PUBLIC AWARENESS ON 3R's SYSTEM FOR AN INTEGRATED SOLID WASTE MANAGEMENT IN KANO STATE METROPOLIS

Jibril Dan'azimi Jibril[1*], Ibrahim @ Atan Bin Sipan[2], Sulaiman Aliyu Shika[3], Dodo Yakubu Aminu[4], Shahabudin Abdullah[5] & Shahril Mohd A.R[6]

[1, 2,3,5&6] Centre for Real Estate, Faculty of Geo-information & Real Estate,
[4]Department of Architecture, Faculty of Built Environment,
Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia.

Corresponding Author [*]jdj4@ymail.com

ABSTRACT

Population in Kano state Nigeria, has been widely increasing in the past seven decades, with an estimated population of 9.38 million people, these lead to force a shift which results the state with an increasing volume of municipal solid waste, attached to this increase, it is an economical and cultural development which has raised the standard of living and changing the waste generator's habits within the environment, these gave birth to the higher volume of solid waste generation. The shift brought about the need to get proper solutions for the sustainable leaving condition of people in Kano State. 3r's (Reduce, Reuse, and Recycle) has been proposed using solid waste management hierarchy with emphasis on source reduction, intermediate treatment then final disposal. Residential areas are amongst the good ways to start with, and enlighten the occupants to practice 3r's as a substantial measure to reduce, reuse and recycle the generated solid waste there all days. This paper examines the level of attitudes and awareness base on 3r's system of municipal solid waste generator amongst the people of Kano metropolis. and proposes a new Institutional and Legislative Framework for the proper management of solid waste in Kano State.

Keywords *– Municipal solid waste management, 3R's, Kano state, Residential area.*

Introduction

Managing solid wastes in society has been a challenge for as long as people have gathered together in sufficient numbers to impose a stress on local resources. In bygone centuries (and nowadays in poorer countries) waste from homes and industries could be dealt with simply by hauling it to crude dumps where it could be buried, eaten by animals and burned.

Most human activities create waste, and it is the way this waste is handled, stored, collected and disposed of, that can pose risks to the environment and to public health (Zhu et al., 2008). Rapid urbanization and other human activities in kano state resulted the state in over-stressing of urban infrastructure services including municipal solid waste Management services. Civic bodies are facing considerable difficulties in providing adequate services such as supply of water, electricity, roads, and public sanitation, including municipal solid waste management (MSWM)

Household waste and other waste streams needed to be removed from the human environment to avoid nuisance and public health problems, and the wider environment provided an ample sink for these negative effects of human life. Growth in population and in individual prosperity have since combined to put greater pressure on the environment, at the same time as permitting a growth in people's appreciation of that environment. Consequently waste management policy and practice in industrialized countries developed rapidly in the second half of the 20th century, to ensure that, while public and occupational health risks are minimized, environmental resources are protected.

Historical Background

Kano State is a state located in North-Western Nigeria. Created on May 27, 1967 from part of the Northern Region with land area of about 42,592.8 sq. kilometres, and a population increase to about 6,869,582 (1997 FOS est.) and now increase to about 9,383,682 in 2006 census, National Population Commission which shows is the largest city in Nigeria. Kano state borders Katsina State to the north-west, Jigawa State to the north-east, and Bauchi and Kaduna states to the south.

Definition of waste

Waste generated in households, commercial establishments, institutions, and businesses. MSW includes used paper, discarded cans and bottles, food scraps, yard trimmings, and other items. (Haghi, 2010)

Basel convention in 1989 defined waste as any substance or object which is supposed to be disposed or intended to be disposed by the provisions of the law. Waste creation by mankind is inevitable as far as the manipulation of the chemical environment continues. (Prasanna, 2001)
Base on waste history, Environmentalists became worried about the heap quantity and toxic level that wastes produced. Pittchel, (2005) is of the view that, the problem of waste has always been created by human since the prehistoric times. By the time immemorial waste has less negative effects on environment due to the less population rather than a benefit to help improve the soil (Pittchel 2005, Wilson, 1977).

