

1 Potential Impacts of Climate Change on Waste Management in 2 Ilorin City Nigeria

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6

7 **Abstract**

8 Ilorin is one of the major cities in Nigeria today and its growing capacity in both
9 socio-economic affiliations is commendable. However, the city is potently polluted with heaps
10 of refuse that are occasionally caused traffic hold-up in places in the urban centre. A lot of
11 health incidence resulting from water, air and pest borne diseases are not uncommon within
12 areas where prevalence of effluents prevailed. Current problems of poor waste management
13 upon the government efforts is as a result of the potential impacts of climate change on the
14 natural world, and with wide effects resulting from these changes has its implications in Ilorin
15 city. This work examines the management of waste in city of Ilorin which has been the sole
16 responsibility of the Kwara State Environmental Protection Agency (KWEPA) and other
17 health management sectors. Worldly wise, there are evidences that climate change and its
18 due,at least in part to human activities , gives rise to emissions of Green house gases (GHG,s)
19 which invariably is disturbing the world (Wilby,2003). Over the last 100 years, the average
20 temperature of the air near the Earth´s surface has risen a little less than 1° Celsius ($0.74 \pm$
21 0.18°C , or $1.3 \pm 0.32^{\circ}$ Fahrenheit). Does not seem all that much? These changes could have
22 significant impacts on a range of social, economic and environmental processes as well as
23 waste management in the areas selected for this study. Two hundred (200) questionnaires were
24 randomly distributed to member of households on wards basis in Ilorin. An addition of Fifty
25 (50) questionnaires was also distributed to agencies that control and manage waste, while
26 their contributions to waste control in the state were assessed. Suggestions were put forward
27 for all to remain alert, and that in the future we may experience higher temperatures,extreme
28 decay and more environmental problems except if proper precautions are taken.

29

30 **Index terms**— Climate Change, Potential impacts, Green house gases, Effluents, Waste management.

31 **1 INTRODUCTION**

32 Climate change results from the increase in the average temperature on Earth. As the earth is getting hotter,
33 disasters like hurricanes, droughts, floods, land degradation, accumulation of wastes and wastes decomposition
34 are getting more frequent. Human activities have led to large increases in heat trapping gases over the past
35 century. The climate change in the past 50 years or more is due primarily to human-induced increase. Global
36 average temperature and sea level have increased, and precipitation patterns have changed. All these not alone,
37 human "fingerprints" also have been identified in many other aspects of the climate system, including changes in
38 ocean heat content, precipitation, atmospheric moisture, plant and animal health and location, and de-forestation
39 syndrome have contributed to the phenomenon of our time.

40 In the U.S., the amount of rain falling in the heaviest downpours has increased approximately 20 percent on
41 average in the past century. Many types of extreme weather events, such as heat waves and regional droughts,

1 INTRODUCTION

42 have become more frequent and intense during the past 40 to 50 years. The destructive energy of Atlantic
43 hurricanes has increased. In the eastern Pacific, the strongest hurricanes have become stronger since the 1980s,
44 even while the total number of storms has decreased. Sea level has risen along most of the U.S. coast over the
45 last 50 years, and will rise more in the future. Arctic sea ice is declining rapidly and this is very likely to continue
46 (Lynne Cherry and Gary ??raasch, 2008). This work focuses on a study of Environmental Impacts of Climate
47 Change on Waste Control Procedures in Ilorin city of Nigeria . The aim of this study is centered on how to
48 improve on climate impacts to reduce perils of waste accumulation in the area of study. The attending objectives
49 used are: Assessment of changes in temperature and other weather parameters, which in turn activate waste
50 generation in the study area. Examination of disposal methods, if in conformity with modern method of waste
51 control and management or not, and, what are the assessment impacts resulting from climate change on waste
52 product on livability of people of Ilorin.

53 Climate change discourse has been a serious international environmental concern and the subject of much
54 research. Moreover, in international scientific circles, a consensus is growing that the buildup of C02 and other
55 Green House Gases(GHGs) in the atmosphere will lead to major environmental changes such as (1) rising sea
56 levels that may flood coastal and river delta communities; (2) shrinking mountain glaciers and reduced snow
57 cover that may diminish fresh water resources; (3) the spread of infectious diseases and increased heat-related
58 mortality;(4) possible loss in biological diversity and other impacts on ecosystems; (5) agricultural shifts such as
59 impacts on crop yields and productivity; and (6) increase in waste generation impediment (McCarthy, 2001).

