Integrated Solid Waste Management as Panacea for a sustainable Clean City in Nigeria: A Case Study of Ado Ekiti

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Abstract: *As a result of continuous economic growth, urbanization and industrialization there has been increase in volume and types of solid and hazardous waste particularly in developing countries. Many Nigeria cities and towns are facing problems of effective collection of garbage from homes and streets the situation that make Nigerians to be permanently accustomed to dirt environment. Based on this background, the paper examines the waste conditions and disposal as well as the influence on the environment in term of cleanliness at Ado Ekiti in Nigeria using both primary and secondary sources of data collection which were subjected to descriptive statistical analysis. The evidence of the result can be clearly seen every day by way of indiscriminate discharge of garbage into drains and at times on the highways due to ineffective ways of waste management in the town. The paper therefore recommends integrate waste management system as an option towards a clean city.*
Keywords: *Cleanliness, Environment, Management, Waste, Urbanization*

I.   Introduction

Cities are considered as economic engines, centres of innovations and culture which attract people to themselves for living, work and study. They are incubators where new ideas emerge, where capital accumulates and where trends in culture, lifestyle and entertainments are produced. Generally, city as pointed out in "[1]" is considered as the primary source of growth and innovation where the world`s business, financial and human capital are concentrated.

Incidentally, the growing urbanization, occasioned by the high rate of natural increase, rapid economic development and the in-built momentum for growth has led to urban waste crisis. The high level of indusrrialisation made developed countries to generate more of waste component that are less degradable. It has also been emphasized that the quantity of solid waste generation in the economically advanced countries is higher than in the developing world while paradoxically developing countries have recorded more failure in the effort to manage the solid waste generated effectively. This does not only lead to the rising volume of waste but contributes much to the indiscriminate dumping of waste in our cities particularly the pure water sachet that litter our roads and dot the city landscape.

The scenario did not only make the dream of almost every person in the world particularly in developing countries to live in clean cities to be a mirage but equally constituted the mix-match effects of the aesthetic look of our cities as well as serious health hazard. For instance, as pointed out in "[2]," Switzerland top the list of the world clean cities with overall Environmental Performance Index score of 95.5% while Accra is rated as the cleanest city in West African. In fact, Nigeria is still to compete at global level to reach that status. There is no doubt that Lagos which is the most populous city in Nigeria is only trying to be clean by ensuring that all solid waste generated in the city are effectively collected and disposed of in sanitary manner while street furniture open space landscape and beautification exercises are carried out [3]. At the same time many other cities like Calabar, Uyo and Owerri are making effort to create and maintain clean cities with varying degree of success [3].

Based on the above facts, the paper consider the concept of integrated sustainable waste management to examine the challenges of clean city in respect to the municipal solid waste management at Ado Ekiti and come out with recommendation that could make the people to live in a clean environment.

II.   Conceptual Framework and Literature Review

The concept for this paper is Integrated Sustainable Waste Management (ISWM). It is a framework that was first developed in the mid-1980s by WASTE, a Dutch NGO. It is also recognized as a systems approach with three important dimensions, namely the stakeholders, the elements and the aspect.

Integrated Waste Management
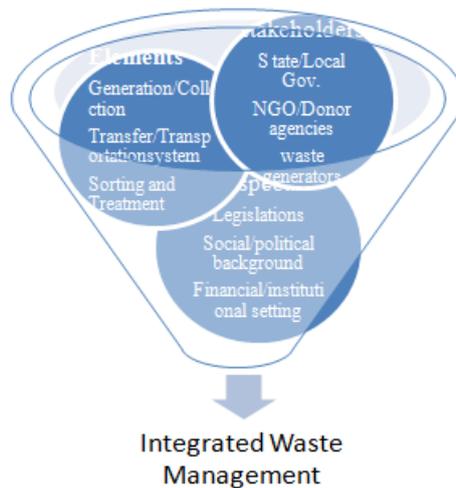
The stakeholders are the people or organization with a stake or interest in solid waste management. The elements are the technical components of a waste management system consisting of a variety of activities, involving reduction, reuse, recycling and composting, operated by a variety of stakeholders. Aspect of the management system includes the entire operational, financial, social, institutional, political, legal and environmental issues which can be used for assessing the situation, determining feasibility, identifying priorities and setting adequacy criteria.

Available records reveal that the world is not only experiencing rapid population growth, but equally witnessing high rate of urbanization and undergoing urban growth as well. For instance, the population of the world as in "[4]," pointed out that it took hundreds of thousand years for the world population to reach 1 billion and in just another 200 years or so it grew sevenfold. In 2011 the global population reached the 7 billion mark and it is projected to climb over 9 billion by 2050. Likewise, as also pointed out in "[5]," the proportion of the world population living in the urban which was only 3 percent in 1800, by 1900 almost 14 percent were urbanites of which 12 cities had 1 million or more inhabitants while in 1950 about 30 percent of the world population resided in urban centers with numbers of cities of million people grown to 83. In fact, available records as in "[6],"revealed that in 1950 about 733 million people or 29 percent of world population lived in urban areas and by 2005 the people had reached about 3.172 billion or 49 percent of the world population and projected to hit 4.9 billion or 61 percent by 2030.

