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Proposal for New Waste Management System in Nigeria (Lagos State)

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Thesis abstract

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Waste and improper waste handling is a significant challenge to developing nations in the past decade. Studies show that improper disposal of waste has given birth to high rate of morbidity and mortality in a developing society.

Waste is generally known to be generated from range of human and animal activities, production processes to consumption stage and the management of waste has been a major problem in developing countries where generation of waste per unit of output is much higher than that in the developed countries because of inefficiency in manufacturing processes.

Furthermore, corruption at all levels in the society is another major predicament toward sustainable development and effective integrated waste management system in Nigeria. Proper awareness of the citizen toward economic value of waste produced by them can contribute immensely to the proper handling of waste by the people and it will create a greener environment, employment opportunities and generate revenue to the government.

Therefore the aims of this project is to review Finnish waste management system being a successful example, in order to establish sustainable and effective waste management in Lagos state and Nigeria as a whole.

In this thesis different literatures were reviewed and analyzed to give the theoretical frame work a concrete foundation to complement the purpose and objectives of the research work. Moreover the study uses both qualitative and quantitative approach for vital information to be extracted from the benchmarked companies. The research shows that sustainable and integrated waste management can as well be achieved in Lagos State if there is proper plan, effective environmental policy and cooperation between Government and the citizens.

Keywords: waste management system, benchmarking, adaptation, power, integrated and sustainable development.

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ABBREVIATIONS

C&D	Construction and demolition waste
EGSSAA	Environmental Guidelines for Small-Scale Activities in Africa
EPR	Extended Producer Responsibility
EU	European Union
ISO	Institute of standard organization
IWM	Integrated Waste Management
ISWM	Integrated Sustainable Waste Management
LSRDB	Lagos State Refuse Disposal Board
LSWDB	Lagos State Waste Disposal Board
LAWMA	Lagos State Waste Management Authority
MEPP	Ministry of the Environment and Physical Planning
MSW	Municipal solid waste
PSP	Private Sector Participation

UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNESCAP	United Nation's Economic and. Social Commission for Asia and the Pacific
WCED	World Commission on Environment and Development

Tables and figures

1 INTRODUCTION

Development is incomplete without sustainability. Therefore, it is highly important in a place, organization or any form of habitant. In this modern day world, there is the need for not only development but sustainability of the environment and world in general. There is a massive need for heads to be put together towards this subject “sustainability”. Sustainability is the continuous improvement of a present state without compromising the future state and for the betterment of the future state generation. As a result of the need for sustainability, there comes the emergence of turning waste to wealth for the benefit of the population.

Increasing population, domestic and industrial activities have led to increase in overall waste generation. Therefore, organizations, communities and individuals have to find ways of managing these wastes in order to preserve and benefit from their habitat. Today, the economic value of waste is enormous. It has been managed to generate a lot of resources (clean and green power, revenues, employment and other forms of development) and its effective utilization has led to greener environment and less polluted environment. For an economic value of waste to be generated, the government, organizations and individual at a particular setting have to be educated massively on waste management. This is important in order to have good knowledge about the economic importance of waste and cooperate towards acquiring the profitable value.

Therefore, in order for all these aims and objectives to be attained, an updated waste management system and benchmarking examination need to be adopted. More also, necessary steps and actions to accomplished the goals need to be established. Benchmarking is an important issue to any organization because it gives opportunity to identify, understand and adapt a remarkable practice from an organization considered to be the best in the industry. Similarly, for any waste management system to be sustainable, a superior, functioning and developed waste man-

agement system need to be benchmarked and an outstanding best practices needs to be considered.

Waste can be seen as items that people discard or throw away because it has hazardous properties and it is of no value. There are different categories of waste, for example; Solid waste, Animal by-product, Electronic waste, Food waste, Agricultural waste, end of live vehicles and Gas cylinder to mention but a few. All these waste can be recycled in order to reduce pollution such as air, water, land, radioactive and thermal pollution, thereby, making the environment greener and conducive for every living object. In addition, recycling can also generate wealth for individuals, organizations and governments. In this manner, it improves the standard and well-being of the people living in a particular environment. Recycling is capable of leading to development in a setting because it reduces waste and at the same time generates wealth. Therefore, the habit of recycling in a proper and standard means have to be employed by all in order to attain a sustainable development in this modern day world.

1.1 Research problem and boundaries

The aim of this thesis is to analyze the method by which waste management system in a developed world and be able to determine, manage and utilize the value that lies in waste and sustain it. As a result of this, there will be adequate and detail explanations, analysis and research on how sustainable development and benchmarking can be achieved in waste management. In addition, the thesis will focus on educating the community, state, organizations and individuals on method to effectively utilize the values in waste for human and environmental benefits.

This thesis will be using Lagos state waste management system as a case study. At the same time benchmarking Finnish waste management system as the process of setting out standard to the Lagos state waste management system.
Lagos being one of the most populous cities in the world and the commercial nerve of Nigeria generates a lot of waste. The state has been making some impact on effective management of waste; nevertheless mountain of load waste generated and heaped on the street is increasing every day. This is because of the rapid increase in population consequently leading to huge waste disposal and the resources to effectively manage such problems are limited.

Therefore this thesis will educate and analyze the method to be utilized by Government, corporations and as well as the individual in order to ensure a greener environment in Lagos state. In addition, the area where Lagos state need to focus and improve on in order to optimally create sustainability development will also be pointed out and explained in details. Their challenges while they are making efforts to effectively manage waste will also be extracted and analyzed.

Essentially, it will provide crucial information for future decision making and any other subsequent feasibility study. Establishing a market avenue for recycling company abroad is another objective of this thesis, generating employment opportunity for Lagos inhabitants and at the same time to create conducive and social improvement in Lagos state.

Above all, an existing and working integrated waste management system will be adopted in order to attain the objective of this thesis. Therefore, Finnish waste management system will be used in order to emancipate Lagos state system from epileptic services render in the state to an efficient system.

This thesis will be emphasizing majorly on Lagos state in Nigeria. It will focus on approach the inhabitants of Lagos states have been well educated on method to effectively dispose their waste and at the same time the knowledge on the significance value of waste they dispose. Furthermore, emphases will be laid on the effi-

cient and effectiveness of the state environmental agency toward educating the Lagosians on waste disposal and its values. It will also look into the success state agency has recorded or attained as well as the challenges they are encountering when it comes to effective management waste materials. It will further check the lapses in the state agency and how it can be managed and re-establish. By so doing, emphasis will be laid on Finnish waste management system, their achievement so far, the steps required to attain their environmental management standard and as well as the problems that was encountered before it was named one of the cleanness nation in the world.

Basically, this thesis will majorly focus on solid waste in general for the purpose of creating an avenue for effective waste management system within state by discovering loop holes and providing recommendation in order to create wealth out of waste generated in Lagos state. The language that will be employed in the thesis will be majorly English language because it is the official language in Lagos and Nigeria at large.

1.2 Research methodology

The research methodology is the means through which facts, data and information are gathered to support the aim of this thesis. The means of collecting this information will be in a systematic form in order to ensure that the right facts and figures are collected. The research will be focusing on how benchmarked state and company within are extracting the economic benefits in wastes at large. In addition, the research will focus more on how individuals, organization and government of the benchmarked state comply with the legislation of waste management and determine the result achieved towards their positive behavior.

This project will employ both qualitative and quantitative means of research. The quantitative approach will be based on questionnaire whereby various questions will be presented to the benchmarked company in order to acquire vital information

which will give the theories in the literature review more understanding in the following chapter. Qualitative research which is based on interview which will enable social interaction that will make the respondents to provide their knowledge, understanding, roles, believes and attitudes on effective waste management activities in Finland. It also enables the studied topic get richer and clearer response and as well help to complement other questions from quantitative research method.

After all, the research methods will be used to discover the significant problems of Lagos state waste management system and recommend a lasting solution that will enhance sustainable development in the state and Nigeria at large.