60 Climate change could result in changes in temperatures, cloud cover, rainfall patterns, wind speeds, and storms:
61 all factors that could impact future waste management facilities' development and operation. The time scales for
62 climate change and waste management are similar. For instance, landfill sites can be operational for decades and
63 still remain active for decades following their closure (Houghton, 2001). There is, therefore, a need to consider
64 potential changes in waste management over significant timescales and respond appropriately.

65 In most developed and developing countries with increasing population, prosperity and urbanization, it
66 remains a major challenge for municipalities to collect, recycle, treat and dispose of increasing quantities of
67 solid waste, especially in a changing climate. A cornerstone of sustainable development is the establishment
68 of affordable, effective and truly sustainable waste management practices in developing countries. It must be
69 further emphasized that multiple public health, safety and environmental co-benefits accrue from effective waste
70 management practices which concurrently reduce GHG emissions and improve the quality of life, promote public
71 health, prevent water and soil contamination, conserve natural resources and provide renewable energy benefits.
72 The major problems facing Ilorin city today are incessant migration of people from rural areas and from other
73 urban centers, most especially from Northern parts of the country where many people fled from religious or
74 political persecutions. This new settlers added to the urbanization problems already prevailed in the city. This
75 also added to some challenges facing by urban planners and developers on ways to ensure that the city adopt
76 cleanliness pattern in conformity with modern cities of the world (Adedibu, 1983;Ahmed, 2008).

77 Ilorin metropolis lacks proper land use zoning arrangement, and has no precinct layouts of both new and old
78 area demarcation. The city has little proper provisions for open spaces, greenbelts and recreational activities.
79 The results of these have led to pollution of all types which are collectively referred as "brown agenda". This set
80 of problems disproportionately has impacts on human, urban health and productivity (Bartone et al, 1994).For
81 any city to be well developed, it must be properly planned because planning tends to concentrate on physical
82 environment through; orderliness of layouts, provision of needed and necessary infrastructure and facilities,
83 efficiency as well as ultimate aesthetic quality for the area. In other words, the planning process, from drawing
84 board to implementation is nothing but environmental control as a means of ensuring functional and harmonious
85 relationship between components of the urban areas and the ability to guarantee good health for urban residents
86 through a sanitary control and management ??Anozie, 1994).

87 In Ilorin, the capital of Kwara state, the problem of wastes is turning into alarming rate because the more
88 these wastes are evacuated the more they are generated on a daily or weekly basis(see table 1). Huge of refuse
89 are found dumped on unauthorized places, gutters and roads are filled up with sand and sediments which at
90 times obstructed both free movement of pedestrians and vehicles alike. Thus, the issue of solid waste situation
91 in Ilorin areas, to say the least, is quite distressing (Oyegun, 1987;Ahmed, 2000).

92 In Africa and Nigeria in general, cities and urban areas are the engines of economic growth and development,
93 but implications of such growth need a thorough environmental management and adequate control. All over the
94 world, urban centers/cities need environment that is free of health hazard, an environment where water, land,
95 river and forest, public health, sewage and garbage disposal in factories among others, are of great important to all
96 and sundry. Where these measures are not properly maintained, the consequences are numerous and hazardous.
97 The gathering and disposal of solid wastes become a major public health issue of our time and this needs some
98 urgent attention if our environment is to be protected. Therefore, this work sets up to achieve the following
99 objectives: Examination of disposal methods that conform to the modern time techniques in removing effluent,
100 bad odour, vermin, dust and other urban waste products in Ilorin township resulting from climate change in the
101 recent time. Also assessment of changes in temperature and other weather parameters, which in turn could affect
102 waste management and control processes among others in the study area.

