

**JOURNAL 1**

**Page 120 - 129**

11  
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**JOURNAL 2**

**Page 145 - 158**



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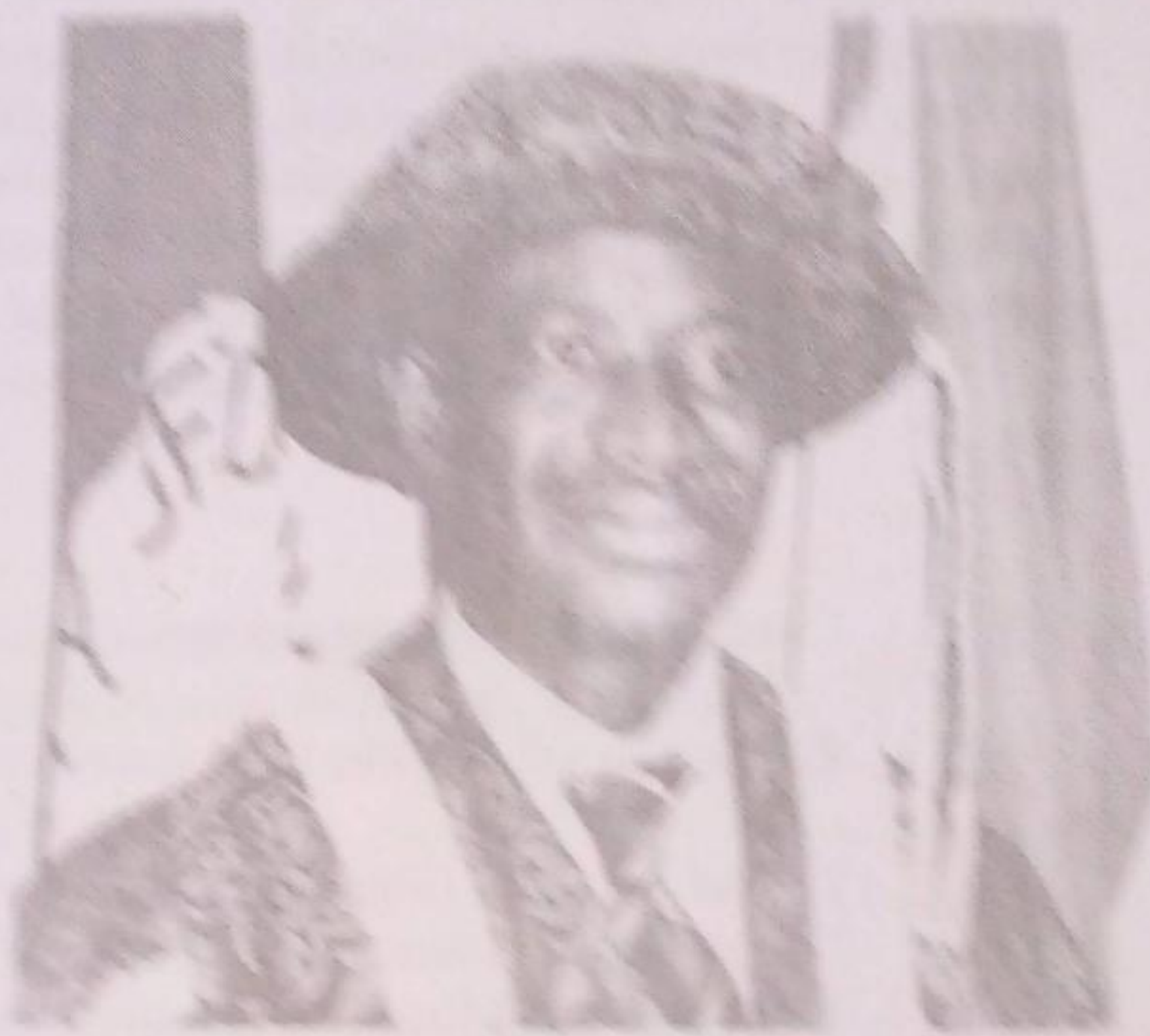
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Consequently, the university decided to resuscitate and sustain the former International University Journal titled the Nigerian Journal of Technology Research (N.J.T.R.). The idea of resuscitation of the journal is also to achieve the university's vision of being a model of efficient delivery of qualitative, functional and sustainable education for F.U.T. graduates, so that they can compete favourably with their mates in the global market economy or be world class or global standard workers, when they graduate.

In this volume, you will get a lot of information in various fields that will promote the teaching and learning of science and technology. I sincerely acknowledge and appreciate the effort of the Editorial Committee that worked hard to resuscitate the journal. It is sincerely hoped that the Nigerian Journal of technology research will be sustained to promote and sustained academic excellence in the Federal University of Technology, Akoka, other Universities in Nigeria and the world at large.



Professor M.S. Audo  
Vice Chancellor

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Professor M.S. Audu  
Vice Chancellor

## EDITORIAL

Universities especially universities of technology are concerned with the teaching, researching, discovering and developing new skills and techniques of manufacturing and fabricating equipments for teaching, learning and industrial development. It is very important the knowledge about these new skills, discoveries and techniques be shared among colleagues in other universities in Nigeria and in other universities all over the world.

This is the reason detre, the resuscitation of the Nigerian Journal of Technological Research was a very laudable venture that will act as a medium for achieving this laudable objective. In pursuance of these objectives the journal encourages scholarly articles that are empirical, practical, theoretical or clinically oriented in science, science education and technological disciplines to promote and sustain teaching and research skills in science, education and technology by providing quality information in various areas of innovations in the teaching and learning of science and technology.

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- Land Resources Management
- Evaluation of Aquifer Characteristics
- Use of Advance Organizers for text visualization
- Mathematical Model for Human Standard of living determination

These articles will be of immense help to lecturers, students and the general reader. It will be a good inclusion to any institution library and private library.

The editorial committee remains immensely grateful to all scholars, who have contributed to this special resuscitation volume. We commend them for their contribution. We appeal to them to keep writing and contributing to the growing body of knowledge, so that their foot prints will be left in the sand of time, as they will still be speaking thousands of years after departure, like ShakeSpear, Einstein etc. Thank you very much, we are grateful and appreciate all of you.

Finally, it is important to note, however that the views, findings and ideas in the articles remain the author's responsibility, while the editorial committee is responsible for the quality of the articles.

Dr. I.N. Mogbo (Associate Professor)  
Editor-in-Chief

13. An Assessment of Efficiency of the Nigerian Tax System 108-119  
- Adeogun, A. S.
14. Urban Residents' Response to Solid Waste Disposal 120-129  
Management System in Minna  
- Popoola, N. I.
15. An Assessment of the Effectiveness of Facilities at Transcorp 130-139  
Hilton Hotel, Abuja  
- Kemiki, O.
16. An Investigation into Group and Individualized Teaching 140-144  
Methods and the Performance of Male and Female Students  
in Mathematics  
- Alenoghena, C.
17. Understanding Public-Private Partnership as a Tool to 145-158  
Achieving Sustainable National Development  
- Popoola, N. I.
18. Evaluation of Groundwater Quality in Diko and Environs, 159-169  
Niger State, North Central Nigeria  
- <sup>1</sup>Amadi, A. N., <sup>1</sup>Olasehinde, P.I., <sup>1</sup>Idris-Nda, A.,  
<sup>1</sup>Chukwu, J. N. and <sup>2</sup>Egharevba N. A.
19. Re-Evaluation of the Petroleum Potential of Bornu Basin, 170-184  
Nigeria  
- Uneuvho, C.I.
20. Can Resistivity Type Curves be used in Engineering Site 185-195  
Characterization?  
- Momoh, O.L.
21. Evaluative Study of Students Online Registration System: 196-203  
A Case Study of Federal University of Technology, Minna  
- Adepoju, S.A.
22. The Role of Games in Learning Mathematics 204-213  
- Musa, B. and Bala, A.
23. Lithological Deduction of the Upper Aquifer of Kawo Dam, 214-222  
Wushishi, and Its Environment  
- Dangana, L. M. and Udensi, E.E
24. Determination of Magnetic Susceptibility of Soil Samples 223-232  
Around Jos Area, Nigeria  
- Akanbi, E. S.<sup>+</sup> and Adoyi, I. M.<sup>++</sup>