2 THEORECTICAL FRAMEWORK

In this chapter, Literatures pertaining to waste and waste management in general will be review and analyze to provide comprehensive explanation on how integrated sustainable waste management could be achieved. The literature review will be used as a foundation to clarify the importance of effective waste management in a society, tools to achieve the objectives and establish an overview analyses on integrated waste management approach will also be review. Furthermore, the topics covered in this chapter are: waste definition from different perspective; types of waste; waste management system; impact of waste and waste disposal; sustainable waste management approach; the old and new approach to conservation of resources; the concept of Integrated Sustainable Waste Management (ISWM) and for the thesis objectives to be achieved further, a literature review on benchmarking and best practice approach will be examine with an example.

2.1 Waste

Waste can be defined from different perspective depending on how the owner of such waste perceives it. Normally waste can be described as something that has no value, useless and that want to be discard by the owner. Waste variably refer to lack of use or ‘useless remain’ (concise oxford Dictionary). From financial point of view, waste is anything that has no financial value either present or the future because there is no demand for such item in the marketplace. Storage of waste typically incurs financial or other disadvantages to the owner (Martin f lemann, p.31). Considering an item to become a waste can be view from different factors, for example:

- Time: If there is scarcity of an item in the society as a result of war, economic instability or an embargo was been placed on such products, then

owner can spend more time or effort repairing an item since the alternative may be costly and hard to find.

- Location: Rural communities may simply utilize food waste for animal feeding and also animal waste as manure which is feasibly rear in an urban center. In other words such material is regarded as a waste in the urban region.
- State: the status of an item (Price, age, level of damage) can influence repair to avoid being discarded.
- Income level: the level of human income can as well caution the way items are discarded either out dated or no longer in vogue.
- Personal preferences: Certain types of items may be collector's items or possess veneration for some individuals.

Moreover, it is clearly understood that what could be regarded as a waste can as well be valuable to another person and trading opportunity may arise if the cost of transportation of such item does not exceed the worth as perceived by the intending owner. (Thomas H. Christensen, p.4)

In addition to the aforementioned factors, what actually becomes waste depends on which items are being purchased and consumed. Or in other words culture, climate, religious and ethnic background as well as economical abilities affect what becomes waste. Hence, waste quantities and composition vary widely, both geographically (regionally, locally) and over time. (Thomas H. Christensen, p.4)

2.2 Types of waste

Solid wastes are discarded or unwanted materials that are generated by households and other sectors like industrial, agriculture, commercial and construction institution which are dangerous to the people and its environs. The following are the type of wastes that are generated by human activities:

1. Municipal wastes
2. Industrial wastes

3. Agricultural wastes
4. Construction and demolition
5. Commercial and institutional waste

And Hazardous wastes which can stem from any of the above sources. Therefore it will not be taken as a part of the classification of wastes by source, rather as a cross-cutting character for all these wastes (UNESCAP, 1993). Moreover, the amount of waste generated in either developed or developing countries depends on the population, degree of urbanization and industrialization, and intensity of agricultural activities in such nation. Sources of waste according to their types are described below in details:

2.2.1 Municipal waste

Municipal solid waste (MSW) are composed of waste generated from household, offices, hotels, shops, schools, open area and other similar institutions which are hazardous. The rate at which MSW are generated vary from city to city and season to season and have a strong correlation with the level of economic development and activity of a country (UNESCAP, 1993).

According to World Bank statistic (1999) it was estimated that high income countries generate MSW more than low or middle income countries. For example High income countries (such as Australia, Japan, Hong Kong, China, Republic of Korea, and Singapore) produce between 1.1 and 5.0 kg/capita/ day; middle-income countries (such as Indonesia, Malaysia and Thailand) generate between 0.52 and 1.0 kg/capita/day, whilst low-income countries (such as Bangladesh, India, Viet Nam and Myanmar) have generation rates of between 0.45 and 0.89 kg/capita/day.
The figure 1 below elaborate more on MSW generation by the high, middle and low-income countries of the region.

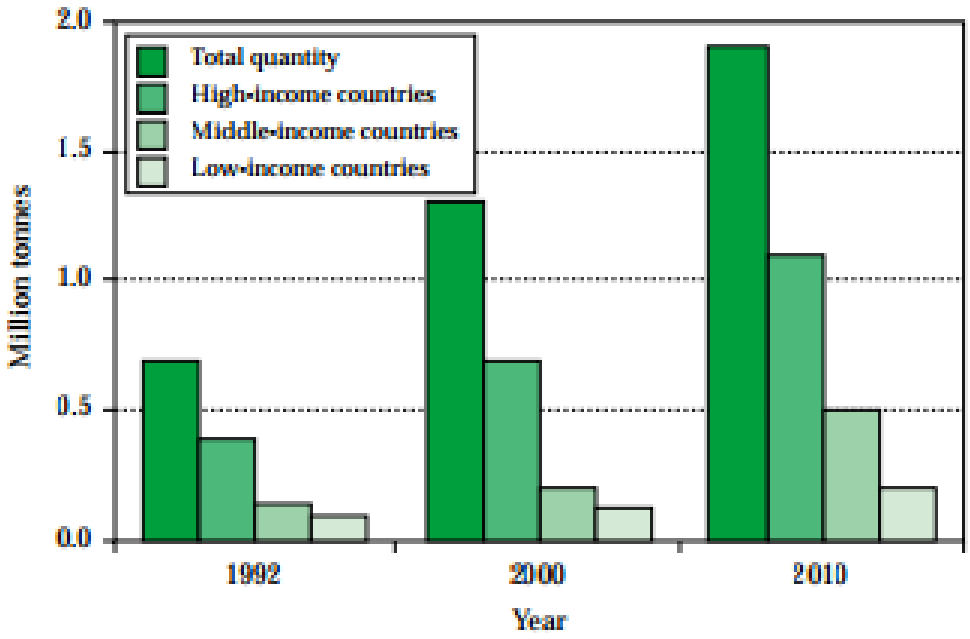


Figure 1: Municipal Solid Waste Generation in Different Groups of Countries in the Region adopted from (World Bank 1999)

In addition, Asian and Pacific Regions are said to be currently producing about 1.5 million tons of MSW each day and these are expected to be double by 2025 (World Bank 1999). Similarly in Africa, Thousands of tons are generated on daily bases which are approximately 0.5 kilograms per person per day and in some cases reaching as high as 0.8 kilograms per person per day. While this may seem modest compared to the1–2 kg per person per day generated in developed countries, most waste in Africa is not collected by municipal collection systems because of poor management, fiscal irresponsibility or malfeasance, equipment failure, or inadequate waste management budgets (EGSSAA 2009). Sources of Municipal solid waste are elaborated in Table 1.

Source	Typical facilities, activities, or locations where wastes are generated	Types of solid waste
Residential	Single-family and multi-family dwellings, low-, medium-,and high-rise apartments, etc.	Food wastes, rubbish, ashes, special wastes
Commercial and Institutional	Stores, restaurants, markets, office buildings, hotels, motels, schools, print shops, auto repair shops, medical facilities and institutions	Food wastes, rubbish, ashes, demolition and construction wastes, special wastes, occasionally hazardous wastes
Open areas	Streets, alleys, parks, vacant lots, playgrounds, beaches, highways, recreational areas, etc.	Street sweepings, roadside litter, rubbish, and other special wastes
Treatment plant sites	Water, sewage and industrial waste water treatment processes	Treatment plant sludges

Table1: General sources of municipal wastes(adapted from peavy, Rowey, and Tchobanoglous, 1985)

The Table below describes in details the type of solid wastes that comprises municipal wastes.

