% use metal drums while 14.6% use cartons (see Table 1.2). However, the use of metal drums for household solid waste storage was higher when compared with other containers in Zaria (53%), Sokoto (49%) and Benin (42%). The use of cartons is able relatively popular in Makurdi (24%), Sapele (20%), Benin (18%) and Maiduguri (18%). (Reference Urban Development Bank Field Survey)

Table 1.2 Primary Waste Storage Materials Used by Households in Nigeria

Settlement	No of Household	Refuse Storage Materials			Others
		Cartons	Plastics Containers	Drums	
Enugu	185	8%	63%	29%	0%
Ibadan	187	4%	59%	35%	2%
Jos		15%	33%	51%	0%
Makurdi	174	24%	70%	7%	0%
Minna	199	15%	51%	34%	0%
Zaria	196	17%	30%	53%	0%

Badagry	169	14%	77%	9%	0%
Lagos	192	7%	70%	22%	1%
Port-Harcourt	168	11%	82%	7%	0%
Sapele	142	20%	51%	29%	0%
Kano	156	22%	44%	35%	0%
Maiduguri	178	18%	52%	30%	0%
Sokoto	174	17%	34%	49%	0%
Yola	153	11%	61%	27%	0%
Asaba	98	11%	73%	15%	0%
Benin	164	18%	39%	42%	1%
Calabar	153	14%	73%	13%	0%
Osogbo	194	21%	62%	18%	0%
Owerri	165	12%	79	9%	0%
Warri	181	16%	61%	23%	0%
Total/Average	3399	14.6	57.8	27.4	0.2

Source: Urban Development Bank Nigeria Limited (UDBN) Field Survey, APRIL 1997

The use of inappropriate storage containers is common among the low and middle income households and also in traditional/poorly serviced residential neighbourhoods. This could be attributed to their perception of waste and lack of awareness of the dangers of such practice among others. Major limitations of these storage facilities are that they do not protect against breeding of flies since they are not usually provided with covers or lids. Some middle and mostly high income households use plastic and galvanised-iron bins usually with lids. Two hundred litre oil drums are often used as primary storage facilities in commercial and institutional premises. (UDBN) Field Survey April 1997.

The most common stationary units usually called depots of varying capacities (from 1 cu:m to 300 cum) in use by local governments in Nigeria are metal containers, walled structure, designated open spaces and pits. Portable ones includes plastic and metal drums. In some Nigerian settlements such as Abuja, Owerri and Port-Harcourt, the plastic "Tote" bins have been introduced, they are susceptible to theft and required lifting devise for speedy loading into collection vehicles.

Survey carried out by UDBN indicate that many Local Governments designate ordinary open spaces as depots while many – about 219 Local Governments use pits as open dumps. This is because such facilities do not require initial capita outlay. The use of standardized secondary storage containers is limited to few Local Governments. For

instance, only 138 L.G.A.s use metal containers, 134 use galvanized drums and 94 use plastic bins while 156 L.G.A.s use walled structures.

The use of these inappropriate storage facilities account for generally inefficient waste collection service observed in most urban centres. (FEPA) Field Survey). Stationary waste storage facilities create aesthetic and health problems when uncleared. Furthermore, the provision of these facilities has been found by the Agency to be grossly inadequate. Very often, the storage bins overflow and spread out at the base where they have to be removed by raking and collected in containers before being carried to the vehicle. This is time consuming and limits productivity. The problem of non-standardization of containers arise mainly due to the cost of acquiring them by the authorities and the difficulties of the residents to pay for them without subsidy.

Waste Collection

The three main methods of waste collection adopted by Local Governments and state waste management agencies in Nigeria are house-to-house, communal depots and curbsides.

House-to-House Collection: This is practiced in residential layouts and other well planned urban areas in Nigeria. However, this method is more common in high income low-density residential neighbourhoods. Waste bins are usually provided by government agencies. From the survey, carried out by UDBN Survey about 198 Local Governments In Nigeria are involved in this practice.

In this method, the collecting crew enters each premises, take out the container and puts it back after emptying the waste into collection vehicles. This method is labour intensive and time consuming. In Lagos and other urban centres, the house-to-house

collection is practiced mainly by private contractors who often sign service agreement with the households and stipulate collection time that is suitable and acceptable to the two parties. (FEPA, KEPA and UDBN)

Collection from Centralized Points or Communal Depots: Communal waste storage facilities are located mainly by the side of the road or other areas with vehicular access. Depots are generally placed or designated in areas of dense population concentration with heavy volume of waste generation. Most Local Governments adopt the depot method over the house-to-house method of waste collection because of its convenience and better affordability.

Under this arrangement, households discharge their waste at designated locations where there are communal storage facilities. Refuse collection vehicles visit at frequent intervals to remove the accumulated waste. The advantage of this method of collection is that reduces considerably number of service points from which the waste has to be collected. Its limitations include the problem of getting land in a central location accessible to residents and the vehicle and the possibility of constituting public nuisance and health hazard if uncleared.

Collection from Curbsides: This is popular where depots are non-existent but waste is high. Roadside and open spaces are usually used for depositing bins and other containers for refuse from where they are emptied.

The regularity of waste collection from the different service points are further analysed to determine the performance of Local Governments. Table 1.3 shows that out of the 546 Local Governments rendering waste collection in house-to-house basis, 47.4% collect waste daily, 8.9% once per week, 6.2% 2-3 times/week, 8.2% twice/monthly, 6.4% once/monthly while 22.7% render no collection service at all. In communal

depots, the regularity of service is more evenly distributed with 25.7% daily, 37.2% once/weekly, 13.6% 2-3 times/week, 11.0% once/monthly and 5.9% no service. With respect to markets, 9.3% Local Governments render no service at all.

Table 1.3 Frequently of Waste Collection by LGAs at Service Points

	Household	Depots	Markets
Daily	47.44%	25.69%	12.78%
Once per week	8.97%	37.23%	15.14%
2-3 Times per week	6.23%	13.58%	12.62%
Twice per month	8.24%	6.42%	22.58%
Once per month	6.41%	11.09%	27.60%
No collection at all	22.71%	5.99%	9.31%
No. of LGA	546	685	634

Source: Urban Development Bank Nigeria Field Survey, April 1997

Inspite of these claims, most of the solid waste generated are left uncleared for a long period of time. This is as result of inadequate manpower devoted to solid waste management by Local Governments as well as lack of operational collection vehicles/equipment. The situation appears the same in most Local Governments across the country. (Kaduna North and South Local Government)

1.4 Waste Disposal

The safe disposal of solid waste is a prerequisite for sound waste management practice. However, the existing disposal practices in Nigeria leaves more to be desired. Some resident discharge their refuse in unauthoritised places – open spaces,, gutters and streams. Other adopt open burning of uncollected refuse.

The degree of this practice varies from one settlement to other depending on the level of service provided.

This notwithstanding, the methods adopted by most state waste management agencies and the Local Governments include the use of open dump sites, sanitary landfills, incineration and composting.

1.4.1 Dumpsites

Dumpsites are owned and operated by both the State agencies and Local Governments. A survey agencies shows that some sites were established in 1970s. Here solid waste is dumped at the site which is usually a disused borrow pit, valley or ditch. Wastes are dumps without any treatment, grading or placement of a layer of inert material to discourage breeding flies and rodents. A summary of dumpsites owned by some Local Governments are given in Table 1.4, while that owned by some State Government Agencies is given in Table 1.5.

Apart from site owned by public agencies, some private dumpsites are used for land reclamation and soil improvement.

Table 1.4 Summary of Dump sites owned by some Local Governments

S/No	State	No. of L. G.	No. of Approved Dump Sites	Average distance (km) of Dump site to collection location	Average Life Span (years)
1.	Abia	2	2	6.5	4
2.	Abuja	1	3	1	10.7
3.	Adamawa	2	10	2.6	4.0

4.	Akwa Ibom	3	9	2.3	6.6
5.	Anambra	4	19	2.8	6.1
6.	Bauchi	1	2	4.5	6.1
7.	Benue	3	6	2.6	4
8.	Borno	1	7	N.A.	18.6
9.	Cross River	4	8	3.9	15.9
10.	Delta	3	15	2.1	10.9s
11.	Ebonyi	3	4	N.A.	3.7
12.	Edo	4	8	4.8	9
13.	Ekiti	3	11	2.0	26
14.	Enugu	3	8	N.A.	5.5
15.	Gombe	3	10	1.3	4.0
16.	Imo	6	10	1.3	7.8
17.	Jigawa	1	1	N.A.	5
18.	Kaduna	6	23	16.3	10
19.	Kano	6	36	14.1	13.9
20.	Katstina	5	30	2.1	8.2
21.	Kebbi	2	2	1.8	3.8
22.	Kogi	3	8	N.A.	10
23.	Kwara	2	13	2	16.1
24.	Lagos	17	32	6.2	13.9
25.	Nasarawa	2	3	N.A.	8.5
26.	Niger	4	14	1.7	12.6
27.	Ogun	5	16	8.2	7.6
28.	Ondo	5	17	4.3	30
29.	Osun	5	14	3.9	10.8
30.	Oyo	6	15	N.A.	9.5

31.	Pleteau	3	11	10.3	13.7
32.	Rivers	3	9	10	5.9
33.	Sokoto	3	6	4.8	9
34.	Trarba	2	7	2.5	25.8
35.	Zamfara	3	10	3	10
36.	Yobe	3	9	4	11
37.	Balyesa	N.A.	N.A.	N.A.	N.A.
	<i>TOTAL</i>	132	414		