## Urban Residents' Response to Solid Waste Disposal Management System in Minna

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### Abstract

Solid waste disposal management planning involves the development, comparison and monitoring of various alternative approaches to solving of municipal solid waste problems as stated by Khan et al.(1990) . It caters for the management of waste from the point of generation to actual waste disposal points. The study examines the responses of the residents of Bosso and Kpakungu areas of Minna to solid waste disposal and management and reveal poor and inadequate waste management system; as over 40% of the sampled population do not have any waste storage facilities, while about 64.56% of the population do not have a reliable waste collection points. Over 76% of the waste generated in the areas ends in open fields or on illegal sites while the remaining 23.64% ends in water channels and road sides. If relevant agencies will rise to their responsibilities, over 60% of the sampled population are willing to pay for waste collection for final disposals. The study recommends strict enforcements of planning laws and regulations and the formulation of a good waste management program for urban sustainability.

**keywords:** Environment, planning, solid waste, urban residents, and waste management.

### Introduction

The menace of solid waste disposal has been a very serious problem facing most urban centers in developing countries today, Nigeria inclusive. Rapid urbanization has in no small measure contributed to waste generation and sanitation problems in the cities. (Adeyemo, 2000). These wastes and their products are the causes of a great deal of environmental problems in the country. Unfortunately, methods of solid waste disposals are not well defined; while, available methods of managing such waste are grossly inadequate.

The provision of efficient and reliable environmental services, especially solid waste management is very critical in the overall development of any nation, but unfortunately this sanitation need of the populace, has not kept pace with the population growth and spatial expansion of settlements.

In Nigeria, solid waste collection and disposal methods have been

dominated by the public sectors (the three tiers of government). It is on record that since 1976 local government reform, the collection and disposal of solid waste have been the statutory responsibilities of local governments. (Olokesusi et al 2005.). Despite this seemingly clear legal arrangement, most, if not all the local government areas (LGAs) especially those that are urban, have failed woefully to properly manage urban solid wastes. The involvement of state governments in solid waste governance (SWG), which led to the formal introduction of private firms to the sector, has not yielded the desired results. Later, joining the train are the itinerant cart pushers whose activities have been blamed for the indiscriminate dumping of solid waste along road kerbs, drainages and open spaces in our cities (Adeyemo 2000).

The management of solid wastes will therefore be the responsibilities of all stake holders (from household, where wastes are produced and generated to the



authorities saddled with the responsibility of proper disposal of the wastes). There is therefore the need for a deliberate solid waste management planning if sustainable environment is to be achieved.

### Statement of Problem

According to Sanio (1998) rapid urbanization along the rising rates of industrialization has created greater concentration of waste than city system can absorb. These wastes and their products are the causes of a great deal of environmental problems; ranging from pollution of various form to erosion and land degradation. Unfortunately, methods of solid waste disposal are not well defined while; management of the wastes is grossly inadequate. Adeyemo (2000).

Sanio (1998) also observed that in developing countries, less than 10 percent of the urban waste are said to be improperly disposed, while only a small proportion of this wastes meets the acceptable standards. As a result, it was stated that about 5.2 million people, including 4 million children die annually around the world from diseases caused by improper disposal of sewage and solid wastes. He therefore recommended that greater attention needs to be paid to the problem of solid waste disposal, this is because it is estimated that by the year 2025, about 70 percent of the world's population will be urban and by then urban wastes will be more than quadruple.

This trend in waste generation should be a major concern to urban administrators. Therefore; it has become necessary for proper management of solid waste to be carried out in our urban centres.

### Aim and Objectives of Study

The aim of this study is to analyze urban residents' response to solid

waste disposal with a view to suggesting workable solid waste management planning for urban sustainability.

In pursuance of the aim, the objectives of the study shall include;

- i) to identify the likely sources of domestic waste generated in the areas
- ii) to examine mode of storage and collection of wastes from residence
- iii) to assess the disposal methods adopted by individual resident.
- iv) to assess residents' response to solid waste management.
- v) to assess the acceptability level of commercialized waste management among resident's and;
- vi) proffer a workable programme for solid waste management planning for the Nigerian urban.

### The Study Area

The problems of solid waste disposal are generally and similarly obtainable at almost every city in Nigeria, and as such, this issue is discussed generally in the context of Nigerian cities; using two (2) neighbourhoods in Minna metropolis as a basis for analysing some data for generalisation. For the purpose of this study, Kpakungu and Bosso areas of Minna were selected. The selection was based on the fact that the areas are prominent slum neighbourhood in Minna metropolis which generates much solid waste. Furthermore, the characteristics evident in the two neighbourhoods are shared by others within the city.

### Methodology

Data for this research work were based primarily on field work; personal interviews published books

and journals, seminar papers, and questionnaires administration. Total number of 100 questionnaires was administered in the two selected neighbourhoods of Bosso and Kpakungu. The selected areas were divided into strata/zones-A, B, and C. Fifty (50) questionnaires were

administered randomly for each of the stratum in Bosso area and similarly in Kpakungu. (See table 1) Data collected were analysed and presented in oral and tabular forms from which summary of findings and recommendations were drawn.

Table 1: Response to Questionnaires

AREA	NO. OF QUESTIONNAIRE ADMINISTERED	NO. OF QUESTIONNAIRES RETURNED	% RETURNED
BOSSO	50	50	100
KPAKUNGU	50	43	86
TOTAL	100	93	93

Source: field survey, 2007

### Literature Review Waste And Solid Wastes Generation

Waste is defined by Adedibu, (1982), as the non-gaseous and non-liquid waste resulting from domestic activities of the inhabitants of a particular residential area. It is the unwanted residue of the resources within human disposal. He observed that basically, wastes are of two types, that is, solid waste and liquid waste. Liquid wastes are liquid contaminants that affect water, aquatic lives and plants. They could be in form of oil spillage, toxins from textiles factories among others. While solid wastes are unwanted solid materials such as garbage, paper, plastics and other synthetic materials, metals and wood.

According to Ahmed, (2000), factors such as inadequate knowledge of the composition of solid wastes, the rate to which population generates wastes, inadequate and uncoordinated infrastructural facilities for waste disposal, and rural- urban drifts are the major causes of poor environmental sanitation. It is therefore evident that the volume of waste generated in a particular area

is directly related to the level of income (standard of living) and population of that area.

The Federal Environmental Protection Agency (FEPA, 1991) has categorized waste into three (3) main types as follows:-

- A. The municipal waste arising from residential, institutional, commercial and street-left-over, include pieces of papers, food waste, plastic and rubber, pieces of metal, tins, cans, leaves and grasses among others.
- B. The industrial waste such as cartons, boxes, crates, scraps, of building materials, wood and celluloid materials, chemical wastes-oil and plastics.
- C. Toxic wastes: This category of wastes is very harmful to health for example, carbon monoxide emitted from the exhaustible fumes of cars, machinery, chimney, generating plants and other combustible items.