Component	Description
Food waste	The animal, fruit, or vegetable residues (also called garbage) resulting from the handling, preparation, cooking and eating of foods. Because food wastes are putrescible, they will decompose rapidly, especially in warm weather.
Rubbish	Combustible and non-combustible solid wastes, excluding food wastes or putrescible materials. Typically combustible rubbish consists of materials such as paper, cardboard, plastics, textiles, rubber, leather, wood, furniture, and garden trimmings. Non- combustible rubbish consists of items such as glass, crockery, tin cans, aluminum cans, ferrous and nonferrous metals, dirt, and construction materials.
Ashes and residues	Materials remaining from the burning wood, coal, coke, and other combustible wastes. Ashes and residues are normally composed of fine, powdery materials, cinders, clinkers, and small amount of burned and partially burned materials.
Demotion and construction waste	Waste from razed building and other structure are classified as demolition waste. Waste from the construction, remodeling, and repairing of residential, commercial, and industrial buildings and similar structures are classified as construction waste. These wastes may include dirt, stones, concrete, bricks, plaster, lumber, shingles, and plumbing, heating, and electrical parts. They are usually of an inert nature. The main exception is asbestos, where special disposal required.
Special waste	Wastes such as street sweepings, roadside litter, catch-basin debris, dead animals, trash like abandoned vehicles, electrical appliances are classified as special wastes.
Treatment plant wastes and dredged soil	The solid and semisolid waste from water, sewage and industrial waste treatment facilities are included in this classification. Sewage sludge is a slurry of fine organic-inch particles with a highly variable chemical composition depending on the sources of the effluent and the type and efficiency of the treatment processes. Sewage sludge tends to concentrate heavy metals and water-soluble synthetic organic compounds, but they may also contain greases, oils and bacteria. Dredged materials are excavated from river estuaries, harbors and other waterways to aid navigation. It is estimated that 10% of dredge, materials in contaminated by oil, heavy metals nutrients and organic chlorine compounds.

Table 2: Classification of materials comprising municipal solid wastes (Adapted from Peavy, Rowe and Tchobanoglous, 1985

2.2.2 Industrial Solid Waste

Industrial solid wastes are residues being generated by human activities which could be described as the activities carried out in the industry. These unwanted residues may occur as relatively pure substances or as complex mixtures of varying composition and in varying physiochemical states which significant proportion of it are regarded as hazardous or potentially toxic, thus requiring special handling, treatment and disposal (UNESCAP 1993).

The major sources of industrial solid wastes are the thermal power plants producing coal ash, the integrated Iron and Steel mills producing blast furnace slag and steel melting slag, non-ferrous industries like aluminum, zinc and copper producing red mud and tailings, sugar industries generating press mud, pulp and paper industries producing lime and fertilizer and allied industries producing gypsum (The Ministry of Urban Development Government of India, [ref. 20 May 2012]).

S.No	Name	Quantity (million tonnes per annum)	Source/Origin
1.	Steel and Blast Furnace	35.0	Conversion of pig iron to steel and manufacture of Iron
2.	Brine mud	0.02	Caustic soda industry
3.	Copper slag	0.0164	By product from smelting of copper
4.	Fly ash	70.0	Coal based thermal power plants
5.	Kiln dust	1.6	Cement plants
6.	Lime sludge	3.0	Sugar, paper, fertilizer tanneries, soda ash, calcium carbide industries
7.	Mica scraper waste	0.005	Mica mining areas
8.	Phosphogypsum	4.5	Phosphoric acid plant, Ammonium phosphate
9.	Red mud/ Bauxite	3.0	Mining and extraction of alumina from Bauxite
10.	Coal washery dust	3.0	Coal mines
11.	Iron tailing	11.25	Iron Ore
12.	Lime stone wastes	50.0	Lime stone quarry

Table 3: Source and Quantum of generation of some major industrial waste (Adopted from National Waste Management Council- Ministry of Environment & Forests-1990/1999)

2.2.3 Agricultural wastes

Agricultural wastes are residues produced from different agricultural activities. For example, horticultural and forestry wastes, comprise crop residues, animal manure, diseased carcasses, unwanted agrochemicals and 'empty' containers (UN-ESCAP, 1993). The composition and amount of agricultural wastes in a particular country depends on the agricultural system being practice and similarly, the continue increase in productivity will significantly lead to a proportional increase in Agricultural waste.

Below table provides an estimate of agricultural wastes and residues in some Asian country (ESCAP 1997).

Country	Annual production, million tonnes		
	Agricultural waste (manure/animal dung)	Crop residues	Total
Bangladesh	15	30	45
PR China	255	587	842
India	240	320	560
Indonesia	32	90	122
Malaysia	12	30	42
Myanmar	28	4	32
Nepal	4	12	16
Pakistan	16	68	84
Philippines	20	12	32
Rep. of Korea	15	10	25
Sri Lanka	6	3	9
Thailand	25	47	72

Table 4: Approximate estimation of annual production of Agricultural Waste andResidues in Selected Countries in the Region adopted from (ESCAP 1997)

According to the above table, it was noted that People's Republic of china produces largest quantities of agriculture waste and crop residues annually from rice, corn and wheat followed by India. Conclusively, since 1960, rapid increase in Agricultural residues had been experienced and there is likely to be continuous occurrence of significant increase worldwide if developing countries continue to intensify farming systems (UNESCAP, 1993).

2.2.4 Construction and demolition(C&D) waste

C&D wastes is the type of waste generated when there is an activity such as building and demolition of roads, bridges, and fly over, subway, remodeling or remover of construction and to name of few. It comprises of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics and so on (The Ministry of Urban Development Government of India, [ref. 20 May 2012]).

In the past, C&D waste has not been given serious attention as a waste that has value rather than using it for Landfill .However in the recent years more concentration has been placed and information were discovered that many material in C&D wastes are contaminated either as part of their original design or through their use and therefore should be managed accordingly. Moreover, it has been noted that a large proportion of C&D waste (about 90 %) can be easily recycled and thus can conserve landfill capacity. (Thomas and Lizzi 2011, p.104).

Below table illustrated the typical data for the waste generated per m 2 of building (floor) as determined in Denmark around 1990. Modest amounts are generated during construction and renovation (23– 50 kg/m 2), while demolition contributes with most waste per area demolished (1625– 1760 kg/m 2). Alternatively, the unit generation rate may be based on employees engaged in C&D businesses. (Thomas and Lizzi, 2011, p.105).

Building waste	Construction		Remodeling		Demolition—residential/nonresidential	
	kg/m^2	%	kg/m^2	%	kg/m^2	%
Concrete, tiles, mortar	18	78	31	62	1510/1400	93/80
Wood and other combustibles	3.5	15	13	26	110/90	7/5
Paper and cardboard	0.5	2	<0.5	<1	5/0	<1/0
Plastic	1	5	<0.5	<1	0/0	0/0
Metal	0	0	5	10	0/90	<0.5/5.0
Other noncombustibles	0	0	1	2	0/180	<0.5/10.0
Total	23	100	50	100	1625/1760	100/100

Table 5: Unit generation rates for building waste (Adopted from Thomas and Lizzi).

According to Table 5, concrete, tiles and mortar constitute the majority (62– 93 %) of building waste in Denmark and relative to the building area under construction, renovation or demolition. Wood and other combustibles are important during renovation (older buildings being renovated often are partly constructed with wood), amounting to 26 %. (Thomas and Lizzi 2011, p.105).

2.2.5 Commercial and institutional waste

Commercial and institutional waste is generated from anything from paper and packaging of obsolete equipment in different sectors like, retail (stores), hotels, restaurants, health care (except health risk waste), banks, insurance companies, education, retirement homes, public services and transport.(Thomas H. Christensen p.112). Commercial and institutional waste generated a significant portion of municipal waste (23%), even in small region and environs which are usually collected by private sectors and municipalities have been slower to target this waste stream for recovery. Nowadays many cities and regions have realized the eco-

nomic importance of commercial and industrial waste recycling system; therefore they are actively participating in the practice.

	Wolfenbüttel, Germany	Vienna, Austria	Pennsylvania, USA	Norway	Denmark
	Kranert (2004)	Kranert (2004)	Beck (2003)	Skullerud and Stave (2002)	Johnsen (2002)
General	—	—	1	—	0.7
Retail trade (all but motor vehicle trade and maintenance)	1.6	0.4	—	1.0[a]	—
Motor vehicle trade and maintenance	2.1	—	—	1.0[a]	1.3–3.7[b]
Retail trade – bread and cakes	1.2	—	—	—	—
Retail trade – meat products	0.9	—	—	—	—
Transportation	0.5	0.4	—	1.0[a]	—
Hotel and restaurant trade	1.3	1.3	—	0.3[a]	1.8[b]
Health care services	0.6	0.2	—	—	—
News delivery, credit and insurance business	0.2–0.6	0.3	—	0.4[a]	0.2[b]
Education	0.3	0.2–0.7	—	—	0.4[b]
Interest groups, culture, sport, entertainment	0.2–0.3	0.2	—	—	—
Public service	0.2–2.1	0.2	—	—	—
Other service professions	0.4	0.2	—	—	—

[a] Biodegradable waste and hazardous waste are not included.
[b] These values are based on a survey which included only a limited number of businesses.