The definition of MSW varies, but typically includes waste arising from private households to that collected by or on behalf of local authorities from any source. MSW therefore includes a proportion of commercial and non-hazardous industrial waste. Depending on the country, the definition can include some or all of:

-household wastes (collected waste, waste collected for recycling and composting, and waste deposited by householders at household waste disposal sites)
-household hazardous wastes
-bulky wastes derived from households
-street sweepings and litter
-parks and garden wastes
-wastes from institutions, commercial establishments and offices

In Britain, municipal waste is defined as waste collected by, or on behalf of, local authorities and includes all the waste types listed above, although the trade waste component tends to be limited. In most countries, municipal waste is taken to be a broader and more encompassing definition than simply household solid waste (Hester et-al, 2002)

Solid wastes could be defined as non-liquid and nongaseous products of human activities, regarded as being useless. It could take the forms of refuse, garbage and sludge (Leton and Omotosho, 2004).

Cities in Nigeria, being among the fast growing cities in the world (Onibokun and Kumuyi, 1996) are faced with the problem of solid waste generation. The implication is serious when a country is growing rapidly and the wastes are not efficiently managed. Waste generation scenario in Nigeria has been of great concern both globally and locally. Of the different categories of wastes being generated, solid wastes had posed a hydra-headed problem beyond the scope of various solid waste management systems in Nigeria (Geoffrey, 2005), as the streets experience continual presence of solid waste from commercial activities. Various researchers have undertaken to study solid waste generation pattern in Nigeria, but most of the studies are usually a case study of a particular state or locality in Nigeria; and it seems the awareness about solid waste generation in several other cities are obscured. Babayemi, J.O (2009)

Map of Kano State, source Ministry of Land kano. (2012)

Problem of Municipal Solid Waste (MSW)

The unrestrained municipal solid waste generation in Kano Metropolis turns to be a major growing problem in the cities, this became a apriority for the government to search for a proper solution. Troschinetz & Mihelcic (2009), fortress that most of countries all over the world following the most environmental friendly approach to combat the challenges and problems associated with MSW by the adoption of the integrated waste management: reduction, reuse and recycling (Troschinetz and Mihelcic 2009), Recycling of waste materials in developing countries is growing and is driven by economic necessity associated with poverty (Haque, Mujtaba et al. 2000; V. Femia 2009). Recycling is generally accepted as for implementing municipal waste management strategy, recycling reduces the total amount of waste that is disposed of, and conserves natural resources (Shekdar 2009).

Scavengers rummaging through the heap of dumped refuse along the street in Kano metropolis. Author's site survey, (2012).

Generation of Municipal Solid Waste

Waste generation encompasses activities in which materials are identified as no longer being of value and are either thrown away or gathered together for disposal. (Haghi, 2010) The waste generation rates ranged from 0.66 kg/cap/d in urban areas to 0.44 kg/cap/d in rural areas as opposed to 0.7-1.8 kg/cap/day in developed countries (Cointreau, 1982). The waste generation rate is typical of low income towns. The rate of waste generation is highly influenced by the population income. In Nigeria 25 million tones of municipal solid waste are generated annually. Table 1 shows the waste generation rates and breakdown density for urban and rural areas in Nigeria

The composition of Municipal Solid Waste

Table 1 shows the composting standards of Kano state metropolis a highly populated residential city in Nigeria.

Table 1. Composition of domestic waste in Kano metropolitan area.

Materials	% Composition.
Plastic/Rubber	32.3
Metals/Iron	26.7
Glass Bottles	15.10
Others	25.9

Others = dust, ash, ceramics rubber, soil, bones
Source: Nabegu (2011)

Income and economic growth have impact on the composition of wastes. High-income earners consume more packaged products, which result in a higher percentage of inorganic materials – metals, plastics, glass, and textile. Waste characteristics vary according to season, income level, population, social behavior, climate, and industrial production, the size of markets for waste materials and the extent of urbanization, effectiveness of recycling, and work reduction. Because of non-uniformity of collection methods, the environmental agencies do not provide separate solid waste management for the six classification of solid waste. The majority of substances composing municipal solid waste include paper, vegetable matter, plastics, metals, textile, rubber and glass. (T. Ch. Ogwueleka, 2009)

Table 2: Volumes of solid waste generation in some Nigerian cities.