Source: Urban Development Bank Nigeria (UDBN) Field Survey, April 1997

Table 1.5 Details of Dump Sites owned by some State Government Agencies

	Name of Agency	Location	Life Span (Years)	Year of Establishment
1.	Abuja Environmental Protection Board	Jikwoyi	5	1994
		Karno	50	1992
		Karshi	10	1992
		Kubwa	15	1995
		Mpape	5	1996
		Gwagwa	10	1992
2.	Adamawa State Environmental Protection Agency	Numah Jah	30	1980
		Yola-Gurin	20	1985
		Yola-Numah	20	1985
3.	Bauchi State Environmental Protection Agency	Buni Bau	20	1985
		Dungul	20	1985
4.	Benue State Urban Development Board	Oturkpo	25	1987
		Gboko	30	1985
		Nyumab	25	1986
5.	Jos Metropolis Development Board	Gada Biyu	N.A.	1974
		New Site	50	1994
		Shendam	10	1995
6.	Kaduna State Environmental protection Board	Kilo 12 Zaria Rd.	10	1996
		Kilo 9 Abuja Rd.	15	1995
		UNI MAAZ-	5	1995

Chapter 3

WASTE REFUSE AND RECYCLINGDEFINITION AND CATEGORIES OF RECYCLING

Although many broad definitions have been proposed, the term recycling in its narrowest and probably original sense denoted the return of a discarded material or article to the same product system, such as the return of waste paper to make new paper. This Thesis is concerned with processes for recycling discarded or waste materials however they arise (thus defining recycling in its broadest sense), but concentrates on artificial or man-made rather than natural processes.

Based on the types of recovery process, there is direct or non sacrificial recycling or reuse and indirect, or sacrificial recycling, or new use. Table 1.1 however lists the recycling possibilities, ranked in order from most preferred to least preferred (Barton, 1979).

Table 1.1: Categories of Recycling

Type of Recycling	Examples
a) Reuse of article	Returnable, refillable bottle
b) <i>Non sacrificial recycling:</i> Reuse of material at similar quality Level (primary recycling)	<i>Colour-sorted glass cullet;</i> Newspaper repulping for news-print production
c) <i>Non sacrificial recycling:</i> reuse of material at a lower quality level (secondary recycling)	Roofing felt from waste paper; Fiberglass insulation from bottles.
d) <i>Sacrificial recycling;</i> new use for material (tertiary recycling)	Road paving materials from glass; Composting of paper.
e) <i>Thermal recycling:</i> Conversion to storable fuel. Direct incineration to produce energy.	Pyrolysis of urban waste Incineration of urban waste.

Source: Barton, 1979

METHODS AND TECHNOLOGY IN THE PROCESSING AND DISPOSAL OF SOLID WASTE

In the Nigerian context, solid wastes are brought to the disposal site with the minimum of initial processing. Processing becomes important in disposal activities when solid waste is viewed as a resource and the idea that salvaging of various components in the wastes can help to offset the cost of collection and disposal operation. Such salvaging can be done through segregation of the components either at the source or at the disposal facility.

VOLUNTARY SEPARATION AT SOURCE

The ideal situation would be the segregation of wastes into their components at source: the household, office, shop, restaurant, or public collection centre (SCS, 1974). Segregation at the source presents problems in storage and may complicate the collection system. In many Nigerian cities, the problem is, however, minimized by various practices whose effects are to encourage such segregational activity.

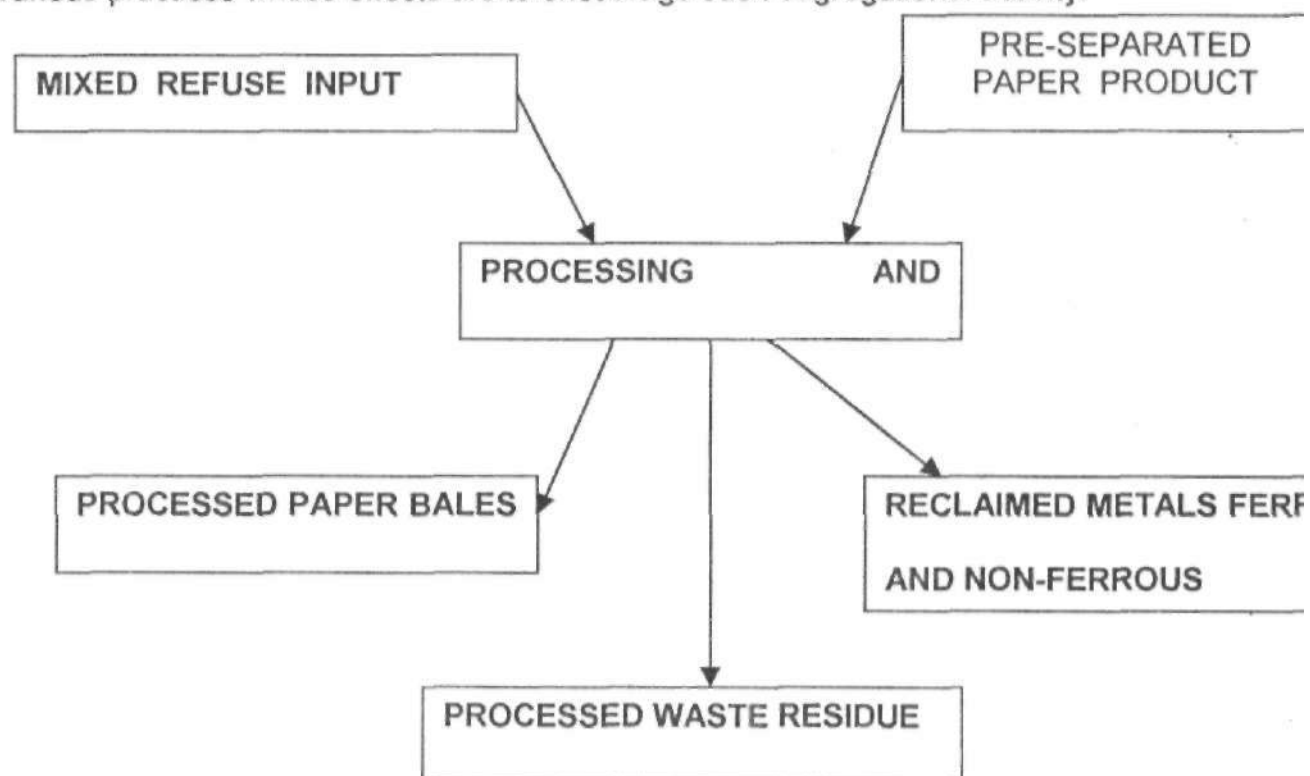


Fig. 3.1: Solid Waste flow through a recycling plant. Source: Cheremisinoff, et al, 1975

Fig. 3.1 (Cheremisinoff et al, 1975) shows the flow of solid wastes through a processing plant for recycling purposes. The basis of the entire plant is separation of the solid wastes into its components. Probably the greatest deterrent to recycling has been the inefficiency of the separation processes of a solid waste processing plant. Many types of separation method exist to classify the the various components of a solid waste. Some are highly complex systems and others are quite simple. In order to properly design a material recovery facility, it is advisable, among other tasks to perform an analysis of the waste stream i.e., a waste characterization study, so that the variety and relative quantities of incoming materials can be identified and determined. Actual field measurements are preferred method of waste analysis.

HAND SORTING

Probably the simplest of all solid waste separation techniques is hand sorting. Hand sorting involves people actually separating specified items from the waste. Every item is hand picked and routed to either a recycling plant or a disposal process.

The hand sorting process occurs at many stages during the handling of solid waste. For example, in the disposal of industrial wastes, reusable item or items which can be sold in bulk such as scrap metal, wood, paper, glass etc. are often salvaged by a hand sorting or picking process. Similarly, construction and demolition wastes are often hand separated into reusable and disposal piles. Also municipal or domestic wastes are also sometimes hand sorted before collection. In some communities, newspaper, glass and tin cans are collected separately either by alternating collection days (one for garbage type wastes, one for reusable items), or by industries (soft drink bottlers, aluminium can manufacturers) seeking a less costly raw material. The occurrence of this separation technique, which is commonly referred to as separation at source is

directly dependent upon the existing market conditions of each particular recyclable material.

MECHANICAL SORTING

Besides the hand sorting technique of material separation, mechanical sorters utilizing colour or radioactivity have recently been introduced. Colour difference or radioactivity is detected by a sensing device, which in turn triggers an air blast that blows the sensed particle out of the mainstream of fall.

MAGNETIC SEPARATION

Magnetic separation is probably the most common mechanical separation method in use today. Basically it consists of a conveyor belt passing refuse past a rotating drum. A stationary magnet is contained within the belt side of the drum. As the drum rotates, ferrous metals become affixed to the drum and non-magnetic materials pass by on the belt. The affixed magnetic materials remain on the drum until the rotation of the drum brings them beyond the stationary magnet. The ferrous metal then fall off the drum and unto a separate conveyor belt.

Magnetic separations can be made dry or wet and with either low magnetic intensity for removing most ferrous alloys or high intensity separators may be employed in the treatment of weakly magnetic materials such as hematite and manganese ores. There are a variety of different types of separators, the belt, induced-roll, and drum being the most common. The magnetic field may be produced by electromagnets or permanent magnets. The latter are becoming more popular because they require no electrical equipment.