Table 6: Commercial and institutional waste unit generation rates (tones/employee/year) adopted from Christensen and Fruergaard).

Christensen and Fruergaard explain in the table above, how commercial and institutional waste is being generated in a country like Germany (Wolfensb uttel), a city in Austria (Vienna) and Norway and Denmark (the latter only for some of the sectors) respectively. A general value was also available for the state of Pennsylvania. (Christensen et al., 2011).

2.3 Hazardous waste

Hazardous wastes are unwanted material that is extremely dangerous and harmful to human health, animal, plants or the environment and it require critical control system by necessary body.

Hazardous wastes can be liquids, solids, or contained gases. They can be the by-products of manufacturing processes, discarded used materials, or discarded un-used commercial products, such as cleaning fluids (solvents) or pesticides. In regulatory terms, a hazardous waste is a waste that appears on one of the four RCRA1 hazardous wastes lists (the F-list, K-list, P-list, or U-list) or that exhibits one of the four characteristics of a hazardous waste - ignitability, corrosivity, reac-tivity, or toxicity. However, material can be hazardous even though it does not labeled or have the characteristic of being hazardous. For example, "used oil," products which contain materials on California's M-list, materials regulated pursu-ant to the mixture or derived-from rules, and contaminated soil generated from a "clean up" can also be hazardous wastes. (California Department of Toxic Sub-stances Control, [ref. 28 May 2012]).

2.4 Impact of waste and waste disposal

Improper disposal of waste has various environmental impacts and it can cause huge problem to human, animals, plants and the society at large. Therefore, house waste and other stream of waste have to be removed from our society in order to avoid rubbish and pollution that can pose risks to public health. On the contrary, effective management of waste disposal can contribute to socio economic devel-opment and sound environment to living things in general. However, this chapter will analyze the problem that can befall our society if necessary step is not taken by the actors involved in the maintenance, educating, improving environmental conditions as well as to increase an avenue for disposing of waste.

2.4.1 Health and environmental impact

Improper handling of solid waste creates negative effect on human health and most affected groups are mostly workers working in the field, who need to be educated on the risk and as well as people living in such area. Waste disposed on land or water become toxic and infectious material that are dangerous to human health. These infectious materials can cause skin and blood infection, eye and respiratory infection as well as different diseases that result from the vector borne disease to name a few (The Ministry of Urban Development Government of India, [ref. 02 June 2012]).

Ineffective management of municipal waste lead to pollution of water, ground water, and air which is from inefficient burning of wastes, either in open air, or in plants that lack effective treatment facilities from the gaseous effluents (The Ministry of Urban Development Government of India, [ref. 02 June 2012]).

Municipal Solid Waste Management System activities is to make proper arrangement of storage, collection, transportation, disposal of waste which is believed to have adverse impact on land, water and air environment, human and environmental health, aesthetics and quality of life. The Environmental and Health Impact Assessment may help in educating on the adverse effects that could occur during these activities and as well provide information on precautions which could prevent effects from occurring (The Ministry of Urban Development Government of India, [ref. 02 June 2012]).

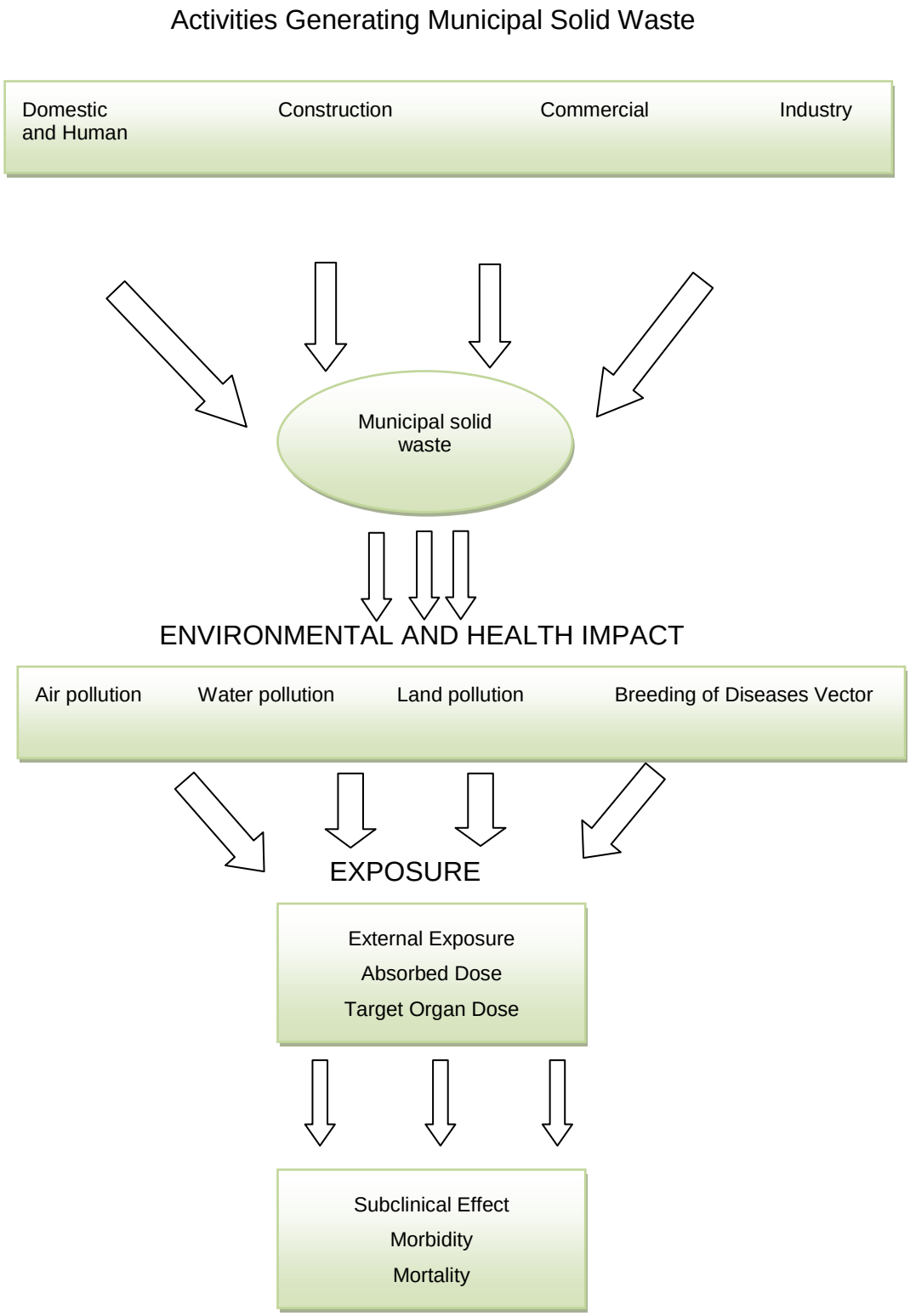


FIG.2 IMPACT OF MUNICIPAL SOLID WASTE ON ENVIRONMENT AND HEALTH

2.4.2 Types of environment and health hazard

Municipal solid waste management activities contributed significantly to air, water, land and noise pollution apart from health hazard which has a potential to cause disease or infirmity to human being.

Environmental and Health hazards associated with solid waste are divided into five main categories listed in Table 7 below.

Environmental & Health Hazards	Examples and Causes
Environmental Pollution	Air quality, water quality, land use, noise
Communicable disease	Gastrointestinal disorders, diarrhea, respiratory infection, skin diseases, jaundice, trachoma, eosinophilia etc.
Non-Communicable disease	Poisoning, hearing defects/loss, dust
Injury	Occupational injury by sharps, needles, glasses, metals, wood, violence etc.
Aesthetics	Odor, visibility, dust etc.

Table 7: Types of Environmental & Health Hazards, adopted from (The Ministry of Urban Development Government of India).