Urban areas	*1982*	*1985*	*1990*	*2000 (Tonnes per year)*
Lagos	625,399	681,394	786,079	998,081
Ibadan	350,823	382,224	440,956	449.882
Kano	319.935	348,580	402,133	535,186
Kaduna	257,837	280,925	324,084	431,314
Onitsha	242,240	263,929	386,593	304,477
Port Harcourt	210,934	229,821	265,129	352,853
Oshogbo	131,903	143,712	173,720	253,841
Aba	131,903	143,712	169,719	236,703
Jos	99,871	111,905	135,272	197,660
Warri	67,477	75,607	91,396	133,531
Gusau	44,488	48,471	7,243	79,835
Potiskum	15,434	16,816	19,399	28,347
Uyo	12,508	13,628	15,721	20,336
Suleja	9,383	10,514	13,311	21,336
New Bussa	5,690	6,200	7,152	9,518

Source: Nabegu, (2011)

Table 2 shows the waste generation for fifteen cities across Nigeria. However, several researchers have indicated that like other developing nations, statistics on waste generated in Nigeria's cities reflect only 50% of the actual generation as the remaining 50% are assumed to be partially decaying at dumpsites and partially burnt before collection (Contrieu 1982; Ogwekela 2003; Nabegu 2011) suggesting that actual generation is much higher than what is officially reported.

Studies in Bandung, Indonesia and Colombia, Sri Lanka have found residential waste composed of 78% and 81% compostable material, and market waste 89% and 90% compostable, respectively (Cointreau, 1982).

A most important source of environmental deterioration in Nigeria is created by the poor refuse disposal facilities (Sada, 1977) In the past, the nation was unaware of the impact of its refuse on the total wellbeing of its society, and recent astronomical increases in the size of the urban population have exacerbated the problems of refuse generation. Although bold steps have been taken by the government, at various levels, to combat the refuse disposal problems these efforts have not, as yet, yielded much satisfaction.

Compilation of Institutions & Waste Management Regulations in Nigeria

As part of proactive measures by government to preserve the environment and protect its inhabitants from hazardous wastes and nuisance, the Nigerian government and several states therein have established various governmental authorities and agencies that would ensure efficient and effective mode of management waste in the country. The following are a list of solid waste management stakeholders and major actors at both the Federal and State level;

The general functions of Environment Protection Agencies vary from country to country and on different circumstances. However, their roles are all aimed at protecting, preventing damage or enhancing the environment such as land, air, water, animals and human beings, with the end

objective of achieving sustainable development. In view of the above Kano state has the following environmental agencies, thus for achieving waste free zone.

- Kano State Environmental Protection Agency.
- Kano State Refuse Management & Sanitation (REMASA) Law.
- Waste Management Society of Nigeria, Kano State (ELRI, 2011).

Constitution of the Federal Republic of Nigeria (1999)

The constitution, as the national legal order, recognizes the importance of improving and protecting the environment and makes provision for it. Relevant sections are:

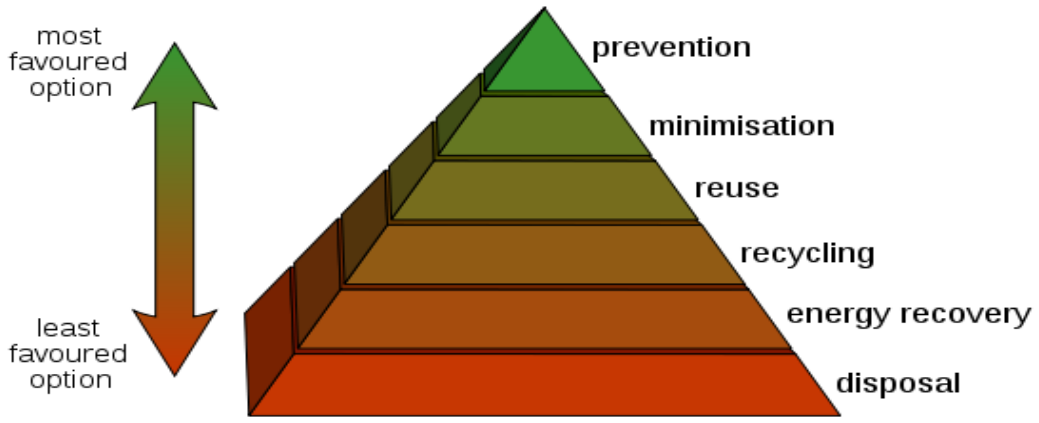
· Section 20 which make it an objective of the Nigerian States to improve and protect the air, land, water, forest and wildlife of Nigeria.
· Section 12 establishes, though impliedly, that international treaties (including environmental treaties) ratified by the National Assembly should be implemented as law in Nigeria.
· Section 33 and 34 which guarantee fundamental human rights to life and human dignity respectively.