### Components of Domestic Solid Waste

From the analysis of components of municipal solid waste carried out in

the United States of America in the year 2000 by the America Environmental Protection Agency, it was observed that a person in an industrialized nation produced a great variety of solid waste, often a mix of potentially reusable or recyclable items (such as food and many types of plastic). Of the municipal solid waste (the waste collected from residences and businesses) produced in the United States in 2000, about two-fifth (2/5) of the paper, metal and yard waste was recycled, and about one-

quarter (1/4) of glass was recycled, while plastics, rubber and other petrochemical waste posed the greatest challenge when it comes to disposal.

However, Saidu, (2007) in his study on domestic waste management in Bosso town, Minna, observed that the components of solid waste in the area include; kitchen ashes, empty cans, left-over cooked foods, plastics, paper pack and cartons with each constituting different percentage of total waste. (See table 2)

**Table 2 :Percentage Composition and Moisture Content of Bosso Domestic Waste**

Material waste	% Composition	% Moisture Content
Food Remnant	33.8	27.31
Metal/ Metal Related	34.27	19.41
Paper/ Paper Related	21.11	10.68
Plastic Rubber	26.15	11.25
Textile	1.89	10.98
Glass/ Bottles	8.28	1.32
Ash/ Dust	2.51	17.24
Others	2.41	1.82

Source: Saidu, M. (2007)

**Categorisation of Waste Collection Methods**

The Chartered Institute of Public Finance and Accountancy (CIPFA, 1988) has categorised the waste collection methods used by local authorities under four main headings as follows;

1. The back door and return system: This involves the operative collecting a bin or sack from within the curtilage of the property, empty contents and return bin back to the premises.
2. Kerbside Collection: in this case, the householder takes the bin to the boundary of the property nearest to the street or on the street where operatives

collect the waste for disposal.

3. Collect and Return System: requires the operative collecting the waste from the front or rear of the dwelling and to return the bin some lesser distance within the curtilage of the property.
4. The Skep System; in this case the operative empties the contents of one or more bins into a skep or larger bin which is carried between the the property and the collection vehicle. (Source; Ivor, H. Seleey, 1992)

**Solid Waste Disposal Methods**

In solving urban waste problems, a good number of methods could be

employed. These methods could either be short term or long term but are largely capitals intensive but the benefits far outweigh the cost.

Jerry, (2006) Observed that disposal of solid wastes on land is by far the most common method and probably accounts for more than 90% of the refuse disposal methods. Incineration accounts for most of the remainder, whereas composting of solid waste accounts for only an insignificant amount. He maintained that, selecting a disposal method depends almost entirely on costs, which in turn are likely to reflect local circumstances. The following are the available methods of dealing with urban waste.

### **I Landfill**

Sanitary landfill is the cheapest satisfactory means of waste disposal if only suitable land is within economic range of the source of the wastes. In a modern landfill, refuse is spread in thin layers, each of which is compacted by a bulldozer before the next is spread. When about 3m (about 10ft) of refuse has been land down, it is covered by a thin layer of clean earth, which also is compacted. Pollution of surface and ground water is minimized by lining and contouring the fill, compacting and planting the cover, selecting proper soil, diverting upland drainage and placing wastes in sites not subject to flooding or high ground water levels.

### **II Incinerator**

In incinerator of conventional design, refuse is burned on moving grates in refractory-lined chambers; combustible gases and the solids they carry are burned in secondary chambers. Combustion is 85-90% complete for the combustible materials. In addition to heat, the

products of incineration include the normal primary products of combustion-carbon dioxide of water as well as oxides of sulfur and nitrogen and other gaseous pollutants, nongaseous products are fly ash and unburned solid residue.

### **III Composting**

Composting operations of solid wastes include preparing refuse and degrading organic matter by aerobic microorganisms. Refuse is presorted, to remove materials that might have salvage value or cannot be composted, and is ground up to improve the efficiency of the decomposition process. The refuse is placed in long piles on the ground or deposited in mechanical systems, where it is degraded biologically to a humus with a total nitrogen, phosphorus, and potassium content of 1-3%, depending on the material being composted. After about three weeks, the product is ready for curing, blending with additives, bagging, and marketing.

### **IV Recycling**

The practice of recycling solid waste is an ancient one. Metal implements were melted down and recast into another form. Today, recyclable materials are recovered from municipal refuse by sorting out the waste materials and processing into other materials or forms e.g. toilet tissue can be produced from waste papers.

(Source; Microsoft Encarter, Microsoft Corporation 2006.)

### **Need for a Sustainable Solid Waste Management Planning**

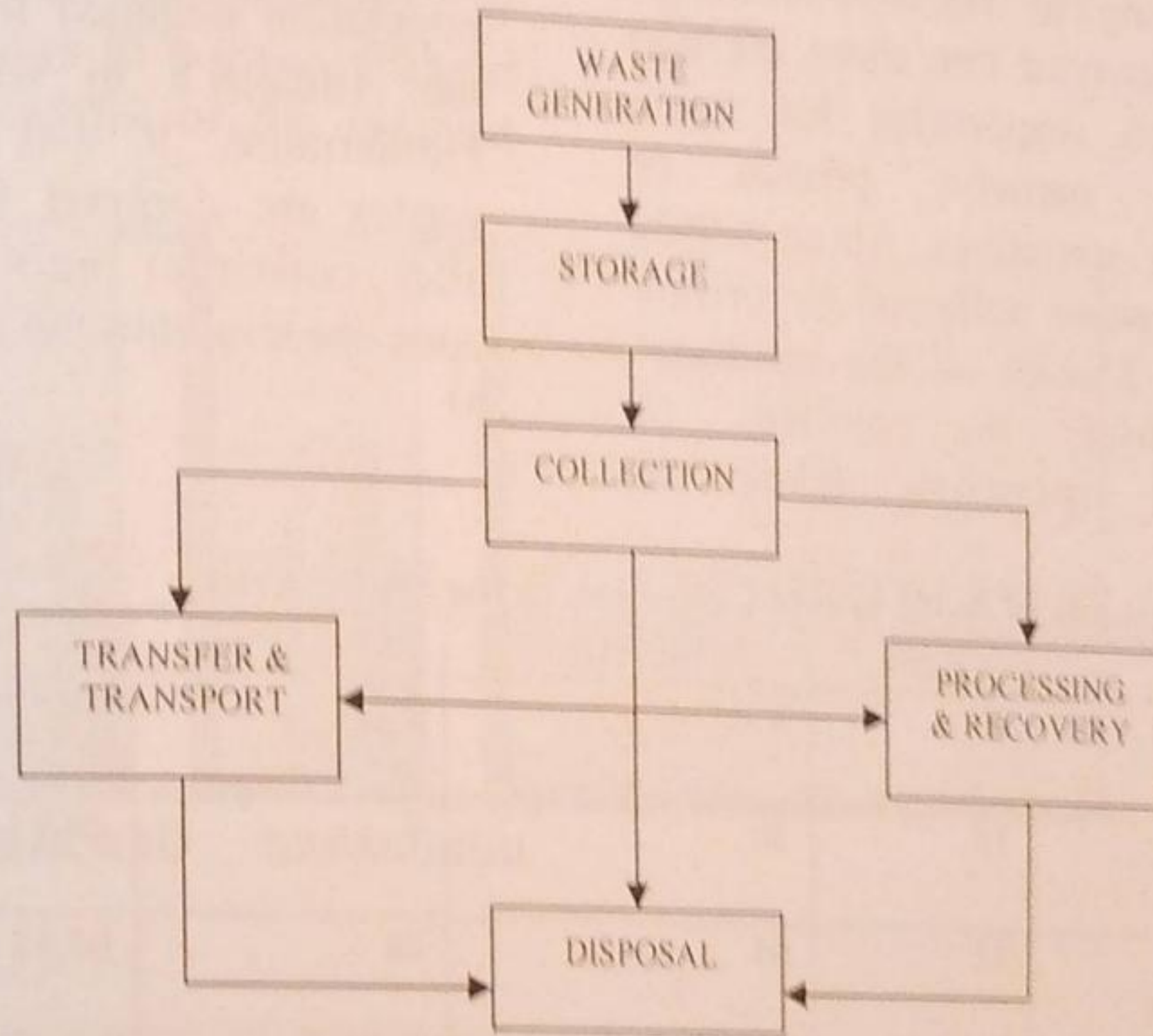
Generally, bad refuse/waste disposal schemes as a whole characterize most of the urban centres in Nigeria. Refuse mounds and dumps are common features of the

contemporary urban centres. In most cases, many people dispose their wastes in cities gutters, drains, streams and rivers. The waste material so deposited become clogged up and flooding results at the on set of a rainy season as the available water ways have been blocked due to the deposit (Ahmed, 2000).