103 **2 II. EVIDENCES OF CLIMATE CHANGE IN DEVELOPED 104 AND DEVELOPING COUNTRY**

105 The global temperature has risen by about 0.60c. over the last 100 years and 1998 was discovered to be the
106 single warmest year in the last 142 global instrumental record (Jonathan and Kerey ??2003). There is also
107 evidence in Nigeria today that climate change is already happening and it is due, to human activities that give
108 rise to emissions of greenhouse gases (GHG) get proper checks. Climate models suggest that in the future in this
109 country we are likely to experience higher temperatures, changes in seasonal precipitation and a shift to more
110 extreme rainfall events, rising sea levels and more frequent storms. These changes could have significant impacts
111 on a range of socio-economic and environmental processes that are affected by the weather ??NIMET, 2009) The
112 timescale for climate change and some of the consequences on how we manage our waste in urban centers are
113 similar. For example; landfill sites can be operational for decades and still be active for decades following their
114 closure. Residual wastes will remain in the landfill site for many years after degradation processes have ceased,
115 while capital assets like energy from waste plants and materials will remain to be operational for decades and so
116 could be affected by climate change. Climate change is happening now and so could already be affecting waste
117 management processes and operations that are subject to weather related impacts. There is therefore a need to
118 consider potential changes over significant timescale and respond appropriately. Different other types of waste
119 are daily piled up in streets of Ilorin, though a contracted company-, 'Clean and Jerk' (Ola Kleen) is responsible
120 for streets cleaning, but our disposal sites are affected by some undisputable items which need some additional
121 and modern means of waste disposal if we must abate the peril of impacts ahead of time in the state in general.
122 This study therefore, call for establishing a lasting solution to the socio-economic menace attached to the impacts
123 that change climate exerts on; individual, agricultural products and on human health conditions in the study
124 area. It suggests that some improvements on the methods of waste collection, transportation and disposal need
125 additional and overhauling operations.

126 Accordingly, the United Nations Programmes on 'Global Environmental Outlook 2000' has warned that an
127 impending worldwide environmental damage is imminent as a result of irreversible harm done to ecosystems
128 ??Owolabi, 2000). The Earth Summit in Rio in 1992 has also clearly alerts the world on the evils of environment
129 mistreatment ??FEPA, 1993). Though many nations are giving priorities to other environmental issues, while
130 many nations are facing other worldly hazards. For example, the United States of America had the highest
131 awareness on environmental issues followed by the European countries. While some Asian, Mid-East and African
132 nations are facing political upheaval and instability.

133 III.

134 **3 CLIMATE IMPACTS**

135 The world view of global warming project is documenting this change through science photography from the
136 Arctic to Antarctica, from glaciers to the oceans, across all climate zones. Rapid climate change and its effects
137 is fast becoming one of the prime events of the 21st century. It is real and it is accelerating across the globe. As
138 the effects of this change combine with overpopulation and weather crises, climate disruptions will affect more
139 people than does war ??Oyedele, 2009).

140 The status of waste management sector in Nigeria indicates that the availability and quality of annual data
141 are major problems for the waste sector. Solid waste data is lacking for many countries, data quality is variable,
142 definitions are not uniform and interannual variability is often not well quantified. However, there are three major
143 approaches that have been used Source : Rushbrook and Pugh (1999) and as modified by the Author (2011).

144 **4 IV. WASTE MANAGEMENT ACTIVITIES IN NIGERIA**

145 In Nigeria, recycling activities are not popular and non-existent. However, the recovery of materials from wastes
146 (scavenging) is practiced on a large scale. This type of recovery takes place at both legal and illegal dump sites
147 where scavengers search continually for valuable metals, plastics, and bottles to be reused or for sale to buyers
148 of different type of scraps. In general, treatment of solid wastes is not often carried out in Nigeria. Incineration
149 of wastes or use of approved sanitary landfill is non-existent. The most common practice is open dumping and
150 burning of waste within residential areas and at illegal and legal dumps. Other strategies employed in disposing
151 waste in the country include: a) Composting :

152 Composting is a biological process that uses micro-organisms to degrade organic matter using atmospheric
153 oxygen. The stabilized end product occupies a reduced volume compared with the starting Waste transfer points
154 are used by waste management companies as a means of increasing the efficiency of their waste collection service
155 through the bulking up of waste into larger consignments prior to transfer to dump and disposal sites. At the
156 transfer points, waste is loaded directly into large bulk container vehicles and transferred by road to the dump
157 site. The environmental impacts commonly cited are: odor, dust, bio-aerosols, attraction of bird, noise and
158 surface water pollution and surface water runoff management. Waste transfer stations are often located along
159 the streets, while the dump sites are usually away from the city centers.

9 SUGGESTIONS AND RECOMMENDATIONS

160 5 V. WASTE MANAGEMENT POLICIES AND REGULATIONS IN NIGERIA

161 The discovery of a major toxic waste dumped by a foreign company at Koko Town near Warri in Delta State, Nigeria in 1987 led to the establishment of Federal Environmental Protection Agency (FEPA) by Decree No. 58 of 1988. In June, 1999, the Federal Government of Nigeria created the Ministry of Environment and as a result, FEPA's function was absorbed by the new ministry.