Each stage of proper project cycle provides opportunities to safeguard environment and health. For example:

- Location vis-à-vis vector borne disease;

- Design affects abundance of vector breeding sites;

- Construction may mix communities in ways that favour a range of communicable/non-communicable disease transmission;

Improper collection, storage, transportation and disposal create conditions for environmental pollution, communicable, non-communicable disease, injury and occupational health risks
(The Ministry of Urban Development Government of India, [ref. 02 June 2012]).

2.4.3 Environmental Management Plan

The main purpose of environmental management plan is to reduce the adverse effect caused by various activities involved in solid waste management on the environment. The following are the precautions to be adopted during collection and disposal of wastes in the society:

- Provision of closed container or bins should be used in order to prevent the exposure of waste and spreading of diseases through flies and mosquitoes.

- Necessary safety materials should be provided for the waste management workers.

- Disposal site or land should be properly covered with soil in order to prevent breeding of disease vectors and escape of gases of decomposition; minimize leaching, suppress foul odour, and provide better aesthetics.

- Regular monitoring of carbon monoxide, methane and hydrogen sulphide should be carried out to check the emissions of such pollutants.

- Burning of refuse in an open environment should be prohibited.

- There should be proper arrangement for the recovery and utilization of bio-gas at the land fields

- Provision of piped water should will help in fighting against dust and as well be useful for fire fighting

- Plantation of tree in and around landfill should be encouraged in order to reduce dust emission and minimize adverse aesthetic impact.

- Necessary first aid facilities should be provided to the working staff

Before these requirements can be achieved effectively, Environmental Management requires collaboration at all levels between different stakeholders, the pooling of expertise and involvement of the community (The Ministry of Urban Development Government of India, [ref. 04 June 2012]).

2.4.4 Health Risk Management

Health risk management can be defined as the process of identifying, evaluating, selecting, and implementing actions to reduce risk to human health and to ecosystem. The goal of risk management is scientifically sound, cost-effective, integrated actions that reduce or prevent risks while taking into account social, cultural, ethical, political, and legal considerations (Risk Assessment and Risk Management, [ref. 09 June 2012]).

Risk management has been defined in several ways by municipal solid waste management project to give profound understanding on safety measures. These are:

- Elimination of the source of hazard;

- Substitution of hazardous processes and materials by those which are less hazardous;

- Geographical or physical isolation of hazards from vulnerable communities, for example by land zonation;

- Reduction of health risk by using engineering control system. For example, using closed bins and containers in order to minimize spreading of diseases through flies and mosquitoes.

- Frequent maintenance of working equipment for safety reason.

Use of personal protective equipment, such as rubber gloves (The Ministry of Urban Development Government of India, [ref. 09 June 2012]).

The table illustrates clearly some actions and concerns that need to be considered during project plan stage. The main purpose is to notify development planner on some area that needed critical attention during each project stage. For example, where the community is exposed to a hazard as a result of occupation, mitigation may be achieved primarily by occupational safety measures and continuous health education. Where the community is exposed through its location, mitigation may be achieved primarily by reducing the hazard or relocation. At the planning stage land-use zonation and resettlement siting could be considered (The Ministry of Urban Development Government of India, [ref. 09 June 2012]).

Project Stage	**Surveillance and monitoring**	**Health service provision**	**Safety provision and preventive measures**	**Obtaining advice from the health sector about:**
Location	Site specific health hazards, general health status of local communities, most common causes of morbidity and mortality, location and functioning of health services	Access to health services	Settlement siting	Disease foci, vector Biology
Planning and Design	Improve routine health service surveillance by retraining health information system, laboratory services	Health centre, trained personnel, drug supply, equipment maintenance , housing for health workers, casualty/ emergency unit as appropriate	OHS planning, traffic routing, environmental management	Communicable disease control, environmental management for vector control, environmental manipulation, environmental health
Construction	OHS monitoring, environmental health, water supply, sanitary system, drug supply, vector monitoring	STD clinic, distribution of condoms, health training casualty/ emergency unit, vector and other communicable disease control	Safety measures consistent with local economy, OHS training, traffic routing	Communicable disease control, environmental health
Operation	Routine medical examination, action oriented disease trend analysis, child growth monitoring, OHS monitoring, infant mortality monitoring, vector monitoring, casualty rates	Health education, immunization, obstetrics, training traditional health workers, food supplement programme, casualty/ emergency unit, access to health service outside working hours, vector and other communicable disease control	Safety measures consistent with local economy, OHS implementation environmental management	Communicable disease control, environmental management for vector control, environmental manipulation, environmental health, human behavior modification

Opportunities for project enhancement	Health information system, diagnostic/ laboratory services	Healthy workforce is more productive and vice versa	Safer working methods, training, injury compensation	Inter-sectoral Collaboration

Table 8: Health Risk Management: some possible actions at different project stages adopted from (The Ministry of Urban Development Government of India)

2.5 Overview of benchmarking theory

Benchmarking theory is established upon the performance comparison, gap, and changes in the management process (Watson, 1993). A literature review also shows that majority of benchmarking methodologies perform the same function as performance gap analysis (e.g. Camp, 1989; Karlof and Ostblom, 1993; Watson, 1993). In a context of waste, first rule of benchmarking is to determine the performance gaps with respect to generation and utilization within a management system and to develop method to close them. The gap between internal and external practices reveals the changes and at the same time differentiates benchmarking theory from comparison research and competitive analysis. The author explained further that competitive analysis focus on product or service comparisons but benchmarking examine the operating and management skills that is use to produce goods and services. More also, competitive analysis looks at the characteristic of competitors in the same geographical location whilst benchmarking seeks to find the best practices regardless of location. (Walleck et al., 1991)

Benchmarking has been defined by many authors due to its positive and negative result affecting the success of performance improvement within the organization. The literature review of Kozak, 2004, original sources: Camp, 1989; Zairi, 1992; Smith et al., 1993; Rogers et al., 1995, explained that benchmarking:

- Enable organization to ascertain the position they have more strength and weaknesses depending upon charges in supply, demand and market condition.

- Enables to set new standard and objectives to enhance customer satisfaction in term of quality, cost, product and services.

- It gives employees new standard knowledge to work on and also motivate them to always strive for more improvement.

- Enable organization to determine the possible level of performance they could attain by looking at others and to what extent they could achieved such performance

- Help organization to stimulate continuous performance which will give them competitive edge over others and enables it maintain world class standard.

Despite the above benefit, a successful benchmarking researcher Bendell (1993) stated that time constraints, competitive barriers, cost, lack of both management commitment and professional human resources, resistance to change, poor planning and short-term expectations are regarded as barriers. The author further noted that poor execution of benchmarking exercise can lead to waste of time, finance and human resources. Elmuti and Kathawala (1997) illustrate that there is no single "best practice" of benchmarking because people's ideology varies and organization concept and system differs from one another.

On a contrary, there is a risk involved in benchmarking others and adopting their new standards into one’s own company. However, the best practice which is producing outstanding performance with good examples should be perceived and adopted.

According to research, benchmarking has been defined by many authors and organization even though each definition aims to reach same conclusion. Nevertheless, benchmarking was basically stems from Deming's quality management theory, which aims to enhance quality and check its sustainability by following several stages in order (Kozak 2004, p.5). Webster's Dictionary defines benchmark as 'a standard by which something can be measured or judged' (Kozak 2004, p.5). Xerox and Robert C. Camp at the end of the 1980s gave most widely accepted and referenced text on the subject of benchmarking as the continuous process of measuring our products, services and practices against the toughest competitors or those companies recognized as industry leaders' (Camp 1989). On a simply note, benchmarking is the process of finding the best practice in an organization and forecasting what performance should yield in the future. The three principles of benchmarking are maintaining quality, customer satisfaction and continuous improvement. (Kozak 2004, p.5, original source: Watson 1993)

Some author sees benchmarking as a continuous process or measurement while others defined it as finding and looking significance things to enhance an organization performance. For example, Vaziri (1992) defined benchmarking as a continuous process of comparing organization's performance with that rated as the best within the industry considering consumer's needs and determining what needed to be improved in order to have competitive edge in the future. Similarly, Watson (1993) also emphasizes benchmarking in term of continuity feature referring to the continuous input of information acquired from benchmarked organization into the organization. Geber (1990, p.36) based his definition at significance focus on the best practice of benchmarking as follow: ''a process of finding the world-class examples of a product, service or operational system and then adjusting your products, services or systems to meet or beat those standards'.