ELECTROSTATIC SEPARATION

A solid waste separation method closely related to magnetic separation is electrostatic separation. Although magnets are not involved in electrostatic separation, the method involves the attraction or repulsion of particles as the driving force of the process. In

electrostatic separation, solid wastes are discharged into a grounded, moving roll and charged by means of an electrode. As a result, the particules which are non-conductors of electricity acquire a charge and are consequently discharged from the roll. The non-conductors are scrapped from the roll to be handled separately (Engdahl, 1969). There are many arrangements for electrostatic separation; for example, the separation can be effected by passing the waste between oppositely charged plates. Depending on the electrical conductivity properties of each material, separation takes place (Engdahl, 1969).

The application of magnetic and electrostatic separation in the field of solid waste could substantially reduce required disposal volume and increase recovery and recycling.

SCREENING

Screening is one of the most common methods of solid waste separation. Hand sorting is in actuality a form of the screening separation process. Solid wastes are discharged into a series of screens which are arranged in order of decreasing mesh size openings. The solid waste falls vertically through the screens and each particle of the waste is collected in accordance to its size. The theory of screening is based on the fact that generally any solid waste component has normal size distribution from which variation is small. Therefore, separation by size yields an approximate separation by material. This is true to some extent, but screening is necessary to the separation process.

There are various arrangements of screening processes, including vertical screens, inclined screens, rotary drum screens and vibrating screens (Yen, 1974). In general, screening is a useful tool for solid waste separation, whose modern procedures provide efficient and low cost removal of sand, dirt, glass and similar materials from solid wastes.

GRAVITY SEPARATION

Gravity separation utilizes differences in specific gravities to classify materials. Included in the gravity or concentration techniques are jigging, tabling, spiraling, and heavy-media separation. Two particles of the same size but of different specific gravity can be separated, as can two particles of the same specific gravity but of different size. Inasmuch as proper combinations of specific gravity and size will result in a large particle of low specific gravity the reacts to apply forces in the same fashion as a small particle of high specific gravity, sizing prior to separation is desirable for maximum effectiveness. Heavy-media separation is an exception to the foregoing statement in that, regardless of the size, specific gravity is the only property that has an effect. In general, dense or heavy-media can have an important role in the process of solid waste separation, but more research will be required to achieve the maximum efficiency from the process.

FLOTATION

Flotation may be defined as a physiochemical methods of concentrating finely divided material. The flotation process is considered a method of gravity separation. Then utilizes air bubbles to carry selected particles from the solid wastes to the surface to be skimmed off and stored. Chemicals can be added to a pulp solution media to make selected waste substances more buoyant or less buoyant in relation to surrounding particles. Flotation is a highly efficient process with widespread applications for many waste separation needs. It can usually be applied to any heterogeneous mixture of particles that are small enough to be lifted by air or gass bubbles (Engdahl, 1969).

INTERTIA SEPARATION.

Inertia separation basically operates on the principle that various components of solid wate will be react differently to applied forces in accordance with their respective initial momentums. As a result, inertial separation is an efficient method used to yield

separation of particles by weight. Since the initial momentum of a particles is directly proportional to its weight, and a similar force can be applied to each particle, the pull of gravity against the particle (weight) remains as the major variable governing the motion of the particle.

There are basically three types of inertial separation; the Ballistic, Sector, and Inclined Conveyor. The ballistic separation utilizes a rotor to accelerate particles horizontally into space. The particles fall at various distances from the rotor depending upon their initial momentum. Compartments are provided below the level of the rotor to collect the fallen refuse. The compartment closest to the rotor will contain the heaviest material while the distant compartments will gather the lighter materials.

The ballistic separation therefore utilizes the force of gravity and atmospheric friction as the applied forces.

Sector type inertial separations utilize a conveyor belt to eject the solid wastes against a stationary wall or plate. The solid waste then falls onto a pulley which is rotating at high velocity. Compartments are provided on each side of the pulley. A particle striking the pulley will either acquire sufficient momentum to be carried over the pulley and into a distant compartment or will not acquire the required momentum and drop into other compartment. In addition, particles which are highly resilient will be collected in the compartment between the pulley and the conveyor as a result of bouncing off the stationary wall. *Inclined conveyor separations are based on a similar principle as the sector.* Solid waste is discharged from the conveyor onto another conveyor which is inclined to an angle approaching 45 degrees and rotating at a high velocity in the upward direction. Compartments are provided at both ends of the inclined conveyor. Lighter particles landing on the inclined conveyor obtain momentum to be carried over

the top of the conveyor and into the compartment while heavier particles cannot obtain the required momentum and fall into the other compartment.

OTHER SEPARATION METHODS.

More complex methods of solid waste separation are constantly being developed. These include optical, spraying drying and the signature method.

Optical separation is presently used by the glass industries for a recovery and reclamation of glass. Optical separation is applied after the glass has been separated from any other refuse present in the waste. The objective of optical separation is to separate colored glass from clear glass. Optical separation utilizes the differences between light transmission properties of clear glass and the transmission properties of colored glass to sort the glasses.

Spray drying is a technique which has been developed to convert a solution to a powder. Spray drying has been utilized by the food and wood processing industries to economically salvage otherwise non-recoverable solutions or suspensions. In the spray drying process, heated air is mixed with a fluid after it has been reduced to a fine spray to produce a dried powder. The air and the powder are then separated. The liquid portion of the mixture is evaporated in spray dryer and the residual powder is collected and packaged.

Basically signature method of solid waste separation is of two types – infrared spectroscopy and impact deceleration.

The infrared spectroscopy technique uses the diffuse reflection of infrared light which is monitored for characteristic absorption spectra.

Light is reflected from solid waste materials in a diffuse form to examine even irregularly shaped objects.

Impact acceleration requires the solid waste materials to be struck by a tool on which an accelerometer is mounted. The principle of both signature separation methods is that these sensors can detect a response induced by either infrared light or impact tool. The response is recorded and identified by a computer which has stored "signature" responses corresponding to various materials within its memory. The computer controls a separation mechanism or mechanisms and, depending on the degree of separation required, the computer orders the separators to remove specified items from a conveyor belt.

REUSE AND RECYCLING OF SOLID WASTE

The term recycling describes a broad range of industrial and non-industrial activities, involving many materials and products. It comprises the recovery of recyclable waste, its processing into new materials or products, and the marketing of these new products. The processing step distinguishes recycling from reuse, in which case products may simply be

cleaned or refurbished before being reused, possibly in the same way as before.

Several distinct forms of processing can be used in recycling. Mechanical recycling means the processing of recyclable waste into new products without changing its chemical structure. Glass waste can be melted and remolded into new glass products. Waste textile fibres have only to be separated and graded before they are turned into new products. Chemical recycling involves more fundamental changes to the molecular structure of recyclable wastes. Plastics can be cracked to produce simpler molecules, from which a range of new products can be made. These forms of recycling are sometimes called feedstock recycling. Incineration with heat recovery is sometimes

termed thermal recycling, but is not strictly speaking a form of recycling since the material product is destroyed by the process.

Closed-loop recycling means the processing of recyclable waste products back into the same products, for example aluminium can waste can be recycled back into aluminium cans. Open-loop recycling, on the other hand, involves the transformation of one product into another, for example, bottles made of the plastic polymer polyethylene terephthalate (PET) can be made into engineering plastic products. In some cases, this process can be repeated a number of times, defined as a recycling cascade. In the case of PET, motor vehicle engineering plastics can be recycled into jacket lining, which can be recycled into a raw material for making carpets. In most recycling cascades, each recycling loop creates a material of lower value than in its previous life sometimes called downcycling.

Recycling is based on a simple principle: waste should be treated as a resource, thus simultaneously reducing demand for natural resources and the amount of waste requiring final disposal (Figure 4.1) (UNEP I E, 1994).

Recycling can also reduce overall energy consumption and pollution though inappropriate or inefficient recycling is capable of increasing these environmental burdens as well as reducing them.

Of course, the priority for planners and for companies must be to minimize waste arising through cleaner production techniques. However world material use is so large that complete abolition of waste would be impossible. Recycling therefore has a vital role to play, both in protecting the environment and in providing employment.

In the industrialized countries, at least some "waste" or "throw-away" materials are re-used in industrial recycling processes. In medium income developing countries recyclable materials comprise about 30% of the solid waste generated while the average recyclable content of Nigerian waste was found to be about 28.4% (UDBN Solid Waste Sector Appraisal Report 1997). Appended in table 4.1 is the valuable recyclable materials that are available in Nigeria.

Table 4.1 Resource Recovery Potential of Waste

Waste Composition	%	Use
Leaves/Vegetable matters	25.53	Compost
Food remnants	4.25	Compost
Paper	10.24	Paper products
Textiles	3.73	Textile
Plastic	7.59	Plastic products
Metals	4.08	Metals and non-metal product
Glasses	2.79	Glass products
Bones	1.26	Feed mills
Wood	2.63	Fuel
Ashes, dust and stones	21.2	Compost
Miscellaneous	9.94	Multipurpose
TOTAL	100%	

Source: UDBN Field Survey, April 1997

MARKETING OF THE RECYCLED PRODUCTS

It is readily apparent to anyone in the recycling industry that stable markets for recycled products are vital to any successful programme. There is need to ensure that once materials are collected and recycled, there will be market for the recycled products.

From purely economic point of view, the recycling of solid waste is only attractive when the recycled product is competitive with natural resources in terms of cost and quality. Recycled products will normally be competitive where there is a shortage of both raw materials and suitable sites.

In a market economy, the choice between recycled and natural materials depends upon price and quality. Recycled materials will be preferred where the price for such aggregate is considerably lower than that for the natural materials provided the recycled aggregates meet given specifications. Currently, markets do not exist for all of the materials that can be recovered from the waste stream. In those markets that do exist, the market specifications are varies. Some of the forms and conditions applicable to finished products include (EPA, 1991)

Paper

- Separated by grade
- Baled (bale size and/or weight specified) or loose
- Dry (or may include wet)
- Clean (or contaminated or not weathered).