Waste management therefore relates to waste handling, controlling and monitoring of the technique adopted in managing the available waste (Mabogunje, 1974). In the same vein, Khan et al.(1990) described Solid Waste Management Planning as the development, comparison and monitoring of various alternative approaches to the

solving of municipal solid waste problems. He mentioned that it also includes environmental, economic, social and political factors. According to Khan et al. it is the dynamic nature of these factors and there interrelationships that makes collection and analysis of data on waste very difficult and as such imposes a number of constraints on Solid Waste Management.

Solid waste Management consists of a number of individual activities which can be grouped into six functional elements namely, waste generation, on-site storage, collection, transfer and transport, recovery and disposal. (Khan et al.1990) See Fig.1 below.



Interrelationship of Functional Elements of Solid Waste Management

Source: khan et al.( 1990)

**Data Presentation and Analysis**  
**Sources of Waste Generated**

From the survey carried out in the area under study, waste generated within the areas consist largely of kitchen wastes such as vegetables, empty cans, leftover cooked foods,

old house wares, plastics, polythene bags, paper packs and cartons. This is in line with the findings of Saidu,(2007). These wastes constitute different percentages of the total waste component.

### Provision of Facilities for Solid Waste Storage

A close look at the waste storage facilities revealed that they are stored in waste bins, sacks, polythene bags while some residents do not have any waste storage facility. The study revealed that 40.44% of the sampled

population have no waste storage facilities. 16.44% make use of uncovered waste bins which can lead to spread of diseases. Only 43.12% of residents provide for adequate waste storage facilities. (See table 3)

Table 3: Provision for Waste Storage Facilities

Options	BOSSO	% RESPONSE	KPAKUNGU	% RESPONSE
Waste Bin	8	16	10	23.26
Sacks/Poly Bags	13	26	9	20.93
Uncoverd Bin	6	12	9	20.93
None	23	46	15	34.88
TOTAL	50	100	43	100

Source: field survey, 2007

### Wastes Collections in the Study Areas.

During the course of the study, it was discovered that there are two main bodies responsible for waste collections, namely; private or government operatives. About 9.96% have their waste collected by private operatives, 25.47% of the residents' benefits from the services of government operatives, while the

remaining 64.56% of the sampled population engaged their children or the Almajiri's in waste collection. Furthermore, it was observed that wastes are dumped indiscriminately after collection into any available open space within the area. (See table 4)

Table 4: Methods of Solid Waste Collection in the Study Areas

Options	BOSSO	% RESPONSE	KPAKUNGU	% RESPONSE
Private Waste Collectors	3	6	6	13.95
Government Operatives	15	30	9	20.93
Personal Arrangements	32	64	28	65.12
OTHERS	-	-	-	-
TOTAL	50	100	43	100

Source: field survey, 2007

### Disposals of Waste in the Study Areas

Residents in the study areas have had to dispose off their waste personally at one point or the other; either due to failure to collect waste promptly by designated government establishment and privates operatives as at when due or that the responsibility to dispose off

waste is solely on them. Most of the residents have resolved to open land disposal method, as 7.8% dispose off their waste by road sides, 10.33% on water channels while the remaining 76.36% of the population disposes on vacant plots or illegal sites. All these actions accounts for the evident environmental pollutions in the areas. (See table 5).

**Table 5: Methods of Solid Waste Disposal in Bosso Area**

Methods	BOSSO		KPAKUNGU	
		% RESPONSE		% RESPONSE
Road Side	2	4	5	11.63
Water Channels	8	16	2	4.65
Illegal Site	29	58	22	51.16
Vacant Plots	11	22	14	32.56
TOTAL	50	100	43	100

Source: field survey, 2007

**Response to Need for Commercialisation of Waste Collection**

Commercialisation of wastes collection will require resident's parting with a specified amount of money for waste to be collected either by government establishment or private operatives to a given disposal site. About 60.40% of the sampled

population supported the idea of Commercialisation, while the remaining 39.60% of the sampled population opposed the idea with reason that waste collection is the sole responsibility of the Local government. (See fig 2 ).

Fig. 2.

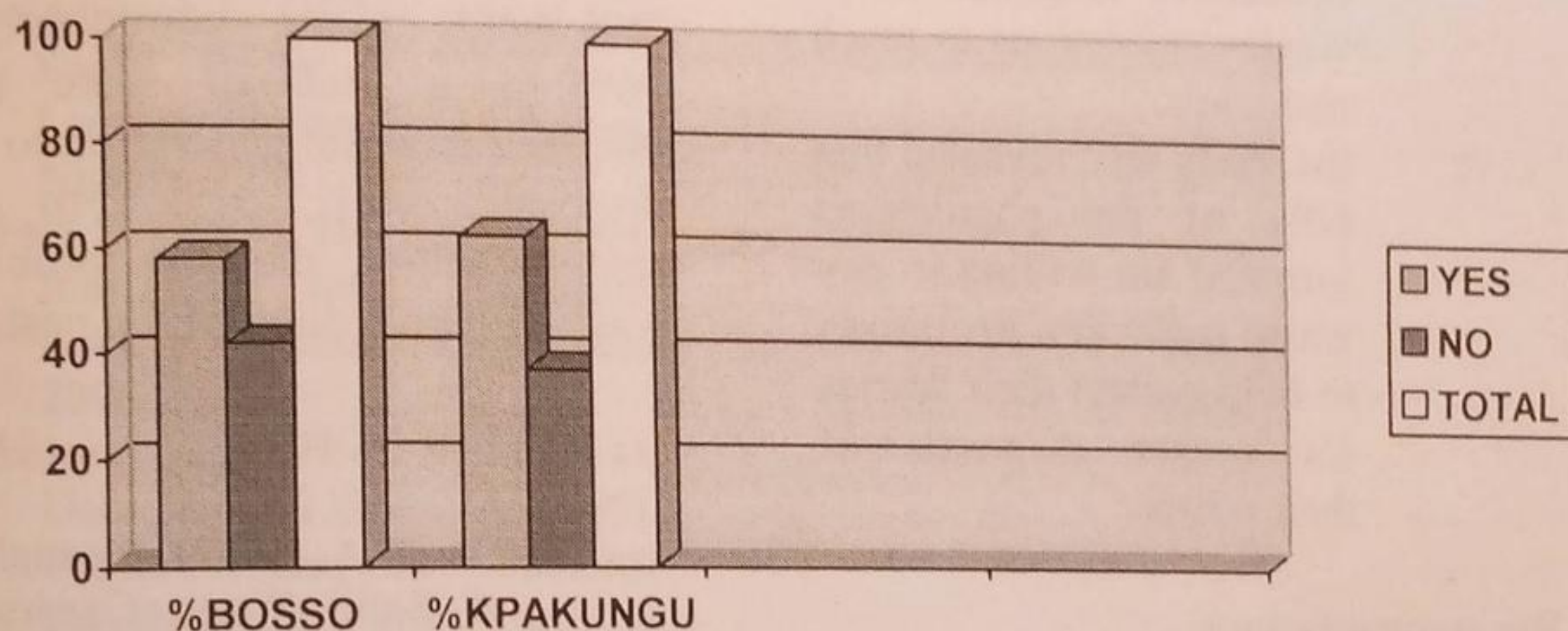


CHART SHOWING RESPONSE TO WASTE COMMERCIALISATION IN THE STUDY AREAS

**Summary of Findings**

In the course of this study, the following findings were discovered;