Federal Government Regulations (1991) on Hazardous and Solid Waste Management

- Section 1 makes it an obligation for industries to identify solid hazardous wastes which are dangerous to public health and the environment and to research into the possibility of their recycling.
- Section 20 makes notification of any discharge to the Agency mandatory.
- Section 108 stipulates penalties for contravening any regulation.

Integrated Waste Management Hierarchy

The EC strategy has been developed into the concept of "hierarchy waste management": Tchobanoglous, (1993), Highlight the principles of Integrated Waste Management are defined in terms of the integration of six functional elements.



Waste hierarchy refers to the "3 R's" **R**educe, **R**e-use and **R**ecovery (Wiliams, 1998):

Reduction - the first in the hierarchy shows that waste production should be reduced. It is realized by the development of clean technology and by the use of such processes which require less material and produce less waste during manufacture.

Re-use – the second step in hierarchy. There are many examples of suitable re-use technologies – tyre re-treading, glass bottles (e.g. from beer and milk). Re-use is not profitable in every case, but environmental aspects can outweigh the benefits.

Recovery - the last step in the hierarchy which has a number of different types:

Materials recycling – using waste material for producing a marketable product. A typical example is the recovering of glass, because scrap glass can be ground and used for new glass production. In the CR, recycling of PET material is very high, and PET is re-used for many products, e.g. load-dependent carpets, car parts (steering wheel, dash-board), fillings for sport clothing. These examples show very suitable process of changing wastes to products, often with energy savings in comparison with obtaining raw materials. But the recycling process assumes that there is a market for recycled materials. Otherwise, waste is produced.

• ***Energy recovery*** - this technology produces energy by incineration of wastes or by combustion of landfill gas. The energy potential of MSW is high, and has recently been increasing. The problem is that the incinerator installations require high initial capital costs. An additional problem is the necessity to install sophisticated flue gas cleaning equipment.

• ***Composting*** - uses the decomposition of the organic waste fraction to produce a stable product similar to fertilizer. But there is a problem with the pollution of raw material by heavy metals and toxic organic compounds. In the CR and other EU countries, there are very strict requirements on the quality of compost; all chemical properties concerning heavy metals and organic compounds are limited.

• ***Disposal*** - the last possibility of how to get rid of waste. The most common method is landfilling, which is the predominant method of waste disposal in Europe and North America. The problem is production of methane and therefore the necessity of gas emission controls to prevent potential air pollution. (Haghi, 2010)

The needs for public awareness on 3R's system.

3R's is meant for the public, and, without the public's cooperation, the system cannot be operated or maintained appropriately. Hence, it is necessary to make the public aware of 3R's through active participation in the system. In practice, system efficiency is directly proportional to the number of participating citizens for 3R's systems. Without public participation, it may be difficult to maintain cleanliness in a city, and resource recovery systems may become less effective if wastes are poorly separated at the source.

However the purpose of the study is to

i. Identify the awareness level of 3R's system within Kano metropolis.
ii. To determine the attributes factors contributing to the awareness level of 3R's system.

Descriptive analysis is used to identify the level of awareness on 3r's amongst the public within the metropolis and factor analysis was used for determining the attributes of each factor.

Methodology

This research focuses on public awareness in 3R's system, Literature search related to 3R's and public awareness to achieve waste free environment has been done extensively; the data were collected through administering a questionnaire randomly, non- probability sampling were used within the Kano Municipal local government areas, to a target population sample of 60 respondents, among which only 40 questionnaires were retrieved back for analysis. The questionnaire includes a cover letter addressing to the general respondents, explaining the purpose of the study and assuring confidentiality. Tony, P. (2005) recommends using the sample technique for a large population, in which participants are selected in a purposeful way. personal observations and interviews were conducted; distributed questionnaires within the metropolis are measured by a 5- point Likert scale type ranging from 1 (strongly agree) to 5 (strongly disagree). The method has been used by different researchers (Vining and Ebreo 1992; Huang, Zhang et al. 2006; Vicente and Reis 2007; V. Femia 2009)

Section A includes a Demographic comprises questions about gender, age, local government area, and level of education, while section B were designed to measure the awareness levels amongst the house hold about 3Rs system for an integrated solid waste management (practices, benefits, responsibilities), also measuring the availability of the needed facilities for 3Rs, and ability for attending and participating in 3R's programs.