Ferrous Containers

- Flattened, unflattened, or shredded
- Labels removed (or not)
- Clean (or with limited food contamination)
- May or may not include bimetal
- Loose, baled or densified into biscuit form with bale or biscuit size and/or Weight specified.

Polyethylene terephthalate (PET) and high-density polyethylene (HDPE)

- Baled, granulated or loose
- Separated by colour or type or mixed
- With or without caps

Aluminium Container

- Flattened, shredded, baled, or densified into biscuit form with bale or biscuit size and/or weight specified
- Free of moisture, dirt, steel, foil, lead, plastic, glass, wood, grease, oil, or other foreign substances.

Glass

- Separated by colour and/or mixed
- Size of cullet (*maximum and/or minimum*) specified
- Nature and amount of allowable contamination, any, specified.

General

- Available markets for secondary materials typically specified the means of packaging and shipping each products.

The specifications depend upon location and end-use. The specifications often include the following:

- Skids or pallets
- Bundles, bins, box, cartons, or drums
- Trailer loads
- Roll-offs
- Rail cars

MARKETS FOR RECYCLABLE PAPER PRODUCTS

Only 15 percent of the world's paper is made in developing countries, and most of that production is concentrated in a few major producers (EPA, 1980). But many developing countries want to cut down on the amount of paper they have to import, so they are trying to increase their own production of paper. As a result, the Third World has become about 85 percent self-sufficient in paper.

Of the paper produced in developing countries, only a third is made from wood fibre; another third comes from non-wood fibres such as straw, bamboo and bagasse. The final third comes from recycled waste paper.

Markets exist for recycled paper in a most of industries involved in packaging, printing and industrial filter manufacture.

MARKET FOR RECOVERED STEEL CONTAINERS

A ready market exist for steel cans. It is important to remember that steel scrap has been an essential ingredient in steel making for some times. In fact, the process is designed to utilize steel scrap, so that the market for steel cans should continue to be dependable and very likely an expanding one.

Iron and steel foundries are part of the nations steel-making infrastructure where market for recycled metal scrap can be readily available. The nation's steel mills are ultimate markets for recycled steel scrap.

DETINNING COMPANIES AS ULTIMATE MARKET FOR STEEL CANS

In addition to the steel mills, detinners also purchase steel cans directly. Most of them have sophisticated equipment that shreds the cans so that paper labels and other minor contaminants are removed prior to detinning. Through various processes, detinners remove tin from steel products containing steel. Then they sell the detinned steel to steel mills and foundries and the recovered tin to its appropriate markets.

MARKET FOR RECOVERED GLASS

There are a number of ways glass bottles can be reused. However, the most logical market for used glass containers is a glass plant similar to the one where they were manufactured. At a glass plant they can be melted down and remake as new bottles and jars in a true example of closed-loop recycling. Nearly all plants purchase glass from general public; therefore for any beginning recycling project a glass plant is the true ideal spot to sell bottles and jars.

There is an excellent market for contaminant free cullet (broken glass). The future of the glass cullet market looks promising. The price of cullet reflects the avoided cost of raw materials, and the energy savings for the lower melting temperature of used glass.

MARKET FOR RECOVERED ALUMINIUM

Every aluminium can that is recycled can go into new can. This situation assures a never ending market for a container that does have the best recycling record in beverage industry. Further, aluminium production by recycling requires 95 percent less energy than that needed to make it from the ore. This contributes to a scrap value that

makes recycling possible without any kind of corporate subsidy or government assistance.

No other beverage container material has the capability, as does aluminium, to pay the public a sufficient amount of money to motivate them to recycle. The value is there, the market is there. All major beer brands and most soft drinks are sold in aluminium cans; about 95 percent of today's beverage cans are aluminium meaning a ready market for recycled aluminium.

INTEGRATION STRATEGIES OF WASTE REFUSE AND RECYCLING INTO NIGERIAN WASTE MANAGEMENT PROGRAMME

When analyzing Nigeria, be it regarding waste or other aspects, the numbers are often overwhelming. With the spread of recycling initiatives, the perception has often been that developing countries need to learn about recycling from developed countries. Recycling, however, is not a formula that developed world has recently discovered and can teach the developing world. It is an economic activity that has existed in many developing countries for decades, but in a form often unrecognizable to those concerned citizens accustomed to separating their bottles and newspapers at home. Recycling in middle and low-income countries depends primarily on hundreds of thousands scavengers who pick at garbage bags, on the curb or in the dumps. This situation is no model for managing waste and is itself a by-product of the lack of proper treatment and disposal facilities in these countries.

There are many benefits associated with achieving new technologies, developing new products, eliminating old products and production techniques, so as to reduce the accumulation of waste that pollutes the environment and diminishes the stock of non renewable resources.

Chapter 4

SUSTAINABLE/AFFORDABLE FUNDING STRATEGY FOR SOLID WASTE

MANAGEMENT IN NIGERIA

In making the use of the economic sense of environmental pollution, the price system in general allocate costs in a manner which is at least superficially fair, those who produce consumer goods which cause pollution pay the costs. Paying for a service such as garbage collection and disposal is a well established tradition in developed nations, and is much less objectionable than having a bureaucrat nosing around and giving arbitrary orders so common in Nigeria today. *The price system (if legally and economically accepted) can simply, control, ad provide an efficient, comprehensive, easily understood, adaptable and reasonably fair way of handling the problem. It is ultimate the only way the problem will be solved. Arbitrary piece-meal, stop-and-go programmes of direct control exhibited in our "task-forces" of today have not and will not accomplish the job required in Nigeria.*

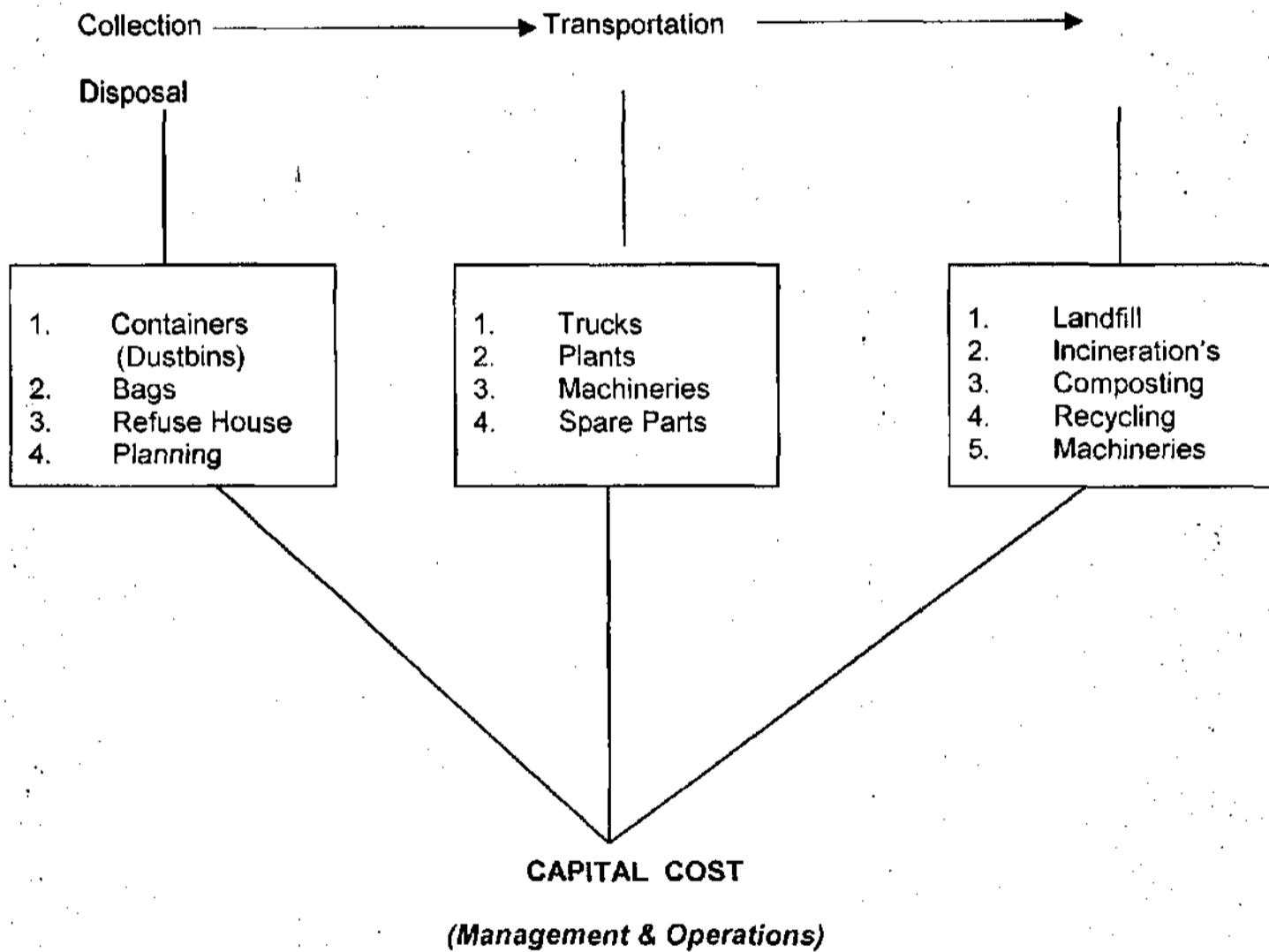
LEVELS OF MANAGEMENT IN SOLID WASTE SYSTEM (DEVELOPING COST CENTRES)

One basic public service which must be performed, despite rising costs, is the collection and disposal of refuse (Solid Waste). At this stage, it is pertinent that we identify the levels of management so as to clearly identify the contained cost centres of the system.