162 The Federal Ministry of Environment has the following instruments of intervention in place to tackle the problem of environmental degradation including waste management:

163 The revised policy on environment, 1999. The National Agenda 21 (published in 1999), which touches on the various cross-sectoral areas of environmental concern and map out strategies on how to address them. 164 These instruments complement what existed in the form of guidelines and standards for environmental pollution control in Nigeria and other regulations that deal with effluents, industrial pollution, waste management 165 and environmental impact assessments ??FME, 2003). Among FEPA's instructions in combating environmental 166 degradation are the waste management Regulation S.1.9 of 1991 and Environmental Impact Assessment (EIA) 167 Decree No. 86 of 1992. FEPA policies regulate the collection, treatment and disposal of solid and hazardous 168 waste for municipal and industrial sources and makes EIA mandatory for any major development project likely 169 to have adverse impact on the environment (see table 2). There is also in existence an environmental sanitation 170 edict of 1997 that declared the last Saturday of every month to be used for cleaning the environment for three 171 (3) hours (7am -10am). This edict is still in force and still being observed all over Nigeria. Every last Saturday 172 of the month, between the hours of 7am and 10am, people are required by law to clean their surroundings 173 and offenders are apprehended and punished as stipulated by the act. The post-1988 environmental laws and 174 regulations continue to prevail without any change.

182 6 METHODOLOGY

183 This work employs in addition to secondary data, a survey aimed at generating primary data on the potential 184 impacts of climate change on waste management standard in Ilorin. The work embarks on the random distribution 185 of questionnaire to 200 households in ten selected wards from Ilorin. This allows for generation of needed and 186 necessary information on; respondents perception about the causes of climate change, the estimated volume 187 of water in which households use during dry season periods, quantity of fuel used when there is no supply of 188 electricity from the Power Holding Company of Nigeria (PHCN) and impacts of combustion carbonized items and 189 other domestic wastes generated by households from homes, selling points (stalls) and farmlands (see tables 3, 4, 190 5 and 6). In all, three hundred structured questionnaires were used to assess the households' response to impact 191 of climate change as affecting domestic waste in their areas and their coping mechanism. In addition to this, on 192 the spot assessment and oral discussions were carried out among the agencies that control and manage waste in 193 the selected study area. The agencies include; the Kwara State Environmental Protection Agency (KWEPA), 194 the Kwara State Ministry of Health and the Kwara State Waste Management Company (KWMC). The reason for 195 this is to assess their contributions and attendance challenges on climate change as affecting waste management 196 activities in the state.

197 7 FINDINGS AND DISCUSSIONS

198 It was found out that from this study that most households need some orientation as regards how, when and 199 where to dump waste they generated daily in their community and homes. Because most households in both 200 Ilorin dump refuse at all available area in their homes or send their wards to dump refuse in the rivers closed to 201 their residential areas. Even where bins are available for waste disposal from homes and community, after bins 202 are filled up, many people still dump waste products in the bare floor. In Ilorin, it was discovered that 56 (28%) 203 households dumped refuse generated in their homes on any available spaces, while 58 (29%) households dropped 204 waste generated from their homes in drums/dustbins in selected wards in Ilorin. Similarly, only 23(11.5%) 205 households drop their waste in barrel or dustbins. However, most households at selected wards in Ilorin claimed 206 that Government did not provide them with any waste-bins but they make provisions for this on their own.

207 In general, when households from the study area were asked if they filled any changes in the weather within 208 their locations, more than half of the total households retorted sharply that, they experienced such sudden 209 changes in climate conditions, such as, hotness throughout the day even in the wet seasons. The likely solutions 210 as they suggested, is that, they want Government to ease the problems of incessant power output so that every 211 home could afford either air conditioners or fans to wade-off heat. Also, Government to take more responsibility 212 on issue of waste management in all cities and towns in the states in order to avoid epidemic diseases.

213 8 VIII.