Result and Discussion

Factor analysis was used in SPSS software to analyze the data. Felício, J. A., *et-al* (2012) highlighted that, Factor analysis attempts to describe the structure of a data set and identify clusters of interrelated variables. Factor analysis describes the covariance relationships among the observed variables in terms of smaller numbers of unobserved latent variables called factors.

Factor analysis is used to discover patterns in the relationships amongst variables and enables reduction of the number of variables into factors combined from these variables. Principal component analysis (PCA) is a statistical technique which is used to replace a large set of variables by a smaller set of variables which is the best representation of the larger set. PCA is the most commonly used method for extracting factors in factor analysis.

Simple form of factor analysis were used to explain the correlation in a set of data and relates variables to each other. A principal component analysis were also used as a classical statistical method which enable the author to reduce and use the generated set of variables called principal factors. The raw data which comprises of 15 variables indicating the attributes of 3R's were used in achieving the analysis of the component factors. The component factors which includes the 3R's awareness, Current practice and policy initiatives have accounts for several observed variables.

Table 3. Rotated Component Matrix[a]

	Component		
	1	2	3
You are using environmental friendly food containers in your area.	.826		
You always separate recyclable materials from garbage bags.	.819		
Local authorities have provides a training program on how to use the waste recyclable bins	.542		
You are reusing used food containers and water bottles	.524		-.449
The recycle bins are provided to you by local authorities for collection services.	.484		
Imposing some solid waste management restrictions will contribute to the increase of carbon emission.	-	-	-
You have heard of Reduce, Reuse and Recycle (3R's) system for Solid Waste Management.		.792	
You are familiar with the issues on sustainable solid waste management.		.649	
Public education is essential and helps to promote the benefit of recycling		.640	
3R's system will increase the effectiveness of ISWM.		.610	
Recycling of the items used for daily purposes is important for sustainable Solid Waste Management		.540	
You can differentiate between Reduce, Reuse and Recycle (3Rs).		.475	.474
You find campaign is efficient enough to raise public awareness of solid waste problems			.750
Using 3Rs system approach will increase the cost implication in solid waste management			-.652
There is a need of more recyclable bins within your area.			-.498

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

Factors loading values give details about the variables related to each of the factors defined, it is also important in the interpretation of a factor. Scores of the factor are related to the degree of higher correlation in the given set of data which load high values on each factor. Varimax rotation is the method commonly used which increase the variance of the loading within each factors concurrently.

Data and results of the test of significance using principal component analysis are presented in Table 3. The statistical results suggest that Waste reduce (Minimization) were characterized by factor 1 which includes; Environmental friendly food containers, separating recyclable materials, training programs, used of eco-friendly water bottles, and waste bins. While Waste Reuse were characterized by factor 2 with components loadings such as , 3R's awareness, familiarity on sustainable solid waste management, public education on 3R's, Effectiveness of integrated solid waste management and individual practice of 3R's. Finally waste recycling was characterized by Factor 3 which constitute; efficient campaign on Solid Waste Management problems, Cost benefits and implication and availability of recycle bins.

The data collected allowed the researcher to define the 3R's as a substantial measure to improve the solid waste management system within the metropolis of Kano state and other cities as a whole, with great understanding and ability to apply the techniques of 3R's the goal is ethical, economical, efficient and visionary, these will guide the public in changing their lifestyles and practices to strive towards equal sustainable natural cycles of waste, in which all the unwanted materials will turns to be a resources for others to use. Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.

Implementing 3R's will surely eliminate all discharges to land, water or air that are a threat to planetary, human, animal or trees and plant health.