Three major sectors are relevant in managing solid waste to improve public health and scenic outlook of our cities and townships. Refuse, following its generation will be collected, transported, and finally disposal.

These three sectors have their sub-sectors which contain the complex cost-intensive sub-sectors. Vide (fig. 1). All the components in figure 1, identifies why management of solid waste is permanently initially cost intensive thereby calling for institutional arrangements in funding to commence appropriate handling of the system.

Figure 1.



The single most important question concerning almost any operation, public or private, is cost --- What are the revenues and what are the expenditures. Service area characteristics such as accessibility to waste storage areas, customer density, quantity and type of waste generated, distance to and from the disposal site, and topographical conditions all affect the types, size and number of various types of equipment --- collection vehicles, containers plants and equipment.

Almost, all these plant and machineries are initially expensive and weighs heavily on the meagre resources of the Local and State Governments any time they attempt to look into the problem created by solid waste management of their major cities. This then calls for adequate funding from any agency local or international, and concurrent rearrangement and management system that will make the project pay for itself through a good pricing structure. Considering the cost intensiveness, Local Governmental units find it difficult, if not impossible, to come up with the required funds to make desired improvement in their solid waste management systems

Financing Solid Waste Collection

One problem prevails in solid waste management: the difference between what residents pay for municipal solid waste services and what it actually costs .

Let us now examine different sources of funds used to finance solid waste services.

The principle modes of payment are the following: -

1. Municipalities or other Governmental units tax the user to pay for Government provided or contract services;
2. Municipalities and private firms charge the user a flat fee for the service regardless of service level;
3. Municipalities and private charge the user a variable fee for the service, the charge varying with either the quantity of refuse collected or the frequency and

location of service provided. It should, however, be noted that where there is a user charge levied by a government, a tax-derived subsidy may also be used, either explicitly or implicitly.

The mode of payment (in our local terms, revenue generation capacity) may affect the cost of collection both directly and indirectly and it may influence the behaviours of the service recipient.

The payment mode may affect the amount of refuse set out for collection. It may also affect the extent to which the service recipient effectively monitors the performance of the service provider and cause the latter to maintain efficient and effective services; and finally may influence the extent to which a service recipient will attempt to void the cost of regular refuse collection and disposal.

Let us review these modes further in order to simplify it to the level of a common understanding.

- i. Many Governments in the developing world finance solid waste management activities out of the general revenue fund by direct payment to private contractor or operating and capital expenses if publicly operated .

Presently this is the system in Nigeria. This has the advantage of being popular with voters since no monthly bill for refuse service is required there are, however, disadvantages for this type of approach that has often "Locked-in" unsatisfactory system. Since the available funds are not necessary related to the necessary costs involved, an under financed sub-standard operation often results. In the competition for fiscal resources in the general revenue fund, solid waste management does not fare too well in most cases. Another related disadvantage

is the difficulty many communities experiences in raising taxes to provide improved facilities and services to meet environmental requirements.

- ii. Another basic approach is the "user fee" concept. This is akin to the method of financing public utilities and involves a monthly, quarterly, semi-annual or annual bill to the household or businessman reflecting the cost of the service he receives. This rate could be a uniform fee per home or business unit, or could reflect the quantity of waste handled from each residence or establishment.

The fee can be billed directly from Local Governmental unit to the user regardless of who provides the service (public agency or private operator). This fee can also be billed directly from a private collector to the user when the franchise approach is used to collect and disposal off waste. The major advantages includes no need to raise taxes since the fees pays for the service no matter what is or how much it concerns. In developing worlds, this mode improves legal control on defaulters and creates a good environment for monitoring the performance level of service providers.

- iii. A third method of financing solid waste management system now being used in some developed nations is disposal tax. This approach involving taxing the which significantly contribute to the solid waste problem on some sort unit basis, (such as weight) and returning the money collected, or some sort of equitable basis, such as population. To the municipalities, Local Governments, Regional Authorities or other agencies responsible for collecting and disposing of solid waste in a designated area. This approach could result not only in an added source of find, but also serve as an incentive for reduction of the total amount of solid waste which must be handled. Generally, the difficulty in equitably administering such a system is its main disadvantage.

- iv. A fourth method of financing is directly Federal or State subsidy or grants.

Monies are rapidly available for needed capital and operational improvements but progress may lag if the monies authorized are not made available. Hence a problem to be watched by principal lending agencies e.g UDBN, UNDP UNEP et al in funding developing economies. Another disadvantage of this type of approach is the negative effect such grants would have upon the continued involvement of private enterprise in the collection and disposal of the nation's solid waste.

Having reviewed these modes of financing solid waste, a range be achieved for a developing nation liked Nigeria.

One way to avoid uneven revenue range is through using a two -tiered or multi-tiered rating system. A hybrid of traditional management system and unit pricing, this type of system uses a reduced flat fee "user charge" to help ensure that revenues never dip below a certain level. The flat fee for households, institutions, industries etc. guarantee a steady cash flow to cover the fixed cost of equipment and machineries a plus administrative cost.

4. Operational Alternative of solid Waste Management (SWM)

Productivity has emerged as a dominant problem in managing Local Governments in Nigerians feel that Government, particularly Local Government which is in the unenviable position of being responsible for daily delivery of highly visible service is inefficient and ineffective. The disparity between inputs and outputs from Local Government looms large in their eyes.

These circumstances nurture the growing belief that significant and enduring improvements in the efficiency and effectiveness of Local Government can be achieved only by recognizing the institutional nature of the basic problems, designing management strategies to overcome them, and building the public support to do so.

It is also true that, under any conceivable institutional alternative, solid waste management systems can be operated by public agencies, private collectors and disposers, or a combination of the two. Private operation can be accomplished by a contract to the Local Government unit or by a franchise under Local Government approval but financed by a "user fee" charged by the private collector to his customer.

5. **When Solid Waste is not Adequately Funded or Managed**

The situation in most of Nigerian cities in relation to its level of cleanliness is as a result of total lack of proper management. In almost all the cities, the decision and policy-makers have not deemed it necessary to prioritize solid waste management in their development budgets.

The relationship between public health and improper disposal of solid waste has long been recognized. Rats, flies, and other disease vectors breed in open dumps and in residential areas or other places where food and harborage are available. Implications for public health and other problems associated with water and air pollution have been linked to mismanagement of solid wastes. Leachate from open refuse dumps and poorly engineered landfills has contaminated surface and ground water. In Nigeria, short-range remedies have held sway over long-range solutions. No matter how the nations see it now, the preservation of public health and aesthetics of the environment should be of paramount consideration in management decisions involving solid wastes.

A system for managing solid waste must be economically as well as technologically feasible. If communities are unable or unwilling to pay for services rendered, the service provider finds it extremely difficult to manage the system thereby turning residential cities into public dustbins. Let us recall to our minds that the term "solid waste" describes that material which is normally solid,

and which arises from animal or human life and activities and is discarded as useless or unwanted. It also includes deposited waste particulate, even when temporarily suspended in air or waste. It refers to the heterogeneous accumulations of agricultural, industrial and mineral waste.

6. **Private Finance and Solid Waste Management: The Demand in Nigeria**

I would want us to understand this section in the context of regarding the Petroleum (Special) Trust Fund as the would-be lending Federal Agency. The Local Government, State Governments and private contractors as benefiting "service providers".

At this level, the Petroleum (Special) Trust Fund lends through the financial institution machinery of Urban Development Bank o Nigeria (Plc).

One would then believe that the lending bank has perfected policy to accommodate the service providers on a level that will afford available machineries, plants and vehicle to them and in turn, enable the financial institution to recuperate their facility on a soft cushionable arrangement. The "user-charge" mode satisfies the level of our development in Nigeria. A user charge, whether flat or variable fee, is the most common means of financing solid waste management service. E.S. Savas et-al conducted a revealing study showing the fraction of people in a quadrant of New York City residents using each payment mode as shown below in Table 1.

Table 1

% of Residence Using Each Payment Mode

Service Recipient	PAYMENT MODE			
	Tax	Flat Fee	Variables	Don't Know
Total				
Small Residents	52.6%	37.0%	10.1%	0.2%
99.9%				
Multiple Dwellings	38.1%	24.8%	35.5%	1.5%
99.9%				

These findings are noteworthy in so far as they suggest that large cities find it more difficult or inconvenient than small cities to administer a system of user charges and variable service levels. (As city sizes increases, the fraction of cities paying for service by flat fee to private firms decreases, but this merely reflects the fact that municipal collection increase and collection by private firms declines as city sizes increases). The fact that user charges are even more common for contract collection than for municipal collection suggest that cities find it easier or more desirable to pass all the cost of contract collection-rather than municipal collection, to residents as a direct charge.

Thereby rests my case on accepting "user-charges as an affordable sustainable funding mode for improving solid waste management in Nigerian. We should note also that in developing countries the market for environmental goods and services is still small but is likely to expand rapidly during the next decade. As Governments respond with environmental legislation (required in Nigeria), strengthened environmental protection institution, and increased enforcement, opportunities are being generated for private investments in environmental goods and service. The constraints on public service such as waste-water treatment and management of solid wastes are also creating opportunities for private sector to provide such services.