Increase in population as a result of urbanization and industrialization together with the rising standard of the living of citizens contributed a lot of the growth and variety of waste being generated daily in our cities It is estimated that in 2006 the total amount of **municipal solid waste (MSW)** generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003 [7]. It is further estimated that between 2007 and 2011, global generation of municipal waste will rise by 37.3%, equivalent to roughly 8% increase per year. At the same time as pointed out in "[8]," the amount of waste generated in Lagos rose from 50 metric tones in 1960 to over 150 metric tons in 1971. However, with the ever increasing population, which is estimated to be over 15 million, Lagos, the country's commercial nerve centre has been trapped in mounting heaps of waste,

Unfortunately, the increasing volume of waste as a result of developmental changes in our cities does not only make effective waste disposal a failure but equally the waste the main sources of environmental challenges, particularly in keeping a clean city. This is due to the fact that waste evacuated, perpetually lag behind the rate of generation of waste. The data as in "[9]," shows waste collection rates for cities in low- and middle income countries generally in the range of 10-90%, which means that large portions of the population receive no services at all, and much waste ends up in the environment pollution and uncleanness. At the same time, it is estimated that between 30 and 50 percent of garbage in urban areas of Africa cities remain uncollected. The explanation as in "[10]," clearly indicated a change in East Africa from an efficient Municipal solid waste management (MSWM) system of the colonial days as a result of the lower urban population and adequate resources to the current status that displays inefficiencies. As a matter of fact, in most urban areas only a small fraction of the wastes generated daily is collected and safely disposed. For instance the percentage collected for Nairobi, Kampala and Dar es Salaam respectively are as in "[11]," 45% ,"[12];""[10]" 43% and"[13]," 30%. The situation is the same in West Africa.   For instance, as observed in "[14],"Accra which generated between 1500 and 1800 tons of waste per day could only disposed 1200 tons per day and attributed this to poorly maintained equipment and road design. In Nigeria the rate at which waste is being currently generated is about 70 percent as compared to the total rate of its disposal which is 30 percent with dehumanizing effect.[15]

In fact, government has to face a lot of problem in keeping cities clean and clear particularly in developing countries. This is simply because management of solid waste for a clean city really demands huge fund. Solid waste management as explained in "[16]," represents 20-50% of a city's budget, with 80-90% of that spent on waste collection. The urban areas of Asia were estimated to spend about $25 billion on solid waste management each year in 1998,"[17]" Unhealthy and poor environment costs the federal government of Nigeria a whopping $50 million about N10billion (Naira) annually".[18]" Hence, clean cities spend a substantial proportion of their available recurrent budget on solid waste management.

Available records revealed that most of the clean cities of the world are in developed world particularly north of equator. For instance, as pointed out in "[19]," 23 of the clean cities are located above the equator while only two were below, making the north cleaner than the south. According to the World Bank except New Zealand all other clean cities countries are super rich. As a matter of fact, excellent infrastructure good planning energy production recycling are some of the key points that normally looked upon when a city is being considered for cleanest

III. Study Area and Methods

The study area is Ado Ekiti, the state capital of Ekiti State. The metamorphosis of the town from local government headquarter to state capital actually led to the transformation of the physical landform of the town through the establishment of some higher institutions, promotion of economic activities in terms of commercial activities and light industries. All these equally contributed immensely to the population growth of the town. For instance, the past population census revealed that the population of the town which was about 20,000 in 1921, rose to over 150,000 in 1963, jumped to almost 400,000 by 2006 population census and projected to 500,000 for 2015. The rapid population growth tremendously influenced the physical development and expansion of the town. For instance, as in "[20]" the area of the town increased from $6.9km^2$ in 1961 to about $36.7km^2$ in 2006. Based on this development, the housing stocks in all the 20 enumeration wards of the town are now currently projected to about 5000.

The method for the study area involved primary and secondary survey. The primary survey was designed to collect data on how waste are generated and disposed at working and living area of respondents across the 20 wards of the city. The secondary data takes account of relevant data of agencies involved in waste management. The design instruments for the survey are Field Observation, Questionnaires and well structured interview. The field observation takes account of the strategic locations of waste bins and indiscriminate waste dump spots across the city. A total number of 480 questionnaires were distributed to households in all systematically sampled buildings in the 20 wards of the town. The sampled buildings were based on the size of these wards. In the core areas of the town where the size of these wards are small, twenty buildings were sampled in each ward while twenty five buildings were sampled in each other wards of the town.