Table 4. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
B1	2.998	19.984	19.984	2.998	19.984	19.984	2.759	18.395	18.395
B2	2.703	18.018	38.002	2.703	18.018	38.002	2.604	17.359	35.754
B3	1.717	11.447	49.448	1.717	11.447	49.448	2.054	13.694	49.448
B4	1.291	8.610	58.058						
B5	1.035	6.902	64.960						
B6	.960	6.400	71.360						
B7	.870	5.798	77.158						
B8	.695	4.636	81.794						
B9	.657	4.379	86.173						
B10	.592	3.948	90.121						
B11	.434	2.896	93.017						
B12	.351	2.339	95.356						
B13	.290	1.936	97.293						
B14	.257	1.716	99.008						
B15	.149	.992	100.000						

Extraction Method: Principal Component Analysis.

The explained values in principal component, Eigen values and percentage of variance are evaluated using varimax rotation method which is represented in Table 4. Three factors were satisfactory to explain 49.448% of the variance for correlation. The total variance distributed in three factors is shown in Table 4. The total variances explained in three factors are 19.984 by B1, 18.018 by B2, and 11.447 by B3.The largest component loading either positive or negative, suggests the meaning of the dimensions; positive loading indicates that the contribution of the variables increases with the increasing loading in dimension and negative loading indicates a decrease (Lawrence and Upchurch 1982).The most significant variables in the components represented by high loadings have been taken into consideration in evaluation of the components (Mazlum et al.1996).

Conclusion

The evaluation studies of the data by factor analysis leads to the conclusion that, the three factors which include 3R’s from the Waste Management Hierarchy, Reduce, Reuse and Recycle, are found to be in good correlation with the respective factor loadings in accordance with their respective status. The data were analysed using factor analysis and first three components are chosen, which contribute 49.448% of the total variance. The principal component analysis were considered which shows that, the awareness to promote 3R’s program amongst the public

within Kano state metropolis is not sufficient a few recyclable products such like bottles, papers, cans, and aluminium are kept in the houses by the house holders and later sold to scavengers aka ("Yan' Gwan-Gwan" in local language). According to Agunwamba et-al (1998) the activities of scavengers can have a great impact on the economy and waste management (if the scavengers are properly organized, enlightened, and provided with the necessary economic and institutional support. At present, however, their contributions are limited by the absence of government policy to encourage reuse and recycling.

The Majority of the respondent doesn't have sufficient knowledge on how or where to recycle, this is due to the fact that efforts for effective recycling programs in Kano state metropolis is not yet implemented, it seems that the awareness program which offered is not sufficient and needed to be more efficient. From the survey it is apparent that waste separation at point of generation is not easy to accomplish in Kano metropolis in this time due to several reasons, Lack of awareness among the public regarding 3R's (practices, benefits, responsibilities) and the unwillingness among the majority of people to cooperate in waste separation.

Yet in Kano state, there is no committed policy initiative on waste minimization. Introduction of 3R's concept and its adoption by both public and industrial sectors can stimulate research in waste reuse and cut wasteful practices, apart from increasing production efficiency, commitment to the waste management policy of reuse and recycling is a positive step towards reducing environmental risk while improving economic performance.

Acknowledgement
The authors will like to acknowledge and thank the International Doctorial Fellowship (IDF) and Research University Fund (GUP) initiated by Universiti Teknologi Malaysia (UTM), supported by the Ministry of Higher Education, Malaysia (MOHE) for contributing to this research work.

References

Agunwamba, J. C. (1994). Environmentally sound manufacturing technology in Nigeria. *first conference of the Nigerian Institution of Production Engineers annual conference* (pp. 180–193). Presented at the Nigerian Institution of Production Engineers, University of Benin, Nigeria: University of Benin.

Agunwamba, J. C. (1998). Solid Waste Management in Nigeria: Problems and Issues. *Environmental Management*, *22*(6), 849–856. doi:10.1007/s002679900152

Aliyu Baba Nabegu. (2010). An analysis of municipal solid waste in Kano metropolis, Nigeria. *J Hum Ecol*, *31*(2), 111–119.

Babayemi,, J. O., & Dauda,, K. T. (2009). Evaluation of Solid Waste Generation, Categories and Disposal Options in Developing Countries: A Case Study of Nigeria. *J. Appl. Sci. Environ. Manage*, *13*(3), 83–88.