Chapter 5

LEGAL AND INSTITUTIONAL CONSTRAINTS OF SOLID WASTE MANAGEMENT IN NIGERIA

BACKGROUND

Effective and efficient solid waste management requires institutions at national, state and local levels to effectively plan and provide service to the people. These institutions require the services of skilled staff, waste management vehicles and equipment and financial resources to sustain operations as well as the necessary legal provisions to enforce compliance with some basic rules. In Nigeria, there are institutions at Federal, State and Local Government levels involve in the various aspects of solid waste management. There are also a number of legislations enacted to ensure the safe collection and disposal of solid waste throughout the country. The aim of this paper, therefore, is to examine and highlight the role of these institutions and the pieces of legislations with a view to identifying constraints faced areas for improvement.

EXISTING INSTITUTIONAL FRAMEWORK

The involvement of each of the three tiers of government with respect to solid waste management is as follows: -

FEDERAL GOVERNMENT AGENCIES

The institution in charge of environmental sanitation and solid waste management at the Federal level is the Federal Environmental Protection Agency (FEPA). It was established by Decree No. 58 of 1998 and charged with the responsibility of controlling the state of Nigerian environment.

By the virtue of its enabling instrument, FEPA has two main organs: the Ministerial Governing Council and the Technical Committee.

For effective coverage of the country FEPA operates a liaison office in Lagos, Zonal Offices in Kaduna, Kano, P/Harcourt, Maiduguri, Owerri and Ibadan and State Offices in Makurdi, Bauchi and Uyo. These offices are coordinated from the Headquarters in Abuja. The Agency has since its establishment in 1988 produced a National Policy on the Environment and Guidelines, Standards and Regulations for environment management including – pollution control, natural resources conservation, industrial and municipal waste management.

STATE GOVERNMENT AGENCIES

Although Solid Waste Management is a constitutional responsibility of Local Governments, State Governments have had to intervene not only in policy formulation but also in direct collection and disposal operations. Such interventions have been attributed to low technical capacity of local governments for providing waste management services especially in large urban centers, need for an umbrella or coordinating body in metropolitan areas; and also due to financial expediency. State organs involved in waste management have taken any of the following forms:

- ❖ Specialized Waste Management Agency;
- ❖ State Environmental Protection Agency;
- ❖ Physical Planning and Development Boards;
- ❖ Task Forces and Ad hoc bodies.

SPECIALIZED WASTE MANAGEMENT AGENCIES

Specialized agencies have been established to specifically handle solid waste management of some state capitals due particularly to their metropolitan nature.

Example of such institutions are:

- ❖ Lagos State Waste Management Authority (LAWMA),
- ❖ Kano State Refuse Disposal Agency (REDA),
- ❖ Ibadan Urban Sanitation Committee (IUSC),
- ❖ Abuja Environmental Protection Board (AEPB).

These agencies except that of Abuja carry out only waste management functions. Other functions of environmental protection are separated and given to the State Environmental Protection Agency.

STATE ENVIRONMENTAL PROTECTION AGENCIES

In many states, newly established State Environmental Protection Agencies have taken over the responsibility for solid waste collection and disposal particularly where the Local Governments and/or Physical Planning and Development Authorities do not have the capacity to do so. The state agencies that render solid waste management service are shown in Table 1.1. From the table about fourteen State Agencies are engaged in waste collection, transportation and disposal.

Table 1.1 Solid Waste Management Services Offered by State Environmental Protection Agencies

Name of Agency	Waste Management Services					
	Collection	Transportation	Recycling	Cost Recovery	Waste Treatment	Other
Imo State EPA	X	X	-	-	-	
Gombe State EPA	-	-	-	-	-	
Enugu State EPA	X	X	-	X	-	
Edo State EPA	-	-	-	-	-	
Ebonyi State EPA	X	X	-	-	-	

Delta State EPA	X	X	-	-	-	-
Abia State EPA	X	X	-	-	-	-
Kogi State EPA	X	X	-	-	-	-
Benue State EPA	-	-	-	-	-	-
Bauchi State EPA	X	X	-	-	-	-
Anambra State EPA	-	-	-	-	-	X
Adamawa State EPA	X	X	-	-	-	-
C/River State EPA	-	-	-	-	-	X
Osun State EPA	X	X	-	-	-	-
Yobe State EPA	X	X	-	-	-	-
Taraba State EPA	-	-	-	-	-	-
Rivers State EPA	X	X	-	-	-	-
Kaduna State EPA	X	X	-	X	-	-
Ogun State EPA	X	X	-	-	-	X
Niger State EPA	X	X	-	-	-	-
Nassarawa State EPA	X	X	-	-	-	-
Kwara State EPA	-	-	-	-	-	-
Plateau State EPA	-	-	-	-	-	-
TOTAL	14	14	-	2	-	4

Source: UDBN Field Survey, April 1997

Most of the State Environmental Protection Agencies are new bodies established in the last five years to collaborate with FEPA in tackling the problems of environmental degradation. Other statutory responsibilities of the body include control and management of pollution, erosion, desertification, and the enforcement of environmental safety standards.

State Physical Planning and Development Boards

Physical Planning and Development Boards are established to foster physical development of the capitals through proper planning of public services and amenities and the promotion of residential, commercial and industrial projects. They are also to render technical assistance to Local Governments. Some of these Boards have been rendering waste management services in the following State Capitals: Makurdi, Jos, Birnin Kebbi, Lafia, Sokoto and Gusau.

Some of the Urban Development Boards, such as Sokoto Urban and Regional Planning Board (formerly SUDA), and Jos Metropolitan Development Board (JMDB) are old institutions responsible for the provision of integrated planning and essential physical urban infrastructure such as township roads, drainage, street lights, markets landscaping and beautification and solid waste management. The state governments envisaged that the combination of solid waste management, city beautification and drainage cleaning in a single institution would enhance integration, cost effectiveness and reduce organizational overlaps.

Local Government Organs

Solid waste management at Local Government level is handled by the Health Department. In some State capitals such as Calabar, Dutse and Benin, the Local Governments exclusively provide solid waste management services. Many local Government headquarters fall into small and intermediate sized urban centres covering only one LGA while a few others are large urban centres such as Onitsha, Aba, Zaria, Oyo, Ife and Ilesha with more than one LGA. This is where the issue of service provision and the need for co-ordination do exist. In most rural areas, regular solid waste collection is hardly undertaken because the low waste volume does not pose much problem to the community. In these areas, important solid waste collection and disposal activity takes place monthly during the mandatory Environmental Sanitation days. However, regular services are often provided at market centres.

PROBLEMS AND LIMITATIONS OF EXISTING INSTITUTIONAL STRUCTURE

The foregoing analysis has shown that there is no standard institutional structure for solid waste management in Nigeria. Although it is the constitutional responsibility of Local Governments, several state agencies are involved in the direct provision of the service. This leads to duplication of efforts and inefficient utilization of the scarce

resources. The limitations and constraints of existing ~~institutional~~ arrangements are examined below:

Ineffective Institutional Arrangement

The non co-ordination of the activities of levels of government in solid waste management has continued to create inefficiency in service delivery, duplication of efforts and waste of resources.

The establishment of state owned waste management agencies pose some institutional and administrative problems.

The absence of a metropolitan administration in the country denies the cities the opportunity to be planned and managed as a single entity. For example, Ibadan, Lagos, Kano, Jos metropolis all divided into 18, 17, 15 and 3 Local Government s respectively. Each LGA operate independent of the other. There is no framework for joint action to tackle citywide problems such as solid waste management, drainage control, transportation, housing, etc. cutting across administrative boundaries. The existence of such organ would have enhanced the performance of a specialized waste management authority in terms of community participation, revenue mobilisation, information dissemination and strategic intervention in difficult or inaccessible areas.

Incessant Political Interference

Most State and Local Governments do not accord solid waste management sector the priority it deserves. They often prescribe short-term solutions to a long-term waste management problems. In some states the solid waste management functions have been moved around several Ministries and agencies over time, with each emerging administration imposing different institutional solutions to waste management problems. This operational and institutional instability deny the relevant waste management agencies the benefit of accumulated experience in the management of the system and dampens staff morale. Table 1.2 gives an account of such institutional changes in some of the federation.

Table 1.2 Institutional Changes in Some Solid Waste Management Agencies

City	Names of Institutions with Dates	Supervising Authority
Lagos	1977 – Lagos State Refuse Disposal Board (LSRDB)	Ministry of Works and Transport
	1980 – Lagos State Waste Disposal Board (LSWDB)	Ministry of Works and Transport
	1991 – Lagos State Waste Management Authority (LAWMA)	Ministry of Environment & Physical Planning (MEPP)
	1994 – Local Government Councils and LAWMA	Local Government/MEPP
	1997 – LAWMA	Ministry of Environment & Physical Planning
Ibadan	1972 – Ibadan Municipal Government (IMG)	Ibadan Local Government
	1973 – Waste Disposal Board	Ministry of Works
	1978 – IMG	Ibadan Local Government
	1983 – State Waste Disposal Board/Ministry of Environment	Ministry of Environment
	1995 – Ibadan City Waste Management Committee	Ministry of Works and Transport
1997 – Oyo State Waste Management Authority	Cabinet Office	
Yola	1984 – Gongola State Urban Planning and Development Authority	Ministry of Lands & Survey
	1985 – Special Task Force on Sanitation	Ministry of Works
	1994 – Adamawa State Environmental Protection Agency (ADESEPA)	Ministry of Works and Transport

Source: UDBA Field Survey, April 1997

The problem of political interference leads to instability and poor governance at the Local Government level. Between 1991 and 1997

Local Government Chairmen have been changed four times with some spending less than one year in office. These frequent changes do not make for proper planning and development. Solid waste management is one of the public utility services that is most affected by this instability as adequate budgetary provisions for system maintenance cannot be made while continuity in service cannot be ensured.