The collected data were analyzed using the descriptive statistics. The descriptive analysis involves the use of quantitative tables for the presentation of the data.

IV. Result of Findings

The research findings of the paper were divided into four major sections, namely the socio-economic background of the respondents, waste analysis, waste management and Environmental conditions.

Socio-economic background: The result of the findings as indicated in Table 1 revealed that about 52 percent of the respondents have tertiary education as background and it is closely followed by secondary education. Unfortunately, majority of these respondents were low income earners with salary less than 50,000 Naira per month. As a matter of facts, those that earn over 100,000Naira per month were less than 10 percent. The findings equally revealed that institutions formed the major bedrock of economic activity of the respondents in the

. **Table 1: Social-economic background**

Background	Total respondent	Percent
Education		
Primary	31	6.45
Secondary	199	41.47
Tertiary	250	52.08
Economic activity		
Commercial	104	2.91
Industrial	72	5.63
Institution	294	61.25
Income		
Less than 50,000	278	57.91
Between 500000-100000	137	28.54
Over 100000	65	13.54

Source: fieldwork 2015

Waste analysis: From the analysis shown in the table below, it is obvious that organic waste food products were highly rated by 75 percents respondents in the town. This was followed by rubber/plastic related materials with 45 percent respondents.. It was also noted that residential area formed the major source of solid waste. At the same time, industrial activity contributed the least percentage of solid waste. Majority of the respondents considered self disposal of waste as the most common disposal system and this was followed by public waste disposal system.

Table 2: Waste analysis

	Highly rated		Average rated		Least rated	
Type of Waste	Respdt No	Percent	Respdt No	Percent	Respdt No	Percent
Organic food product	360	75	120	25	-	-
Rubber/Plastic product	67	13.96	216	45	197	41.07
Paper product	52	10.83	185	38.54	243	50.62
Metal/Glass product	-	-	15	3.12	465	96.88
Source of Waste						
Residential	427	88.96	53	11.04		
Commercial	38	7.92	250	52.08	192	40
Industrial			17	3.54	463	96.46
Institutional	14	2.92	178	37.08	283	60
Method of Disposal						
Self disposal	480	100				
Public disposal	-	-	380	79.17	100	20.83
Private disposal	-	-	100	20.83	380	79.17

Source: fieldwork 2015

Environmental condition The respondents' analyses of the environment indicate that about 68 percent have unkept road network while 5 percent are not connected with road network. Although 68 percent respondents indicate non- availability of river channel in their environment while 32 responded that their environment has polluted river channel. However 46 percent respondents experience unkept water drainage in their environment. According to the available data, almost 85 percent respondents indicated that their environment lack public waste bins and at the same time 52 percent respondents have their environment blessed with unkept vacant land.

Table 3: Environmental conditions

	Not Available		Available but unkept		Available and well kept	
	Respdt No	Percent	Respdt No	Percent	Respdt No	Percent
Road network	24	5	326	67.92	130	27.08
Water drainage	153	31.88	220	45.83	107	22.29
River channel	302	62.91	154	32.08	24	5
Public waste bin	408	85	57	11.88	15	3.12
Vacant land	182	37.91	249	551.88	49	10.21

Source: field work 2015

Waste management analysis: The management of waste was sole responsibility of state government through Ekiti State Waste Management Board until 2010 when selected private companies were allowed to participate in the management of solid waste in the town. The board initially made provision for twelve waste bins which were strategically distributed across the town and in 2014 another batch of fifteen were added. It is equally important to note that the number of sweepers employed to maintain the major streets stood at one hundred and twenty in 2003 and rose to two hundred and fifty in 2014.
The town had only one dumpsite as at 2007 and became three in 2014. The number of vehicles engaged for disposal of waste to the dump site increased from three in 2003 to twelve in 2014 while the drivers employed jumped from three in2003 to fifteen in 2014.

Table 4:Waste management analysis

	2003	2007	2010	2014
No of Agency	1	1	4	3
Staff				
Sweepers	120	150	200	250
Drivers/Operators	3	6	15	15
Operators Assistant	7	12	32	32
Adm staff				
Vehicles				
Tipper	-	2	3	3
Tractor	3	3	6	6
Trunks	-	-	2	3
Tricycles	-	-	-	-

Levelers	-	-	-	-
Waste Depot				
Landfill	-	-	-	-
Dumpsite	1	1	2	3
Recovery	-	-	-	1
Capital budget	3400000	1200000	2500000	4600000

Sources: Author compilation

V. Discussion of Findings

The facts that the town witnessed rapid population growth, physical development and expansion over the years tell much on the amount of waste being generated. This is simply because as population increases the waste generation increases. At the same time, organic products of domestic food remnants popularly known as garbage formed the major waste generated as a result of the fact that residential sector was rated the highest generator of waste.