- i) that there is poor methods of waste storage in the study areas. Only 43.12% of the population sampled stores their wastes properly while 40.44% of the

- ii) population have no storage facilities. that 64.56% of the sampled population does not have their wastes collected by either private or government operatives. Therefore, wastes are dumped indiscriminately after collections by either

- their children or the "Almajiris".
- iii) Waste disposal methods in the two areas are faulty as most of the residents' adopts open land disposal method. Wastes are dumped on open sites, while the remaining ends in water channels, road-sides and on vacant plots.
- iv) observation also revealed that the two areas under survey does not have good layout plan both as a result of neglect by planning authorities and violation of building regulations by residents'. Therefore, accessibility to some areas is very difficult which could make it difficult for government or private operatives responsible for wastes collections to reach residence.
- v) the study also revealed that 60% of the populations sampled are willing to pay waste collection operatives to help collect their wastes for proper disposals of their refuse.

### Recommendations

In the light of the above findings, the study recommends as follows;

- i) that the state organs responsible for waste collections and disposals should be well equipped for the effective performance of their roles.
- ii) Private waste collection operatives should be mobilise and organise to adequately perform their functions within the neighbourhood. This could be done by passing a law which makes it mandatory for

residence to dispose off their wastes properly.

- iii) that the development control board should enforce planning laws regarding development on land in order to curb violation of building laws and for easy accessibility. And that,
- iv) the general populace should be mobilized to actively participate in the process of refuse collection and disposal for better environment and urban sustainability. This could be done through effective public enlightenment on radio, television and community sensitization through local leaders and chiefs.

### Conclusion

Improper disposal of solid waste has great environmental implications which we often overlook. If every household, every community, the government and all stake holders involved in waste generation to proper disposal will rise to their responsibilities, then the problem of waste will be a thing of the past.

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## Understanding Public-Private Partnership as A Tool to Achieving Sustainable National Development

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### Abstract

There are numerous reasons why the international and policy community has supported private participation in infrastructure provisions. Public-private partnerships (PPP) have gained support due to the improvements in financing, pricing, efficiency, risk distribution, human resource management, and services they can provide. Despite these apparent benefits of public-private arrangements in infrastructure provision, there are numerous problems associated with such arrangement. This is why this study examined the different forms of PPP arrangements available, their modes of operation, problem associated with such arrangements, which ranges from power of corporate players, access inequality, environmental concerns, increased public risk, and inappropriate application of private participation. The study suggests that achieving optimum benefits from this form of arrangement will depend on the future development of factors decisive for the growing importance of partnerships: economic conditions and prerequisites, local authority scope for action and finances, and the way local authorities define themselves, together with the relevant political actors and their main priorities. All these factors and their development determines whether PPPs become the rule, an exception or a transitional stage towards the progressive privatization of public sector responsibilities.

**Keywords:** Infrastructure, national development, optimum benefits, Public-private Partnership and Urban sustainability.

### 1.0 Preamble

The recent quest to achieve sustainable development in the country has revealed the fact that governments (Federal, State and Local) alone cannot achieve this goal without the assistance of the private individuals who are either profit making enterprises or non-profit making organisations. This is because huge capital is required in providing infrastructure in the urban and rural areas. Hence the need for government to partner with private individuals to achieve their laudable goals. The consensus is that improvement of the economy could be attained with concerted partnerships between the public and private sectors. Also, the attainment of meaningful and sustainable development requires the genuine participation of both the public and private sectors. (Bankole et

al., 2005). One thing always forgotten is the fact that the public interest may not necessarily be private interest. The public aim might be, providing a liveable environment for the benefit of the citizenry, while private interest may be centered on how to maximise profit at a minimal cost.

This conflict of interest is the major problem that needs to be addressed if sustainable development is to be achieved. If care is not taken, the profit burden might be passed on to the poor citizens or private partners who will succeed in sapping the nation's funds. Worse more a breach of contractual agreements may occur which may lead to more and more abandonment of projects.

It is therefore of utmost importance for public and private partnership to be well defined and a common goal established in order to

achieve the desired sustainable development.

### Statement of Problem

Given the shortage of public funds in most developing countries, Nigeria inclusive, the obvious solution is to invite greater private sector participation, which might not be too safe since investing in infrastructure projects in many parts of the world is not financially viable from a private sector perspective. Therefore, there is the tendency that the private sector will seek to pass the envisaged risk associated with their form of investment to the public sector, because their ultimate goal is to effectively maximise profit.

It is against this background that this study seeks to examine the potential benefits and possible risks associated with PPP with the view of guarding against embarking on an unprofitable venture and to see how the scheme could be more beneficial to all stake holders involved, but most especially to the private sectors.

### Justification for Study

Nigeria, in just some few weeks back celebrated ten(10) years of unbroken democracy. Every visible improvements and development in the economy within this period has been termed "Dividend of Democracy". Also, within this period, there has been succession of power at every level of government with each politician show casing what they have done and will do to proof to the masses that they are better-off than their predecessor, thereby entering into different contractual agreements with private investors.

The justification of this study hinges on the fact that our leaders need to be cautioned with the way they handle the nation's fund and

resources in the face of dwindling and unstable economic situations. Furthermore, developmental funds are becoming very scarce and the search is on to find new sources of funding projects. Therefore our government needs to exercise caution so as not to venture into projects that are not viable and in the longrun not beneficial to the nation at large.

### Aim and Objectives of Study

The aim of this study is to critically examines the roles of PPP in national development; with the view to identifying potential benefits and risk associated with such arrangement and suggest ways of achieving success in PPP in the attainment of sustainable national development.

In pursuance of this goal, the following objectives shall be observed;

- i. trace the history of PPP in national development.
- ii. examine the different forms of PPP available and their mode of operations.
- iii. Identify risk and problems associated with PPP arrangements.
- iv. Identify factors determining the success of PPP for the achievement of sustainable development.

### Public Private Partnership Defined

According to Raghav(2008) Public private partnerships (PPPs) are arrangements between government and private sector entities for the purpose of providing public infrastructure, community facilities and related services. A PPP is a contractual arrangement between the public and private sectors, with clear agreement on shared objectives, for the delivery of an asset or service that would otherwise have been provided through traditional public sector procurement. Public sector includes

government agencies, and local government Institutions while private sector includes private profit sector, association of private sector, and non profit service delivery institutions.

Bankole et al (2005) described PPP as the new trends in partnership strategies and an alternative approach to the delivery of goods and services. They defined PPP as contractual agreements between the public sector and the private sector to achieve well-defined and shared objectives in a well-managed, costeffective, efficient and sustainable manner.

### **History of Ppp in National Development**

According to Stephen( 2005) almost all developing countries have undertaken public-private partnerships in infrastructure since 1990. Some countries and sectors, as well as some forms of PPP, have been much more prominent than others, but this should not disguise the quasi-universal nature of the phenomenon. Investment in infrastructure projects with private participation in developing countries took off in the early 1990s, growing from USD 18 billion in 1990 to peak at USD 131 billion in 1997. Faced with the growing perception that existing infrastructure was both insufficient and inefficient, developing countries began to open up the sector to foreign participation beginning in the early 1990s.