Poor Management Capacity

The most striking problem confronting all levels of waste management agencies nationwide is inadequate management capacity caused by inadequate number of trained personnel and overstaffing at the lower level cadre.

Field observation reveals that out of 199 Local Governments covered in the UDBN survey, 65% have Engineers on their staff list. The employment of other professionals shows 32% for Doctors, 77% Health Inspectors, 44% Town Planners, 26% Architects and 29% Chartered Accountants. This figure indicates the level of professional competence of Local Governments. Most of them employ the services of technicians and sub-professionals in the planning and execution of projects as well as in providing essential services. This low technical capacity is partly responsible for poor planning, inefficient systems management and poor revenue mobilization capacity.

Wrong Institutional Location

The institutional location of waste management services have their origin from the British colonial period. The responsibility of refuse disposal under the system is usually entrusted to the Medical Officer of Health and the Public Health Inspectors or Sanitary Officers who manage solid waste among other duties, such as the control of epidemics,

insects, food inspection, slaughter houses, meat inspection, public health education, immunization, sewage and night solid disposal. With this load of the responsibilities, the *officers are not able to devote the required attention to waste management. Moreover, this arrangement is not workable in large metropolitan centres where large quantity of waste are generated daily. Modern solid waste management involves complex engineering solution as well as organizational, planning and management skills.*

Poor Staff Development Programme

As a result of poor remuneration, there is limited commitment of the staff towards meeting the organisational goals and objectives in most public sector agencies.

This is compounded by poor staff development by most agencies. There is no national agency that specializes in training staff in the modern technique of waste management. UDBN survey reveals the poor training and manpower development programme throughout the country. This limits the productivity of the staff and dampens their morale.

Poor Community Participation

One major constrain to effective waste management is the limited participation of the public or waste generators in the waste management process. Aspects of community participation include the involvement of community – based organizations, the organized private sector and non-governmental organizations. When Local Governments were asked the public was not involved in waste handling process, various answers were given. Out of 556 Local Governments interviewed, 23% said the Local Government is rural and solid waste management does not constitute serious problems, 14% claims that it is a social service and responsibility of LGA, 23% says the

private sector is disinterested, 21% alludes that to improper definition of method of private intervention and 6% ascribes to lack of awareness.

It could be said that most plans have failed due to inadequate public integration. Therefore, any future plan for waste management should incorporate community participation from the on set.

LEGAL ISSUES

Laws and regulations are usually made to guide the storage, collection and disposal of solid waste generated in the city. During the colonial period, many legislations were enacted to safeguard public health and the environmental sanitation of the towns.

These include among others the public Health Act 1909, the Township Ordinance of 1917, the Lagos Colony Ordinance of 1928 and the 1946 Town and Country Planning Ordinance. With independence in 1960 and rapid urbanization, the legislations became inadequate to deal effectively with the problems of managing wastes in most large urban centres.

The post independence legislations on waste management are highlighted below:

Federal Environmental Legislations

The beginning of serious Federal Government intervention in environmental management came with the promulgation of the Harmful (Toxic) Waste Criminal Provision Decree No. 42 of 1988 following the discovery of five ship loads of toxic waste of Italian at the small port town of Koko. This was followed in the same year with the establishment of the Federal Environmental Protection Agency (FEPA) by Decree No. 58 of 1988 and its Amendment Decree No. 59 of 1992. The Decree vests in FEPA the overall responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources. In

addition, the Decree mandates FEPA to prepare national policy for the protection of the environment, prescribe standards for the control and removal of hazardous wastes, monitor and enforce environmental protection measures and promote mutual co-operation with relevant local and international agencies.

FEPA prepared standards and regulations on pollution control; natural resources conservation, effluent limitation as well as issued guidelines on industrial waste management. The most important instruments on environmental management are the National Policy on Environment, the Environment Impact Assessment Decree and National Environmental Protection Management of Solid and Hazardous Waste Regulations.

The National Policy on Environment was prepared in 1989. It prescribes guidelines and strategies achieving the goal of sustainable environmental management. The policy also defined tasks for FEPA on waste management to include specification of adequate standards, selection of appropriate technology, setting up enforcement mechanisms, monitoring, periodic surveillance and project development.

An important piece of legislation made by FEPA is Environmental Impact Assessment (EIA) Decree No. 86 of 1992.

The Decree makes it mandatory for any major physical development project likely to have adverse impact on the environment to conduct an EIA. It also prescribes the procedure for conducting and reporting Environmental Impact Assessment. The most important aspect of this Decree is that all government projects are required to prepare Environmental Impact Assessment Report as condition for approval and for inclusion in the National Rolling Plans.

In 1991 the Federal Government issued the management Solid and Hazardous Wastes Regulations with a view to achieving the following objectives among others:

- i. Identify solid, toxic and hazardous wastes that are dangerous to public health and the environment;
- ii. Provide for surveillance and monitoring of dangerous extremely hazardous waste and substances and ensure that they are detoxified and safely disposed of;
- iii. Provide guidelines necessary to establish a system of proper record keeping, sampling and labeling of dangerous and extremely hazardous wastes.
- iv. Research into possible reuse and recycling of hazardous waste.

The regulation places emphasis on the safe disposal of hazardous wastes as well as stipulates measures to be taken to establish toxicity levels of wastes and monitor waste disposal.

Another related legislation is the Nigerian Urban and Regional Planning Decree No. 88 of 1992 which replaces the obsolete 1946 Town and Country law. The Decree provides for the establishment of Federal, State and Local Government Authorities to oversee physical planning and development of the country.

In addition, the National Urban Development Policy, which was prepared in 1992, was launched in October 1997. It is aimed at developing a dynamic and sustainable system of urban settlements, which will foster economic growth, efficient regional development and improved standard of living. The policy emphasizes the need for concise actions and strategies to achieve balanced, efficient and functional settlement development throughout the country.

State Legislations

In 1984, the Federal Military Government gave environmental sanitation and issues of waste management a top priority. All State Governments were mandated to enact Environmental Sanitation Edicts to address problems of public sanitation. All states promulgated the Edicts between 1984 and 1985. This law laid the foundation for the general tidiness of the city streets, waste collection and disposal. Institutions – both adhoc, through Task Forces and permanent were established to enforce the law.

The establishment of FEPA in 1988 and the subsequent efforts of this organization made many states to establish their State Environmental Protection Agencies. At the 1991 Conference of Directors and General Managers in charge of Environmental matters, a set of complementary Federal and State responsibilities and functions for environmental protection and improvement were approved. The State Environmental Protection Agencies and other waste management institutions are usually set up urban State Laws.

Each State Environmental Protection Agency is usually given the responsibility for the protection and development of the environment and conservation of the State natural resources.

With respect to Waste Management, the Agency is mandated to:

- ❖ Assess recycling as a waste management option for industries and government agencies;
- ❖ Establish and recommend the basic standard requirements for Solid, Liquid, Gaseous

or Toxic waste management in the State provided they do not conflict with, but complement

the standard requirements of the Federal Environmental Protection Agency;

- ❖ Establish and recommend acceptable safe methods of collection and disposal of hazardous and toxic waste products in the state;
- Survey and Monitor the water (including underground water) air, land and solid environment in the state to determine pollution levels (if any) in them and collect baseline data therefrom with a view to controlling quality;
- ❖ Monitor, control, discharge and dispose of solid, liquid and gaseous industrial waste protections; and manage all types of erosion in the State.
- Educate the general public on the various types of disposal methods acceptable to the State Government for domestic and industrial waste protections;
- ❖ Carry out research and conduct toxicological tests on insecticides, herbicides and other agricultural chemicals which are new in the market with the aim of checking their possible effects on the environment;
- ❖ Initiate environmental protection legislation and keep existing legislations under constant review to reflect the latest discoveries and observations on the subject;

In some State, particularly the oil producing ones, the Agency is to advise the state governments on the utilization of one percent Ecological Fund for the protection of environment. They could also undertake pilot schemes in collaboration with public and private organizations to further the object of the agency.

LOCAL BYE-LAWS AND REGULATIONS

The Statutory functions of local Governments were clearly defined by the 1976 Local Government Reforms, which characterized the focus of Local Government Administration as consisting of:

- i. Making appropriate services and development activities responsive to local wishes and initiatives by developing or delegating them to local representative bodies;
- ii. Facilitating the exercise of democratic self-government close to the local levels;
- iii. Mobilising human and material resources through the involvement of members of the public in the development of their environment;
- iv. Providing channel of communication between local communities and government.

In furtherance of above objectives, Local Governments promulgate by-laws and regulations to guide their operations in addition, most State Environmental Protection or Sanitation Edicts provide for the establishment of Local Committees to facilitate co-ordination and co-operation with Local Government Authorities.

Limitations And Constraints

The Federal Government has initiated policies, legislations and guidelines, within the ambit of constitutional requirements, for general environmental protection and for the collection and disposal of solid wastes. Most states have enacted Edicts establishing relevant Waste Management Agencies. In addition, all communities are made to observe the last Saturday of every month as Environmental Sanitation Day. Some States have even added another day in a month as State Environmental Sanitation Day. All these were backed by laws as necessary legal instruments to facilitate enforcement. For instance each Local Government has patrol and monitoring team to undertake surveillance during the sanitation days where contraventions are appropriately

sanctioned. These policies notwithstanding, it is important to observe some shortcomings of existing system which require some attention.