Authors	Features of benchmarking			
	Ongoing process	Against the best	Performance improvement	Gaining new information
Camp (1989)	X	X	X	
Geber (1990)			X	X
Vaziri (1992)	X	X	X	
Balm (1992)	X	X	X	X
Spendolini (1992)	X	X	X	
McNair and Leibfried (1992)	X		X	
Codling (1992)	X	X	X	
Evans and Lindsey (1993)		X	X	X
Watson (1993)	X			X
Kleine (1994)			X	X
Lu *et al.* (1994)				X
Cook (1995)			X	X
Cortada (1995)			X	X
Watson (1997)		X	X	X
APQC (1999)	X	X	X	

Table 9: Approaches to definitions of benchmarking adopted from (Kozak 2004. Destination Benchmarking)

In practice by many organizations, benchmarking process usually encompasses the following:

- Regularly analyzing and comparing aspect of performance with high ranked organization
- Identifying the performance gaps
- Establishing fresh method to improve on such performances
- Continuous tracking the implementation improvement; and
- By continuous monitoring progress stages and assessing the benefit

2.5.1 Types of benchmarking

Due to many relevant literature reviews, it could be seen that there are many classification of benchmarking, the main categorization are internal, competitive and functional benchmarking (Kozak 2004, p.10 original authors: Camp, 1989; Zairi, 1992). Kozak (2004, p.10) further classified benchmarking into two parts: internal and external benchmarking, in same context, competitive and functional benchmarking was classified under external benchmarking.

Internal benchmarking

Internal benchmarking is regarded as two ways communication and sharing information between departments within the same organization or between organizations operating as a branch in different countries (Cross and Leonard, 1994; Breiter and Kline 1995). This kind of system can be found in a franchising company whereby an outstanding performance by any part of the organization will be learnt by the other. Internal benchmarking is an added advantage to an organization or partner who shares a common language, culture and systems, having easy access to data, and giving a baseline for future comparisons (Breiter and Kline 1995).

External benchmarking

It is an opposite or reverse case of internal benchmarking as it was read in many relative literatures. External benchmarking requires comparison of activities with external organization in order to acquire method, new ideas and knowledge using by the organization to attain such an outstanding performance in the production of goods and services. Kozak (2004, p.11) noted the objective of external benchmarking as the persistence in improvement of one’s performance by measuring and comparing with that of others and determine how others achieve their performance levels. This type of benchmarking provides opportunities for an organization to learn from the best practices and experiences of the others who have the

competitive edge in the industry. The consistent review of benchmarking by Kozak (2004, p.11) has brought up another three subcategories of benchmarking which are: competitive, generic and relationship benchmarking.

Competitive benchmarking

This type of benchmarking occurs only among the direct competitors. According to Kozak (2004) explains that competitive benchmarking is regarded as the most sensitive type of benchmarking activities because of it difficulties in achieving an applaudable collaboration and cooperation with direct competitors and reach primary sources of information. For example Xerox's market shares starts to diminish because of the entrance of new competitors. Therefore the management decided to benchmark its performance with competitors within the same industry. The results of this enhance its financial position, stabilized its market shares and increase its customer's satisfaction. (Cook 1995).

Functional benchmarking

Functional benchmarking refers to comparative research and attempts to seek world-class excellence by comparing business performance not only against competitors but also against the best businesses operating in similar fields and performing similar activities or having similar problems, but in a different industry (Kozak 2004, original sources: Davies 1990; Breiter and Kline 1995). For instance British Rail Network South East benchmarked British airways in order to improve the standard of cleanliness of trains. They were able to achieve such aim by the survey that was conducted on British airways mode of cleanliness. (Cook 2005) Moreover, this type of benchmarking makes it easier for best in class organizations to share new ideas, best practice and experience together and it is as well regarded as non- competitive benchmarking (Kozak 2004, p.12).

Relationship benchmarking

This type of benchmarking occurs between organizations that have mutual relationship together before the agreement of benchmarking is sealed (Anderson, 1995). This method potentially may provide some benefits to organizations since less time is required and the trust established between the two parties will help break down confidentiality barriers. Cox et al., (1997) call this 'collaborative benchmarking'.

2.5.2 Benchmarking best practice

Historically, benchmarking is seen as an essential tool for continuous improvement of goods and services in an organization (Dattakumar and Jagadeesh 2003). For example Xerox Corporation in the United States was the first company to be credited with a successful benchmarking project in 1979.

Nowadays, organizations have realized that in order for them to survive in the nearest future, they have to initiate major changes within their organization that will make them more productive and reduce costs. Benchmarking goes beyond just competitive analyses, rather than analyzing organizational processes and method to assess how the competitive edge is achieved. Benchmarking against Best practice requires seeking out the undisputed leader in the process that is critical to business success regardless of sector or locations. I.e. using the most effective methods of achieving optimal performance leading to superior performance is the process of benchmarking for "Best Practices" – identifying, sharing, and imparting knowledge, innovative ideas, and highly effective operating procedures related to best business practices, inside and outside your organization (Julian L. Aston and Jonathan A. Goldhill). In a nutshell, the achievement of any organization is to successfully identify and applying best practices in its operations which will result to reduction in business expenses and improve its organizational efficiency.

In order for benchmarking process to be achieved in an organization, the follow steps need to be initiated and implemented (Julian L. Aston and Jonathan A. Goldhill):

Step 1: The management needs to establish a lead Best Practices team that will be engaged with overall development and company-wide implementation of this important new activity. In addition, creates departmental benchmarking teams charged with development and implementation of Best Practices within their individual department.

Step 2: Each team need to establish the types of Best Practices their department must put in place.

Step 3: Teams need to ascertain benchmarking resources applicable to their Best Practice needs.

Step 4: The teams need collect and analyze information critically.

Step 5: Each team need to determine the value of each Best Practice relative in order to attain departmental and overall corporate aims and objectives.

Step 6: Team members need take the time to understand and analyze the ‘point gap’ between an existing standard or practice and the desired best practice standard.

Step 7: Each team brainstorms strategy they can use to close the ‘point gap,’ and develops an action plan in support of upholding each Best Practice.

Step 8: The teams need to operate under the leadership and guidance of the outstanding Best Practices Team, reporting to Senior Management.

Finally in order for the implementation of a Best Practices Program to be success full, establishment of departmental Best Practices teams must be initiated and charged with the task of managing the process on a continuous basis.

2.5.3 Best Practices Example

A vivid example of a best practice is established by SRC in Springfield, Missouri. Convinced that everyone is responsible for the company's success, SRC's management team trained every employee in "cash flow management," a tool that has enabled the company to generate double-digit growth every year since its founding 12 years ago. SRC has grown in 12 years from one company of 100 employees to 12 employee-owned companies in 16 sites with 750 people. SRC has been named the "Entrepreneurial Company of the Year" by Inc. magazine for the last three years. The current turnover rate is less than one percent. (California Department of Toxic Substances Control, [ref. 10 August 2012])

2.5.4 Difference between benchmarking and best practices

Are benchmarking and best practices the same? According to many literature reviews, it could be understood that benchmarking is totally differ from best practices. Benchmarking is the process that gives one the opportunities to ascertain potential best practices, i.e. identifying best ranked performer; one to locate a specific practices within an organization that could enhance own performance. However, there are different categories of benchmarking which organization might practice and it was understood that some organization benchmarked for the purpose of setting performance target for their own organization rather to ascertain practices that contributed to the success of other organization and to emulate it.

2.5.5 What distinguishes best practices from benchmarking?

A best practice is never a new idea, perhaps is what meets the seven following criteria:

1. Successful over Time: A best practice must be documented.

2. Quantifiable results: The achievement must be quantifiable.

3. Innovative: Must have a distinctive program and process from its peer

4. Recognized positive outcome: Best practice should generate different positive result and indicators

5. Repeatable: A best practice should be adopted with modifications. Should establish different strategies and be able forecast benefits that are likely to be accrue to others.