Gray et al.(2003a) maintained that over the past two decades governments in developing countries and several developed countries have embarked on radical structural reforms, encompassing restructuring and privatisation of infrastructure sectors and a new approach to regulation. One prong of this new strategy involves public-private partnerships to provide infrastructure.

PPPs were responsible for USD 786 billion in infrastructure investments between 1990 and 2003. Some of this money obviously came from the public purse, but the private sector nevertheless contributed significantly to infrastructure development over the period ( far in excess of what governments could have financed on their own ) and assumed several of the risks (e.g. commercial and currency risk) that would otherwise have befallen the public sector.

The European Commission observed that recent years have seen a marked increase in cooperation between the public and private sectors for the development and operation of infrastructure for a wide range of economic activities. Such Public-Private Partnerships (PPP) arrangements were driven by limitations in public funds to cover investments needs but also by efforts to increase the quality and efficiency of public services. This is particularly true, given the enormous financing requirements to bring these infrastructures up to the standards. The Commission has identified four principal roles played by private sector in PPP schemes as follows:

- i) to provide additional capital;
- ii) to provide alternative management and implementation skills;
- iii) to provide value added to the consumer and the public at large;
- iv) to provide better identification of needs and optimal use of resources.

In the quest to achieving the Millenium Development Goals (MDGS) and the attainment of the 7 Point Agenda of President Yar'adua the Nigeria government over the years have also partner with private sectors in provision of basic infrastructures

and services ranging from the construction of physical infrastructure, to public administration, to the provision of health and social services for the achievement of sustainable development.

### Potential Areas of Ppp in National Development

The potential areas in which PPP is applicable for national development will include;

- i) *Public Utilities* such as; Bus Park, Parking area, Health services, water, Market Centres, Public Park and Recreation Areas, Bridges, Road, Electrification projects, Telecommunication, Convention centers, Urban Sewerage system, Housing etc.
- ii) *Income Initiatives* like; Dairy, Slaughter House, Public housing, Mass Transit Systems, City Transport Systems, Agriculture etc.

However, Public private partnerships can occur in a wide spectrum of local activities and services: in the transport sector, in municipal sewage and waste disposal, in urban and regional development, in housing construction and environmental protection, as well as in the operation of cultural, educational or recreational facilities. PPPs may be set up for all public (local authority) services as long as there are no statutory obstacles to full or partial privatization. Werner(2005).

Gray et al (2003b) observed that, as a rule, private developers show an interest in economic crisis regions or areas with low commercial demand only when the public sector offers attractive incentives, particularly of the financial or planning-regulation type, and when,

despite the problems they face, the areas concerned, appear to possess the potential for economic and commercial growth.

As regards the project priorities of public private partnerships, first of all construction, urban development, and infrastructural improvements play the prime role in the majority of cases. As a rule, these are complex and quite often spectacular projects which are expected to improve the image of an urban area or the city concerned. Many these projects have not been undertaken in reaction to actual demand; they have been the outcome of a supply-oriented growth strategy, fuelled by government subsidies and private borrowing opportunities. Medalye et al.(2008)

Werner(2005) stated that, beginning in the mid 1990s, private actors showed increasing interest in the profitable facilities of urban transport, sewage and waste management infrastructure; and nowadays, apart from these activities, "practical" activities (like renovation, operation and management) in a wide range of public facilities are to the fore.

PPP's activities in Nigeria are evident in the following areas; Road, Electrification projects, Telecommunication, Convention centers, Urban Sewerage system, security, Health Care, Housing, Transportation, Education etc.

### The Most Common Forms of Ppp in Utilities

In public-private partnerships, the public and private sectors join forces to design, finance, build, manage or maintain infrastructure projects. According to Stephen, (2005), such partnerships can take many forms, depending upon the exact allocation of risks and responsibilities. These includes:

### 1. *Service contracts.*

The private sector provides a bundle of specific services to a public utility, but the public sector retains overall operational responsibility. Service contracts can in practice take many forms, but two of the most common ones are:

i) *Management support.* The private operator supplies the public authority with human and technical resources for a fee. It provides technical know-how on all operational and financial aspects of project management remaining within the jurisdiction of the public authority.

ii) *Operation and management (O&M).* The private operator is in charge of daily maintenance of the facilities. The private operator is paid for its services by the public authority according to specific and qualified performance criteria. Unlike management support, the private operator may in some cases take on the responsibility for operating the facilities.

### 2. *Delegated management contract*

In his type of contracts the public sector retains overall ownership of the assets, but delegates the responsibility for their operation to a private operator for a definite (often long) period of time. Two of most commonly seen models are:

i) *Affermage or lease agreement.* The private operator manages the services for a period (often five to fifteen years) and is responsible for maintaining and renewing the facilities according the terms of the

contract. In this capacity, it takes charge of all personnel and existing assets but is not responsible for financing new facilities. The public authority remains responsible for all new investment and compliance to existing norms. The private operator invoices the end-users directly.

ii) *Concession.* The public authorities fully entrust the private operator with management of the services and all necessary investment for a period of 20 years or more. The private operator invoices the end-users directly, the public authorities retaining strict control over service terms as well as all key decisions related to applicable rates and targets.

### 3. *Construction support.*

In the most wide-ranging form of PPP contracts the private operator is involved in the design and construction phases of new infrastructure and carries at least some of the risks associated therewith. Some of the main forms of construction support have been:

i) *Build Design Operate (BDO).* The public authorities entrust the private operator for a fixed period of time with design, construction and operation of new facilities which remain the property of the public authorities. The private operator assumes the risks linked to design and management of the facility. It is paid a fee by the public authorities and commits to an overall cost for the

facility's construction and operation.

- ii) *BOT (Build Operate Transfer)*. The private operator designs, finances and builds infrastructure. While formal ownership of the assets is assigned to the government, the private sector operates the project long enough to service any debt incurred and to earn a suitable return.
- iii) *BOO (Build Own Operate)*: In contrast to the BOT case, the private investor retains ownership and control of the project.

**Characteristics of Alternative Form of Ppp**

Gruber (2003), observed that the main forms of PPP differ in terms of the allocation of ownership, investment and commercial risk between the private and public sector. He observed that the two main considerations for countries seeking private participation in their infrastructure are efficiency and funding and that these can only be realised jointly where at least part of the investment is private. Where it remains public, only efficiency gains can be hoped for.

Therefore where there are cases of failing or distressed PPPs it can easily be traced back to whether the commercial risk rests with the public or the private sector. (See table 1 below.)

**Table 1. Characteristics of alternative forms of PPP**

	Operation & maintenance	Ownership	Investment	Commercial risk	Duration (years)
Management support	Public and private	Public	Public	Public	1-2
Operation and management (O&M)	Private	Public	Public	Public	3-5
Leasing	Private	Public	Public	Semi-private	8-15
Concession	Private	Public	Private	Private	20-30
Build Design Operate (BDO)	Private	Public	Public	Private	20-30
Build Operate Transfer/ Build Own Operate (BOT / BOO )	Private	Public / private	Private	Private	20-30

Source: Gruber (2003) and OECD Secretariat.