Unfortunately, majority of these wastes which are self disposed is a clear indication of low participation of all stakeholders particularly the NGO and donor agencies. As a matter fact, the low participation of all stakeholders actually contributed much to non availability of public dustbins in residential areas and therefore made dropping of waste in drainage and water channel to be a popular phenomenon as could be seen in the plate below.

Plate 1: Ureje River with solid Pollutants
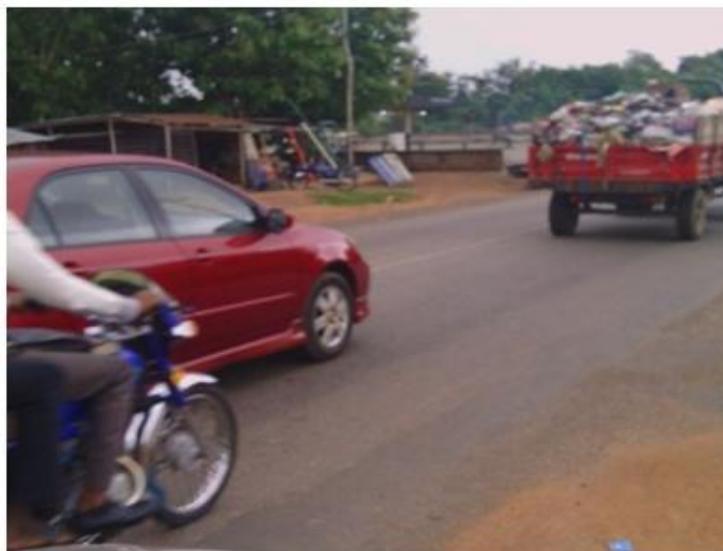

Source: Fieldwork 2015

The aspect of waste management in the town has nothing to write home about as a result of ineffective legislations and the altitudinal behavior of the people. These ineffective legislations and lack of control of human behaviors have no doubt contribute immensely to improper handling of waste which has become obvious in waste management where the existing system appears to be incapable of coping with the mountain of waste generated and heaped on the road side as shown in plate two . The situation of shortage of fund allocation as well as improper organization structure and control eventually become the main sources of environmental challenges, particularly in keeping a clean cit

Plate 2: Illegal waste disposal and Legal dumpsites

For instance, the shortage of personnel coupled with inadequate plants and equipments are indicators of poor evacuation and transportation system of waste management as shown in plate 3.The situation has resulted to mountains of indisposed waste at various located waste bins that were lopsidedly distributed against the residential areas where waste are heavily generated. The fact that recovery process in the town is still at infancy stage make sorting of waste to be alien. At the same time, lack of landfill has led to the indiscriminate dumping of waste at dumpsites which has not only resulted to mountains of refuse but equally constitute another environmental pollution. (See also plate 2)

Plate 3: The poor transport method

Source: fieldwork 2015

VI.   Conclusion and Recommendations

Obviously, increasing population of cities and urban settlements has no doubt contributed a lot to the growth and variety of waste being generated daily by their citizens. It is also observed that poverty, altitudinal behavior, low level of environmental awareness and poor governance actually led to the ineffective waste management system. At the same time, this has made continuous indiscriminate disposal of solid waste to be the order of the day which in turn makes the town unclean.

In order to address these challenges, the following issues must be addressed:

- Government must not only enact waste management laws they must educate the public properly about the laws especially youth in the school. There must be adequate enlightenment campaign for the adult on the importance and method of achieving clean environment. In order to keep the major routes free of refuse, government must make provision for adequate litter bins along the route at reasonable distance for pedestrians to drop their waste and also ensure regular collection and maintenance. At the same time, government is expected to take care of the proper collection of refuse in various offices and institutions.

- The local government which is the nearest organ to the people must rise to its constitutional role of waste management by purchasing enough disposal bins to be placed at various locations within the residential district where it will be convenient for residents and be accessible to local government disposal van. The local government must also employ more hands for collection of waste from individual home with payment of token fees for the evacuation exercises.

- The participation of private sector in the management of solid waste is imperative. In this respect, the collection of waste at the commercial district of the town should be the responsibilities of private waste management agency. The agency will have to negotiate with the people of the district in terms of agreement for the collection of the waste.

- The treatment of waste and resources recovery should be the responsibility of both the private and public sectors. The State Waste Management Board should be well funded to take adequate care of all dumpsites and to procure necessary equipment and tools for the provision of a sanitary landfill that could be properly treated and maintained. At the same time resource recovery methods of waste disposal such as composting, recycling and re-use should be emphasized. This will ensure the full exploitation of the long-neglected energy material potentials of solid wastes.

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