214 9 SUGGESTIONS AND RECOMMENDATIONS

215 Nigeria with a population of about 130million people and a few urban areas where the population is concentrated 216 provides fertile grounds for LFGE / MSWE projects. The waste disposal sites in these concentrated urban areas

217 provide a vast supply of renewable energy sources. Methane gas which is created naturally through anaerobic
218 waste decomposition is a readily available renewable energy source that can be collected and used directly as
219 medium or high Btu gas for industrial use or to fuel turbine driven generators of electricity. The inability of the
220 existing power infrastructure to consistently meet the power demand needs in the urban and rural areas provides
221 an opportunity for the public and private sector to explore alternative energy sources using existing sustainable
222 resources. The existing alternative energy solutions (residential and industrial generators) are prohibitively
223 expensive to acquire and maintain and are not environmentally sound.

224 In order to ensure success and sustainability of LFGE / MSWE projects in the study area and Nigeria in
225 general, Greenovative Chain recommends the following keys: 1. Recognizing generated waste as a reusable
226 resource for generating electricity supply rather than an unfortunate urban and rural menace. Through energy
recovery processes, collected and disposed waste serves as a reusable resource for generating electricity supply.



Figure 1: 17

227
228 1 2

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1

to estimate global waste generation and this is adopted for this work:

- i. data from national waste statistics or surveys including IPCC methodologies (IPCC, 2006);
- ii. estimates based on population (NBSC, 2006) iii. the use of a proxy variable linked to demographic or economic indicators for which national data are annually collected (US EPA, 2008). Global solid waste generation rates range from <0.1 t/cap/yr (tons per capita per year) in low income countries to >0.8 t/cap/yr (table 1). Overall, the waste sector contributes $<5\%$ of global GHG emissions (US EPA, 2003).

In Nigeria, accurate data on the quantities of municipal solid waste generated in Nigeria are not easy to come by. Nevertheless, Rushbrook and Pugh (1999) outlined the range of per capita waste generation as well as waste densities (on net weight basis) from low and middle income neighborhood of Nigerian cities (see table 1).

Figure 2: Table 1 :

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[Note: vaporb) Collection and Transfer :]

Figure 3:

2

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2 42

c) Combustion :

Combustion of MSW results in emissions of CO₂ (because nearly all of the carbon in MSW is converted to CO₂ under optimal conditions) and N₂O. CO₂ from burning biomass sources (such as paper products and yard trimmings) is not counted as a GHG because it is biogenic.

| C Climate Variable | Potential Climate Change | Examples of Impacts on Waste Management on the environment |
|--------------------|--|---|
| Temperature | Annual warming of between 1.0 and 5.0 by the 2080s More hot days increases especially in dry seasons Number of cold days decreases, especially in rainy seasons More frequent stagnant summer anticyclones. | Increased water for both workers and site operations. Decline in air quality and subsequent negative impacts of heat on vulnerable groups. Impacts on biological processes e.g. composting anaerobic digestion etc. Increased risk of changes in distribution of vermin and pests. |
| Precipitation | Generally wetter days for Nigeria, mostly In the Southern part. | Increased risk of flooding from groundwater, Surface water, tidal and sea surfaces.. |

[Note: Potential Impacts of Climate Change on Waste Management in Ilorin City Nigeria © 2012 Global Journals Inc. (US) Global Journal of Human Social Science Volume XII Issue VI Version I Source: Adopted from Enete I. C.(1996) and modified by the Author (2011).VI.]

Figure 4: Table 2 :

9 SUGGESTIONS AND RECOMMENDATIONS

| | | | | |
|------|--------|--------|---------|---------|
| 0.32 | 1.43 | 0.17 | 8.204 | 9.84 |
| 0.29 | 0.883 | 0.35 | 2.494 | 2.99 |
| 0.15 | 0.731 | 0.18 | 2.967 | 3.56 |
| 0.09 | 0.814 | 0.17 | 4.547 | 5.45 |
| 0.06 | 0.732 | 0.20 | 3.672 | 4.41 |
| 0.31 | 1.14 | 0.21 | 5.543 | 6.65 |
| 0.28 | 1.53 | 0.28 | 5.484 | 6.58 |
| 0.30 | 1.09 | 0.23 | 4.834 | 5.79 |
| 0.02 | 1.17 | 0.23 | 5.094 | 6.11 |
| 0.12 | 0.98 | 0.30 | 3.309 | 3.97 |
| 0.16 | 0.76 | 0.14 | 5.251 | 6.29 |
| 0.21 | 0.84 | 0.18 | 4.553 | 5.46 |
| 0.29 | 0.62 | 0.15 | 4.08 | 4.89 |
| 1.41 | 0.23 | 1.70 | 6.241 | 7.49 |
| 1.55 | 0.36 | 0.89 | 4.25 | 5.09 |
| 0.65 | 0.17 | 1.10 | 3.72 | 4.46 |
| 0.85 | 0.24 | 0.93 | 3.501 | 4.19 |
| 0.99 | 0.32 | 0.58 | 3.054 | 3.66 |
| 0.63 | 0.43 | 0.15 | 1.453 | 1.74 |
| 0.14 | 0.13 | 0.33 | 1.105 | 1.33 |
| 2 | 4 4.48 | 1 18.4 | 8 83.36 | 9 99.95 |
| | | | | 20.51 |