**Risks Faced by Private Investors in Ppp**

Risk is associated with any form of investment and as such PPP is not without its own risk especially to the private sectors which will always seek to minimise these risks in order to adequately maximise profit. Gray et al. (2003) identified the risk of PPP to the investors to include the following:

*a. Design and construction risk:*

Given the size of many infrastructure projects, cost overruns and delays are common, especially if there are subsequent modifications to the design as a result of political or environmental concerns. The private sector typically bears this risk, even when the project will ultimately be run by a public entity.

b. *Operating risk:* When the private firm takes over the assets of a previous provider, usually the public sector, the quality of such assets is never completely known in advance. In the water sector, for example, most assets are underground. This risk can be reduced if the private operator initially enters the market through an operations and maintenance contract with the public sector provider.

c. *Commercial risk:* As with any investment, demand might not prove sufficiently robust at price levels necessary to ensure long-run profitability or might be subject to a macroeconomic shock. This risk is greatest in those areas where there has not previously been an infrastructure provider and hence potential demand is unknown or where tariffs were formerly subsidised and collection poor. In some contractual arrangements, the government accepts responsibility for tariff collection or agrees to buy the infrastructure service from the PPP at a fixed price. While this reduces the risk for the investor, it opens the way for almost certain renegotiations if a crisis means that the government can no longer afford its financial obligations.

d. *Regulatory risk:* Very few developing countries have a well-established and autonomous regulatory agency to deal with infrastructure. With no track record, such agencies might not apply regulations in a consistent pattern, especially if those laws and regulations are themselves untested.

e. *Political risks:* The support of the national government is often cited as a crucial factor in the success of a project. If this support wanes in the face of popular discontent at the cost of private provision or if a new regime disavows certain policies of its predecessor, the private operator

might find that contractual obligations of the government are no longer being honoured. Political risks might also involve litigation or bureaucratic barriers.

f. *Currency risk:* Perhaps the greatest risk to the profitability of a project involves the risk of devaluation. Infrastructure projects in developing countries are often financed in part through international lending. These debt repayments, together with payments of dividends, must be made in foreign currencies while profits usually accrue in the local currency. As a result, any sudden devaluation can completely modify the profitability of a project. This was the case for many PPPs in the 1990s, notably in Latin America and Southeast Asia, and helps to explain the diminished enthusiasm for such projects on the part of the international investment community.  
(Source; Gray et al. 2003)

### **Problems Associated With Ppp Within Developing Countries**

Jacqueline(2008) observed that despite the apparent benefits of private sector involvement in infrastructures provision, there is also evidence which fosters opposition to this form of governance. Problem arises from concerns over the economic implications of private participation, the power of corporate players, labour concerns, access inequality, environmental concerns, increased public risk, and inappropriate application of private participation.

Also, based on a study carried out by Sader and the *Camdessus Report*, (2000) which focused on the experience with partnerships in the water sector in Senegal, the main problems associated with PPP within



developing countries would seem to include ;

- **Conflicting aims.** Often one objective (that is, one PPP project) has been expected to serve several policy objectives, from financial, to macroeconomic, to social, to environmental. Protests by local communities and non-governmental organisations against individual projects have rebounded on investors rather than the initiating authorities.

- **Award procedures.** The award procedures often lack transparency and are not based on objective evaluation criteria. Corruption has been a problem – in general, and in the specific context of awards. Also, some projects have been compromised by official preference for local participation, preferred sub-contractors or suppliers and the employment of weakly qualified local staff.

- **Regulatory frameworks.** A weak legal environment necessarily leads to concerns for non-state underwriters of long-term contracts. Existing legislation in many countries was designed to define public sector responsibility in infrastructure and is inadequate in a situation of private participation. In addition, human capital such as relevant regulatory expertise is in short supply in many countries without much experience in privately operated utilities.

- **Public governance.** Many private investors have had to contend with

conflicting public authorities, for instance central versus sub-national governments, or regulatory bodies versus ministries. In addition, non-existent or inexperienced regulators created avoidable uncertainty about price and tariff setting.

- **Existing service providers.** Where incumbent service providers, often state owned, remain in the market they are often the subject of preferential treatment. This goes hand in hand with a tendency, in many countries, to invite private participation in the absence of a commitment to overall sectoral liberalisation.

- **Political commitment.** In countries where the rule of law is not firmly entrenched governments have reneged on contracts signed by previous administrations. There also have been several cases of governments reneging on contractually agreed terms (e.g. the right to levy cost-recovering tariffs) in the face of public dissatisfaction.

### Advantages and Disadvantages of Ppp

For the suitability and effectiveness of alternative ppp structures the basic knowledge about the advantages and disadvantages of each type of PPP is required. This will enable any government hoping to enter into such form of agreement to have a clear view of what she is into, various risks associated with each action and how to better manage such risk. See table below:

Table 2: Advantages and Disadvantages of PPP Relationships

PPP Type	Main Features	Application	Strengths	Weaknesses
<b>Contracting</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Contract with private party to design &amp; build public facility</li> <li><input type="checkbox"/> Facility is financed &amp; owned by public sector</li> <li><input type="checkbox"/> Key driver is the transfer of design and construction risk.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Suited to capital projects with small operating requirement.</li> <li><input type="checkbox"/> Suited to capital projects where the public sector wishes to retain operating responsibility.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Transfer of design and construction risk.</li> <li><input type="checkbox"/> Potential to accelerate construction programme</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Possible conflict between planning and environmental considerations.</li> <li><input type="checkbox"/> May increase operational risk.</li> <li><input type="checkbox"/> Commissioning stage is critical.</li> <li><input type="checkbox"/> Limited incentive for whole life costing approach to design.</li> <li><input type="checkbox"/> Does not attract private finance</li> </ul>
<b>BOT (Build Operate Transfer)</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Contract with a private sector contractor to design, build and operate a public facility for a defined period, after which the facility is handed back to the public sector.</li> <li><input type="checkbox"/> The facility is financed by the public sector and remains in public ownership throughout the contract.</li> <li><input type="checkbox"/> Key driver is the transfer of operating risk in addition to design and construction risk.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Suited to projects that involve a significant operating content.</li> <li><input type="checkbox"/> Particularly suited to water and waste projects</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Transfer of design, construction and operating risk</li> <li><input type="checkbox"/> Potential to accelerate construction</li> <li><input type="checkbox"/> Risk transfer provides incentive for adoption of whole life costing approach</li> <li><input type="checkbox"/> Promotes private sector innovation and improved value for money.</li> <li><input type="checkbox"/> Improved quality of operation and maintenance.</li> <li><input type="checkbox"/> Contracts can be holistic</li> <li><input type="checkbox"/> Government able to focus on core public sector responsibilities</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Possible conflict between planning and environmental considerations.</li> <li><input type="checkbox"/> Contracts are more complex and tendering process can take longer</li> <li><input type="checkbox"/> Contract management and performance monitoring systems required.</li> <li><input type="checkbox"/> Cost of re-entering the business if operator proves unsatisfactory.</li> <li><input type="checkbox"/> Does not attract private finance and commits public sector to providing long term finance.</li> </ul>
<b>DBFO (Build Design Finance Operate)</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Contract with a private party to design, build, operate and finance a facility for defined period, after which the facility reverts to the public sector.</li> <li><input type="checkbox"/> The facility is owned by the private sector for the contract period and it recovers costs through public subvention.</li> <li><input type="checkbox"/> Key driver is the utilisation of private finance and transfer of design, construction &amp; operating risk.</li> <li><input type="checkbox"/> Variant forms involve different combinations of the principle responsibilities.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Suited to projects that involve a significant operating content.</li> <li><input type="checkbox"/> Particularly suited to roads, water and waste projects</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> As for BOT plus:</li> <li><input type="checkbox"/> Attracts private sector finance;</li> <li><input type="checkbox"/> Attracts debt finance discipline;</li> <li><input type="checkbox"/> Delivers more predictable and consistent cost profile;</li> <li><input type="checkbox"/> Greater potential for accelerated construction programme; and</li> <li><input type="checkbox"/> Increased risk transfer provides greater incentive for private sector contractor to adopt a whole life costing approach to design.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Possible conflict between planning and environmental considerations.</li> <li><input type="checkbox"/> Contracts can be more complex and tendering process can take longer than for BOT.</li> <li><input type="checkbox"/> Contract management and performance monitoring systems required.</li> <li><input type="checkbox"/> Cost of re-entering the business if operator proves unsatisfactory.</li> <li><input type="checkbox"/> Funding guarantees may be required.</li> <li><input type="checkbox"/> Change management system required.</li> </ul>
<b>Concession</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> As for DBFO except private party recovers costs from user charges.</li> <li><input type="checkbox"/> Key driver is the</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Suited to projects that provide an opportunity for the introduction of user charging.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> As for DBFO plus:</li> <li><input type="checkbox"/> Facilitates implementation of the <i>Polluter Pays Principle</i>; and</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> As for DBFO plus:</li> <li><input type="checkbox"/> May not be politically acceptable</li> <li><input type="checkbox"/> Requires effective management of</li> </ul>