Danbuzu - composition and spatial distribution solid waste collections' points in urban Katsina, northern Nigeria. (2011.).*My Opera*. Retrieved April 13, 2012, from

http://my.opera.com/DANBUZU/blog/an-analysis-of-municipal-solid-waste-in-urban-katsina-northern-nigeria

Effect of waste disposal and recycling in Nigeria. (n.d.).*HubPages*. Retrieved from http://mr-gadget.hubpages.com/hub/Effect-of-waste-disposal-and-recycling-in-Nigeria

ELRI. (2011). Compilation of institutions & waste management regulations in Nigeria. Environmental Law Research Institute. Retrieved from http://www.elri-ng.org/newsandrelease2_waste.html

Felício, J. A., Couto, E., & Caiado, J. (2012). Human capital and social capital in entrepreneurs and managers of small and medium enterprises. Journal of Business Economics and Man agement, 13(3), 395–420. doi:10.3846/16111699.2011.620139

Haghi, A. . (2011). W*aste management: research advances to convert waste to wealth*. New York: Nova Science Publishers, Inc.

Haque, A., & Mujtaba, I. M. (2000). A simple model for complex waste recycling scenarios in developing economies. *Waste Management*, *20*(8), 625–631.

Hester, R. E., & Harrison, R. M. (2002). *Environmental and health Impact of Solid waste Management Activities*. RS.C.

Huang, P., & Zhang, X. (2006). Survey and analysis of public environmental awareness and performance in Ningbo, China: a case study on household electrical and electronic equipment. *Journal of Cleaner Production*, *14*(18), 1635–1644.

Leton, T., & Omotosho, O. (2004). Landfill operations in the Niger delta region of Nigeria. *Engineering Geology*, *73*(1-2), 171–177.

Mohammad Aljaradin1*, Kenneth M Persson1, I. Al-Itawi Hossam2. (2011). Public awareness and willingness for recycle in Jordan. *International journal of academic research*, *3*(1), 507–510.

Muktar. (2011, January 27). Dr. Mustapha Muktar Archives: The economics of waste scavenging in kano state. *Dr. Mustapha Muktar Archives*. Retrieved from http://mustaphamuktar.blogspot.com/2011/01/economics-of-waste-scavenging-in-kano.html

Nigeria: Kano - Why so dirty? (n.d.).*IRINnews*. Retrieved April 18, 2012, from http://www.irinnews.org/report.aspx?reportid=75444

Norušis, M. ., & SPSS Inc. (1993). *SPSS for Windows Base System Users Guide.* Release 6.0. Prentice Hall: Englewood Cliffs.

Onibokun,, A., & Kumuyi, A. (n.d.). Urban poverty in Nigeria: towards sustainable strategies for its alleviation. Centre for African Settlement Studies and Development, Ibadan. *CASSAD Monograph Series*, *10*, 1–2.

Parasanna, S. (2004). The Basel Convention of 1989- A developing country's perspective. Visiting Research Scholar Liberty Institute.

Pitchel, J. (2005). *Waste Management Practices*: . USA:municipal, hazardous,and industrial. USA: RC Press, Taylor and Francis Group

Shekdar, A. V. (2009). Sustainable solid waste management: An integrated approach for Asian countries. *Waste Management*, *29*(4), 1438–1448.

The urban informal sector in Nigeria: towards economic development, environmental health, and social harmony. (2005).*Global Urban Development Magazine*, *1*, 1.

Tony, P. (2005). Essentials of marketing research (4th ed.). England: Pearson Education Limited.

Troschinetz, A. M. and J. R. Mihelcic. (2009). Sustainable recycling of municipal solid waste in developing countries. *Waste Management*, *29*(2), 915–923.

Udoessien, E. I. (1998). Pollution in Petroleum and Allied Industries. *M.E.F Nigeria.*, 2–5.

V. Femia, P. O. c. (2009). Waste and Recycling Behaviors -Do Domestic or Commercial Recycling Programs Raise Awareness and Cause Best Practice. *Sardinia*. Presented at the Twelfth International Waste Management and Landfill Symposium S. Margherita di Pula, Cagliari, Italy: CISA.

Vicente, P., & Reis, E. (2007). Segmenting households according to recycling attitudes in a Portuguese urban area. *Resources, Conservation and Recycling*, *52*(1), 1–12.

Wilson, D. (1977). *Handbook of Solid Waste Management*. New York, NY: Van Nostrand Reinhold.

Nabegu, A. . (2011). Solid Waste and Its Implications for Climate Change in Nigeria. *Journal of Human Ecology*, *34*(2), 67–73.