6. Has local importance: Best practice is seen as an outstanding performance to those who seek for it. Therefore, it should not be a duplicate strategy; i.e organizations should adopt it with modification.

7. Not linked to unique demographics: A best practice may have evolved as a result of unique demographics, but organization from other demographics should be able to transfer with modification. (Professor Tarun Das, Benchmarks and Best Practices, [ref. 11 August 2012])

In conclusion, although different authors views benchmarking from their different perspectives as it is demonstrated in the table 9. All these definitions portray same aim and objectives: the continuous measurement and improvement of an organization's performance against the best in the industry to obtain information about new working methods or practices (Kozak 2004, p.7). However, best prac-

tices and methods that are seen as the success key to an organization may not necessarily be the best to those adopting it. Therefore benchmarking requires full scale modification and extensive innovation in order for justifiable achievement to be attain.

2.6 Sustainable waste management approach

In the history of waste management, Public health and safety has been the major concern i.e. waste must be managed effectively in order to minimize health hazard. Nowadays society has seen beyond this and the major demand now is how waste management can be sustainable. Sustainability or Sustainable Development has been defined as ‘development which meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED, 1987). The figure identify the synergy between economic development, social equity and the environment and which simply implies that waste management must be :

- Economically affordable
- Socially acceptable
- Environmentally effective.

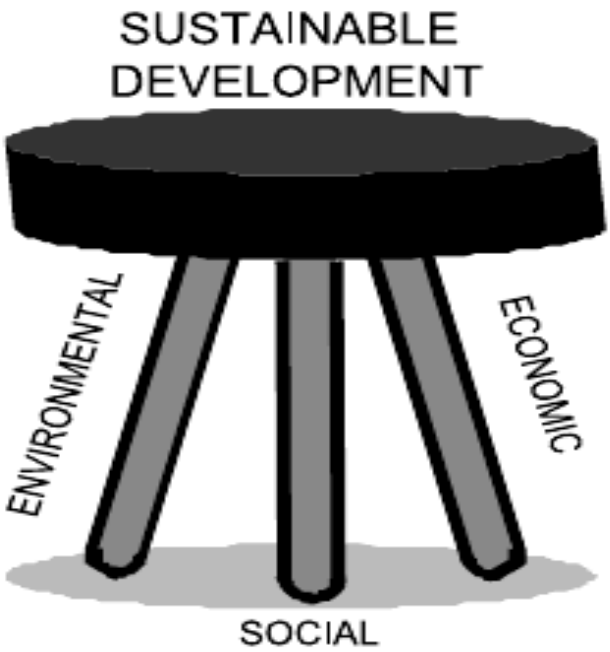


Figure 3: The three pillars of Sustainable Development. Equal consideration of each is necessary otherwise the whole system will become unbalanced adopted from (McDougall, Forbes R., 2001)

According to McDougall, Forbes (2001) explained that economic cost is a major striving factor in the decision making process of waste management in the past; however, recently environmental concerns have played significant role in this process. Although, the introduction of social aspect in waste management as a decision making process is not a new concept, thus has been limited as research into how to measure social concerns is only just beginning (Nilsson-Djerf 1999).

The two major areas of environmental concern over the management and waste disposal are conservation of resources and pollution of the environment.

2.6.1The old concern- the conservation of resources

Four decades ago, Meadows et al., (1972) argues that the conservation rate of earth's finite materials and energy resources (nonrenewable) will finished indefinitely. Similarly few years after, but with increased urgency; raw materials are being used at a faster rate than they are being replaced, or alternatives are being found. As a result of the argument, sustainable development was introduced which state natural resources should be effectively managed and where possible conserved but not to the detriment of future generation Brundtland Report Our Common Future (WCED, 1987).

Recently, with technology discovering and new innovation, the concern about the imminent depletion of natural resources has proved to be incorrect (Beckerman, 1995; UNDP, 1998; UNDESA, 1999). The table 9 explained how technology and innovation have led to the discovery of more raw material deposited on earth and at a lower extraction cost today than 20 years ago (McDougall, Forbes R original authors: Meyers and Simon 1994; Simon 1996). Consumption has changed in favor of less material-intensive products and services – 'eco-efficiency'. Energy efficiency has improved and technological advances and the recycling of many raw materials have increased the efficiency of material use. These factors have led to material use now growing more slowly than many economies (UNDP, 1998). However, depletion of resources argument can as well be true to some extent, but technology development has limited such to happen because of the time period for such occurrence is extremely long.

	Reserves 1970	Reserves 1989	Cumulative consumption 1970–89
Aluminium	1170	4918	232
Copper	308	560	176
Lead	91	125	99
Nickel	67	109	14
Zinc	123	295	118
Oil*	550	900	600
Natural gas	250	900	250

Table 10: Proven reserves of raw materials (10 tonnes unless otherwise stated). In all cases (except lead) reserves in 1989 were greater than reserves in 1970 by more than the amount consumed during this 19-year period. After: Beckerman (1995) *10 9 barrels of oil equivalent

2.6.2 The new concerns – pollution and the deterioration of renewable

Nowadays, apart from the contemplation of depletion on non-renewable material, (UNDP, 1998), there are two major concerns that need urgent attention for the survival of our future generation needs. These are:

- The continuous increase in pollution and waste that is overwhelming our planet and that cannot be absorb or convert to harmless compounds and

- The increased decline of renewables such as water, soil, forests, fish stock and biodiversity.

In addition, Figure 4 described that urban, industrial contamination and waste are increasing at a faster rate in within and across regions except Africa and polar Cap.

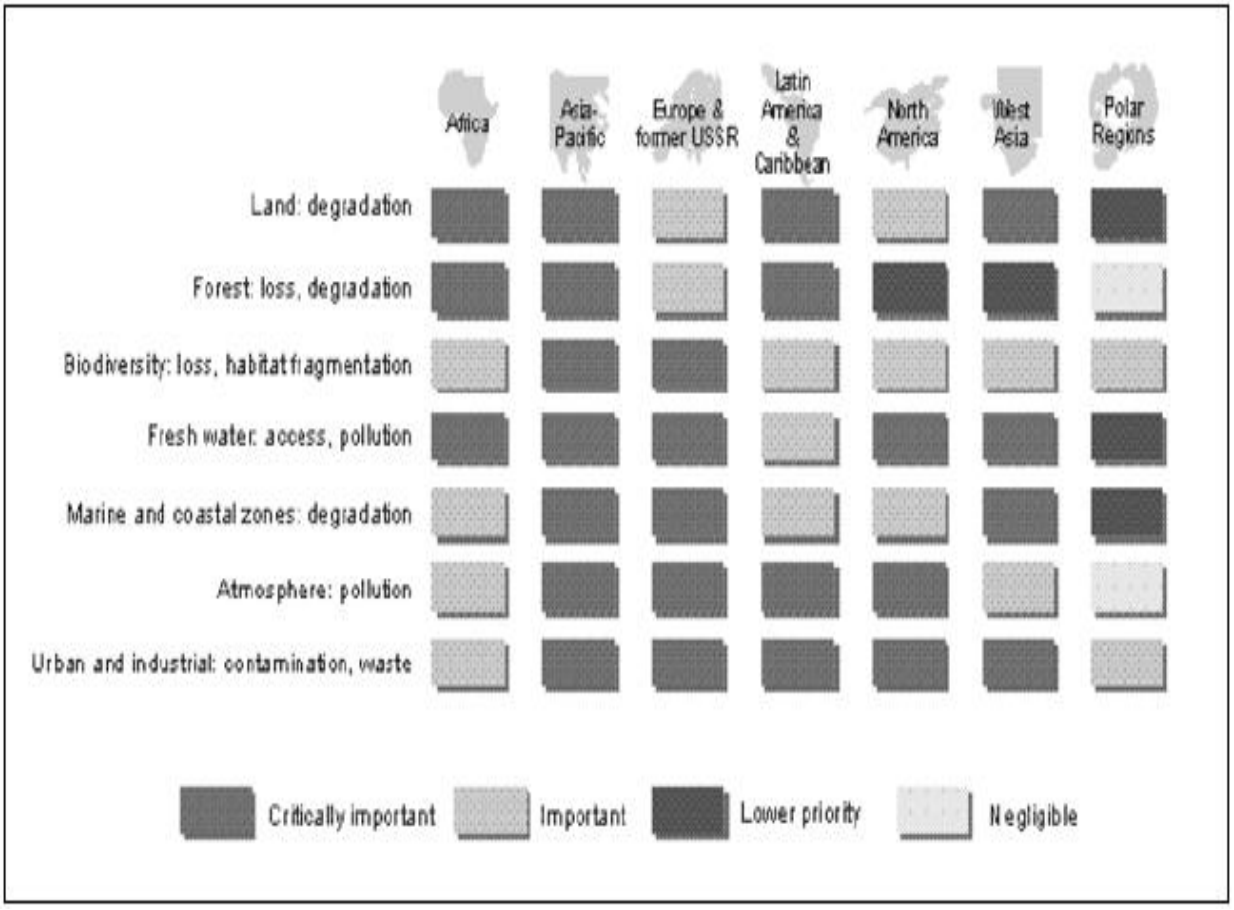


Figure 4: Regional concerns: relative importance given to environmental issues by adopted from UNEP (1997).