	Public: Ppa (principle and utilising private finance and transferring design, construction and operating risk)	Particularly suited to roads, water (municipalities) and waste projects	Increases level of demand risk transfer and encourages generation of third party revenue	alternatives / substitutes, eg alternative transport routes; alternative disposal options)
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Source: Adapted from European Commission Directorate-General Regional Policy, Brussels, (February 2003)

Table 2 above, indicates some forms of PPP with their areas of operations, strength and weaknesses. In other word, success in any PPP agreement will depend on basic knowledge of mode of operations of each forms of PPP, their strength as well as their weaknesses.

The European Commission Directorate-General Regional Policy (2003) suggested that success in any PPP arrangements will depend on the following key points:

- i) ensuring open market access and fair competition;
- ii) protecting the public interest and maximising value added;

Therefore, the best that developing country authorities, acting on their own, can do to enhance the chances of successful PPPs is to:

- Develop a better knowledge of the operation of different forms of PPP;
- Take steps to address obstacles and problems associated with each; and
- Prepare better all levels of the public administration before embarking upon such partnerships.

#### Cases of Failed or Otherwise Disappointing Ppps

According to *World Bank Report, (2003)*, Between 1990 and 2003, 91 projects worth USD 27 billion were cancelled, representing only three per cent of total PPPs and of total investment – a relatively small share

given the crises to which many prominent developing countries have been subjected since the mid-1990s. A more complete picture can be obtained by including projects which are distressed in the sense that at least one partner has requested termination or the project has been submitted to international arbitration. Cancelled and distressed projects amount to five per cent of projects and nine per cent of investment. The discrepancy between these two shares suggests that larger projects have a greater likelihood of encountering difficulties.

Estache et al. (2004) observed that, the greatest number of troubled projects has been in the energy sector, followed by toll roads and telecommunications (see table 3). As a share of total investment in each sector, water and sewerage has had the least favourable experience with over one third of investment in cancelled or distressed projects. In contrast, the telecommunications sector has one of the highest success rates in terms of investment in on-going projects.

According to the *European Commission Report(2003)*, By number of projects there is little difference in the failure rates, ranging

from four per cent for management and lease contracts to seven per cent for concessions. Measured by investment value, however, concessions are three times more likely to fail than greenfield projects and twice as likely as divestitures. While this might suggest that concessions are inherently more risky, it seems more likely that they are preferred in those sectors with the greatest political sensitivity since they allow the host government to retain ownership of infrastructure assets. The greater failure rate is thus more an indication of the sectors in which concessions are used than the legal form of the project itself. Most failed projects have tended to be terminated relatively early in their life, on average four and a half years after financial closure.

Excluding telecommunications, over forty per cent of concessions in Latin America between 1989 and 2000 were renegotiated, including over 70 per cent of those in the water sector. (Guash, 2002). In the region's water and transport sectors, 58 per cent of renegotiations were initiated by the government, compared with

only one third by private investors. It can of course be argued that contracts lasting 15 to 30 years are perhaps bound to encounter changing and unforeseen circumstances, but 60 per cent of all renegotiations took place within the first three years of the concession. (Harris et al. 2003).

Finally, over time the value of investments which are either cancelled or subject to termination proceedings or international arbitration in any given year has dropped precipitously from a peak of USD 13 billion in 1997 to only USD 500 million in 2003. This trend suggests that the financial crises of the late 1990s may have run their course in terms of deleterious effect on project profitability. (Hesselbarth, 2004)

This is a lesson to the Nigerian government who presently are adopting the same avenue for the provision of basic infrastructures for national development. To succeed in any PPP, there is need for proper knowledge of various forms of PPP, set up proper monitoring mechanism and avoid signing long durations contracts.

**Table 3: CANCELLED OR DISTRESSED PROJECTS BY SECTOR AND BY TYPE, 1990-2003**

Sector	Cancelled or distressed projects		Share of total	
	Number	Committed investment (2003 US\$ billions)	by number	by investment value
Energy	59	29,8	5,3%	11,4%
Natural gas	8	7,1	4,3%	16,7%
Electricity	51	22,7	5,5%	10,4%
Telecommunicas	21	13,4	3,5%	3,7%
Transport	47	14,9	6,4%	12,0%
Airports	3	0,7	3,4%	5,9%
Ports	3	0,2	1,4%	0,1%
Rail	4	2,0	4,9%	7,4%
		155		

Toll roads	37	11,9	10,3%	
Water & sewerage	15	14,3	5,7%	18,9%
<b>Total</b>	<b>142</b>	<b>72,3</b>	<b>5,2%</b>	<b>35,9%</b>
Concession	37	21,3	6,5%	9,2%
Divestiture	36	28,4	5,8%	18,9%
Green/f projet	63	22,0	4,5%	8,9%
Mgt. or lease contract	5	0,7	4,4%	6,3%
				0,0%

Source: World Bank PPI database(2003)

### How to Acheive Success in Ppp Arrangements

Most developing countries, Nigeria inclusive are already entering into PPP agreements in the provisions of basic infrastructures for the development of their environments, but are encountering problems as highlighted above, which ranges from usage of substandard materials, upshot of contract sum and in some cases, abandonment of projects. etc

What we fail to understand is that, though PPPs presents a number of advantages, these schemes are also complex to design, implement and manage. They are by no means the only or the preferred option and should only be considered if it can be demonstrated that they will achieve additional value compared with other approaches, if there is an effective implementation structure and if the objectives of all parties can be met within the partnership.

In order to profit from the advantages of PPP, all potential participants must enhance their understanding of the different approaches and the optimal methods to structure such arrangements.

Success in PPP will depend on the simple knowledge and undestanding that:

1. Each PPP structure has strengths and weaknesses which must be recognized and integrated. (See table 2 .)

2. PPP does not provide a 'quick fix' and should be applied only where suitable and when clear benefits and advantages can be demonstrated
3. PPP structures must be adapted to sectoral and project context
4. Desired impacts and benefits will influence PPP selection and design.

### Conclusions

While PPPs can present a number of advantages, it must be remembered that these schemes are also complex to design, implement and manage. They are by no means the only or the preferred option and should only be considered if it can be demonstrated that they will achieve additional value compared with other approaches, if there is an effective implementation structure and if the objectives of all parties can be met within the partnership.

### Recommendations

In view of the above findings, the study recommends as follows;

- i) There is need for the realisation of the facts that PPP is not an end in it self; but rather, a means to an end.
- ii) Government planning to partner with private investors need to understand the most

- suitable type of PPP for different development project before signing any agreement.
- iii) There is need for the establishment of legal platform with which action can be staged against defaulting investors in any PPP arrangement.
  - iv) No Government should use National Development programmes as platforms for the attainment of political ambitions; but rather be transparent in the handling of the Nations funds and resources.
  - v) There is need to formulate development programmes that will encourage the participation of the benefiting communities for local empowerment and poverty alleviation.

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