[Note: Source : Author's fieldwork. © 2012 Global Journals Inc. (US)]

Figure 5:

3

| L Location By Wards | Dump on Available Space | Drum/Dust Bins | Bury in Ground | Burn in Incinerator | Other & % |
|---------------------|-------------------------|----------------|----------------|---------------------|-----------|
| Adewole | | | | | |
| Balogun Alanamu | | | | | |
| Balogun Gambari | | | | | |
| Balogun Ajikobi | | | | | |
| Balogun Fulani | | | | | |
| Baboko | | | | | |
| Magaji Aare | | | | | |
| Magaji Badari | | | | | |
| Magaji Ibagun | | | | | |
| Magaji Ngari | | | | | |

Figure 6: Table 3 :

Figure 7:

2. Designing robust and sustainable municipal waste management plans that are based on strategic goals.
3. Identifying and recommending appropriate disposal infrastructures that reduce environmental pollution caused by combustion of waste in regulated and non-regulated waste disposal sites.
4. Identifying sustainable energy solutions using Landfill Gas to Energy (LFGE) / Municipal Solid Waste to Energy (MSWE) technologies to address the endemic power supply shortage in Nigeria while mitigating greenhouse gas emissions.
5. Providing lower cost alternative LFGE / MSWE energy solutions as compared to the current prohibitive acquisition costs for private fossil fueled electricity generating sets.
6. Financing LFGE / MSWE projects through the Clean Development Mechanism (CDM). Benefits of LFGE / MSWE

There are several environmental and social benefits from implementing LFGE / MSWE solutions. A few are listed below:

1. Improved Security: With improved power supply, it can be expected that night crimes will be reduced.
2. Increased Productivity: Countless hours are lost each day due to a) power outages and b) health related issues caused by hazardous air pollutants.
3. Increased Profitability for Businesses: Lower energy costs compared with the current alternate solution of private generating sets. This will lead to lower costs of doing business and subsequently increases in returns to shareholders.
4. Increased Ownership and Accountability: If consumers and businesses understand the correlation between appropriate waste disposal and power supply, it is anticipated that consumers will be motivated to ensure appropriate disposal of waste takes place within their communities.
5. Sustainable Electricity: Landfill Gas and Municipal Solid Waste is available for combustion to electricity 24hours in 7days..
- 6.

Figure 8:

9 SUGGESTIONS AND RECOMMENDATIONS

229 .1 Global

230 .2 CONCLUSION

231 This study has begun the process of understanding what climate change could mean for waste management in
 232 urban areas of Nigeria. As it is a new area, it is recommended that more research is carried out into specific
 233 impacts. The selection of truly sustainable waste strategies is very important for both the mitigation of GHG
 234 emissions and for improved urban infrastructure. Most wastes could be turned into a new product that can
 235 benefit all a sundry, therefore some private companies and individuals could be encouraged to source for new
 236 wealth from refuse as it is being practiced in advanced world through wastes recycling efforts. Finally, the work
 237 has also demonstrated a research effort on upgrading waste management and control in Ilorin city of Nigeria.
 238 Though the bulk of this management was left to Government who also contacted the waste management to
 239 firm like-Ola-Clean Company to handle. The job being carried out by this company is commendable, but from
 240 all indications and information gathered for this investigation, only the main streets and low density area like
 241 Government Reservation Area (G.R.A) were adequately catered for. Whereby, the inner parts of the urban areas
 242 were almost untouched by this agent (Ahmed, 2008). Efficient and effective disposal of refuse and other effluent
 243 is dependent on the waste/refuse management technique adopted by the local or state government. Therefore all
 244 stakeholders-the governments, the present company that handle the sanitary development in the city, as well as
 245 private and public sectors should share the responsibility together. This no doubt will pave ways for an improved
 246 quality of environment free from deplorable sanitary condition or from any threat from change in weather or
 247 climate which is a new peril to the world.

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