Inadequate Policy Guidelines

The Federal Environmental Protection Agency (FEPA) has since its inception been making efforts to control waste menace in Nigeria particularly with industrial and hazardous wastes. However with regards to municipal waste management, the actions taken to address the problem have not gone beyond the issuance of guidelines setting up of a Monitoring Unit (Urban Compliance Unit) – within the inspectorate and Compliance Monitoring Department. FEPA is yet to prepare a blue print on Solid Waste Management that will assist the State Environmental Protection Agencies and their corresponding Local Committees to evolve self sustaining strategy for:

- ❖ Volume reduction, waste recycling and re-use,
- ❖ Collection, transportation and disposal methods,
- ❖ Appropriate technology for equipment and vehicles,
- ❖ Guidelines for private sector participation,
- ❖ Staff training and manpower development.

The same applies at state levels where relevant agencies are not rendering the much desired guidelines to Local Governments. The absence of an Environmental Management Plan at state level has greatly prevented co-ordination of the actions of the various Local Governments within each State.

Much as the enabling legislations for State Environmental Protection Agency set the role of the Agency as consisting in broad policy and standard setting, some states have widened the scope of operation. Some agencies now undertake direct solid waste management services spanning many Local Government areas thereby encroaching on the exclusive jurisdiction of Local Governments. The Agencies should assist and strengthen the appropriate arm of local administration rather than rendering its services.

Poor Enforcement Mechanism

Although the State agencies are established by law, most of the instruments of the law are not strictly followed. For example, each Agency is supposed to have a Governing Council under the direct supervision of the Governor or Military Administrator. This Council is supposed to be serviced by a Technical Advisory Committee headed by a General Manager and a complementary technical crew. However, in most of the states this structure is not in place. In most cases, the Board had been dissolved leaving alone the Technical Committee to operate either as Task Force or ~~State~~ Administrator.

In addition, it is found to be very difficult to enforce some provisions of the laws. While it is easy to prosecute offenders under the Environmental Sanitation Edict for non compliance with sanitary practices, it is not easy to enforce payment for waste management services especially from residential area partly due to inadequate monitoring staff, and absence of sanction and enforcement systems at the local level.

Delimitations of Local Government Functions

Although solid waste management is a constitutional responsibility of Local Governments, State Governments have been actively involved particularly in state capitals. In large towns or metropolitan areas, the absence of an existing collaborating organ for all Local Governments comprising of a city have always created infrastructure maintenance and urban management crisis. The intervention of State Governments has not also helped matters because Local Governments do not always pay for mandatory services. The continued disbursement of state funds to waste management

exclusively in state capitals raises the question of equity. This is because other component parts of the State which should have equal access to State resources are neglected. The situation becomes more obvious in highly urbanized states having several urban centres. Composite Local Governments within the State capital seldom appreciate state intervention policy since they are the third tier of government with separate plans and agenda. Most often, they come up with parallel programmes with the State Government, which results in competition rather than complementing state actions. There is a need therefore to review the institutional arrangements for municipal administration to improve their capability in rendering important services.

Chapter 6

SUMMARY, CONCLUSION, AND RECOMMENDATION

SUMMARY

Environmental pollution is one of the Greatest challenge facing the Global community today. In Nigeria urban centres are facing problems of effectively collecting and disposing the solid waste generated. Waste in these urban centres are generated at such a faster rate than what the authority could collect and properly dispose of. Lack of adequate resources to acquire the necessary waste disposal vehicles and equipment as well as maintaining the few existing ones has been a serious impediment to an efficient solid management system. Lack of operational vehicle is one of the major reason for none collection of refuse at depots. Similarly lack of equipment at the landfills make proper disposal of waste difficult.

The world has tremendous technical capacity to transform industrial and consumer waste into useable products. New and emerging technologies will continually be added to our body of knowledge.

In our world in which the human population is growing faster than available resources, we can no longer offered to consider any material waste. We must make technologies available to convert recyclable into useable necessary products. An efficient solid waste management system with many benefits is critical to attaining sustainable human settlements, development and management. This is critical for promoting a safe, clean and healthy living environment. Where the lives of urban dwellers will be prolonged.

The Thesis highlighted many institutional and legal constraints affecting solid waste management service throughout the country. Bringing out the key issues that must be considered for institutionalizing a sustainable waste management system in the country is important in getting to the root of the problems.

In Nigeria, there is a great urgency required in tackling the ever increasing complexity of solid waste management. Except in Lagos metropolis and Port Harcourt city and former

Imo State where attempts have been made or are being made to modernize handling of solid wastes, all other State Government have not thought of taking solid waste management as a priority. I will not conclude this Thesis without doffing my hat for the PTF (now scrapped) for the identifying themselves to this important life-saving and aesthetic project in Nigeria. On another platform, a good start has been

made by using the Urban Development Bank as the consulting institution so that funds and grants made available to Governments and private providers for waste management will be adequately monitored. The concepts presently should be to make use of what is available locally to adequately provide for appropriate and affordable solid waste management strategy in Nigeria. The Federal and State Governments stand on solid waste management must be revisited in order to convincingly make a strong and effective commencement to the problem in Nigeria. It is necessary for the citizenry not to see Refuse Management as a public good where Governments must accept the waste as social cost. The user charge must be built into management of solid waste in Nigeria.

CONCLUSION

Much as Environmental Pollution is a global problems, it is much more endemic in Nigeria. Considering the lukewarm altitude towards handling of Solid Waste Management. On a national scale in Nigeria, the solid waste problem is simply a waste management situation totally out of control.

This Thesis has identified some of the major urban solid waste management problems in Nigeria. These problems are Technical, Institutional and Administrative and Political problems respectively.

TECHNICAL PROBLEMS:

- i. lack of public enlightenment
- ii. lack of Landfill sites for waste disposal
- iii. lack of appropriate methods for waste disposal
- iv. Lack of adequate information regarding geological formations, topography and settlement patterns.
- v. Lack of adequate equipment for waste disposal
- vi. Manpower shortage
- vii. Inadequate transport and non-available of spare parts
- viii. Ineffective neighbourhood services; and
- ix. Limited funds.

INSTITUTIONAL AND ADMINISTRATIVE PROBLEMS

- i. Too many agencies involved in waste disposal
- ii. No clear policies on recycling and non-commitment of policy operator and executors
- iii. Inadequate times of collection of wastes
- iv. Inadequate planning
- v. Inadequate finance
- vi. Apathy on the part of waste management agencies
- vii. Corruption
- viii. Poor management
- ix. Manpower problems

- x. Lack of effective monitoring and supervision
- xi. Lack of administrative continuity
- xii. No organized waste and collection system
- xiii. Lack of public enlightenment on refuse transportation
- xiv. Mismanagement, misappropriation and embezzlement of funds; and
- xv. Wrong prioritization.

POLITICAL PROBLEMS:

- i. Political instability
- ii. Bad and inconsistent policies
- iii. Site acquisition at state government level
- iv. Irregular financial assistance
- v. Political differences
- vi. Absence of law enforcement mechanisms
- vii. Overlap of the function of the three tier Government
- viii. Misplacement of priorities
- ix. Poor leadership
- x. Lack of public awareness
- xi. Lack of public co-operation and;
- xii. Boundary disputes.

RECOMMENDATIONS

This Thesis has examine the strategies for effective public and private sector participation in solid waste management in Nigeria. We have also identified critical areas that requires urgent attention so that the private sector can be involved effectively in complementing the present efforts of government in solid waste management. One area of particular significance is lack of access to soft loans. There are also clear signs of unstable and untidiness in the policy conceptualization and implementation, poor public co-operation and perverse actions at various level of the bureaucracy which tend to thwart the realization of well-intended policies of government.

It is important to note that in order to make private sector participation in solid waste management relevant in Nigeria, there are people who are conversant with the economic and political environment of some selected localities in the country.

The focus of such survey should be to address the contextual issues discussed in this Thesis, such as institutional problems, unfavourable policy, inappropriate legislation, and many others. The relevance of each of these constraints and the effect that these might have on the efficiency of private sector participation in solid waste management in Nigeria cannot be over emphasized.

Furthermore, the cost benefit analysis in terms of capital operations maintenance and repairs between private sector and public service delivery would need to be carried out in the selected cities where there already exist private sector participation in solid waste management. Care must be taken not to compare the cost of already fully depreciated equipment of the private sector with the

cost of sector, using new equipment that are appropriately designed. This is in order to determined area where private sector can operate efficiently more than the government.

A well defined monitoring and control system should be put in place for the private and public sector participation in solid waste management by this, we need to design procedures and measures to follow in order to ensure effective private sector participation in relation to public sector participation in solid waste management. Such comparison should be done on equitable basis, so that the same yardstick like vehicle functions, equipment use, landfill management etc. will be the basis for public and private sector comparison of efficiency in waste management.

Finally, in order to ensure effective private sector participation in ~~solid waste~~ management in Nigeria, the contextual issues discussed in this Thesis as constraints to private sector involvement in solid waste services, may necessitate changes in the policy and regulatory framework at the National Level. This might include recommendations on the need for stable political environment in the country that will allow for continuity in government and its policy. There is need for a revision of the present legislation guiding the management of solid waste, provision of technical and financial assistance to all intending private investors in solid waste management, organization restructuring, and proper institutional arrangements. Contracting out vehicle maintenance, waste disposal and collection should not be lumped together to a company who does not have the necessary finance to maintain or secure staff and equipment. Each firm should be given a particular task, for example one firm should specialize in collection, another firm in disposal or landfill management, another firm in recycling and treatment etc.

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