2.6.3 Sustainable Waste Management

Contrary to the explanations above, many still believes that the method of putting waste in the hole on the ground (landfill) is an act of inefficient material management. However, scientifically the concentration of the useful materials out of those in the hole is higher than the original raw material ore. Therefore, land filling could be considered as a means of long term storage of material rather than traditional

thought of improper disposal. Could this be the best way to manage such material? However, this call has led to integrated approach to solid waste management.

2.6.4 Integrated Waste Management (IWM)

McDougall defined Integrated Waste Management (IWM) systems as the combination of waste streams, waste collection, treatment and disposal methods, with the objective of achieving environmental benefits, economic optimization and societal acceptability. This will lead to a practical waste management system for any specific region.

The Key features of IWM are:

1. An overall approach

2. Uses a range of collection and treatment methods

3. Handles all materials in the waste stream

4. Environmentally effective

5. Economically affordable

6. Socially acceptable (McDougall, Forbes R 2001, p.15).

The basic requirement of waste management

The initial basic principles of waste management were developed primarily to protect and safeguard human and its environs from harmful substances. Managing waste is another major concern which needs to be address for the betterment of the future generation. The two fundamental concerns are: minimizing waste and then an effective system for managing the waste still produced.

The generation of less waste

According to Brundtland report at united nation summit “Our common future” stated categorically that sustainability could only be achieved if the society in general and industry in particular learn to utilize less resources in producing more; more goods and services from less of the world’s resources (including energy), while generating less pollution and waste (WCED, 1987). Moreover, the concept of less from more has been the major practice by industry in range of concentrated product, light weighted and refillable packaging, reduction of transport packaging and other innovation (Hindle et al., 1993; IGD, 1994; EPU, 1998). Also many companies are using internal recycling of materials as another mean of solid waste minimization during production.

In conclusion, McDougall state that ‘waste minimization’, ‘waste reduction’ or ‘source reduction’ are usually placed at the top of the conventional waste management hierarchy. In reality, however, source reduction is a necessary precursor to effective waste management, rather than part of it. Source reduction will affect the volume, and to some extent, the nature of the waste, but there will still be waste for disposal (2002, p.16)

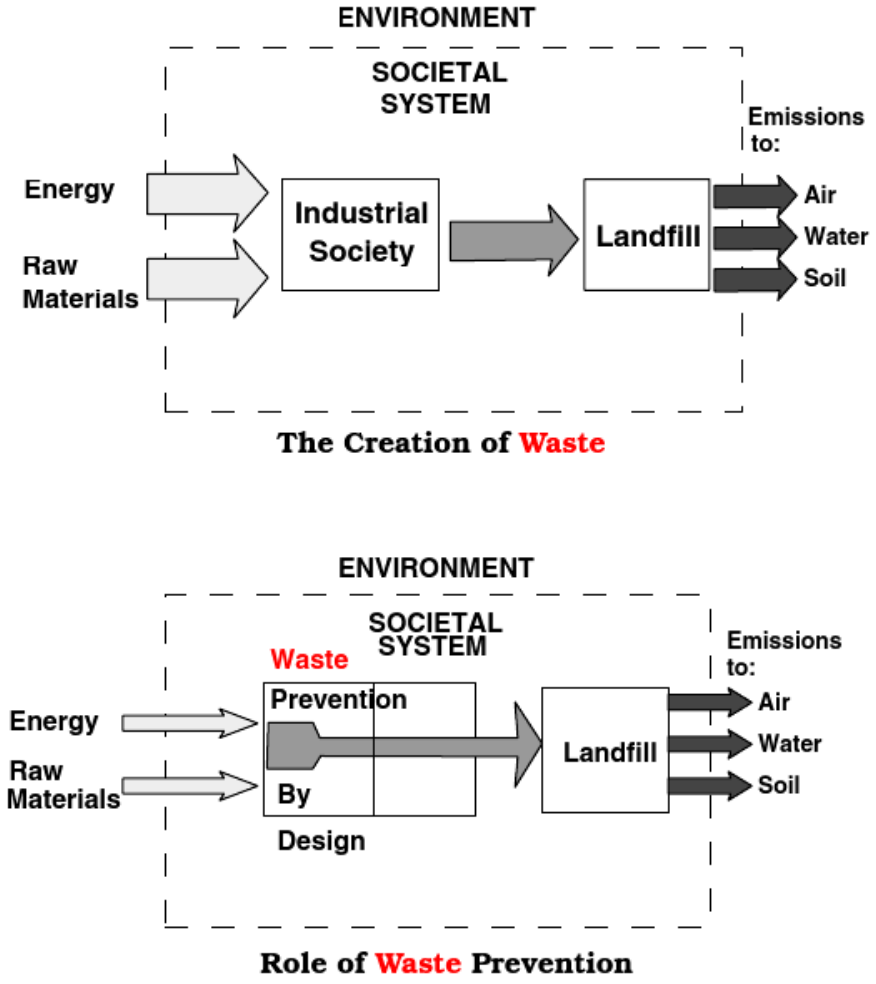


Figure 5: The respective roles of Waste Prevention and Integrated Waste Management.

In life cycle studies, a ‘system’ is defined (with boundaries indicated by broken lines). Energy and raw materials from the ‘environment’ are used in the system. Emissions, including solid waste, leave the system and enter the environment (adapted from McDougall, Forbes R 2002).

2.6.5 The concept of Sustainable Waste Management

The optimum priority of solid waste management system is to ensure human health and safety. They must protect workers and general public by preventing spread of diseases. Additionally, some other objectives of sustainable system of solid waste management are to be environmentally effective, economically affordable and socially acceptable.

1. Environmentally effective: waste management system must be able to protect and reduce the environment from improper disposal of waste that can cause hazard (emissions to land, air and water, such as CO 2 , CH 4 , SOx, NOx, BOD, COD and heavy metals).

2. Economically affordable: The general public should be able to afford the cost placed on waste operations by waste management system. Means that the cost of effective waste management system should consider the living standard of people in such community.

3. Socially acceptable: For waste management system to operate effectively, public cooperation is important. Moreover, they should always try to provide vital information, educate, develop trust and gain support from the community. Provision of bins or containers for collection and sorting of waste is another means by which recycling can be effective in the communities.

Obviously, it is easier said than done to achieve the three variables at the same time without any trade off. Therefore, it is better to be done simultaneously, firstly; by reducing all the environmental burden of waste management system with an acceptable level of cost and with such an achievement further improvement will be decided and put into practice (McDougall, Forbes R 2002).

2.6.6 The concept of Integrated Sustainable Waste Management (ISWM)

This section of ISWM will be elaborated in the context of technological and design aspect of waste management system instead of the general conventional approach. Further explanation will be based on the principles and mechanisms of ISWM and their importance for the technology selection and system design.

Before further explanation on the concept of ISWM, it is important to elaborate on the term sustainable and integrated from a context of ISWM.

Arnold and Justine (1999) seen sustainable as a system that:

- appropriate to the local conditions in which it operates, from a technical, social, economic, financial, institutional, and environmental perspective, and;

- capable to maintain itself over time without reducing the resources it needs

Integrated = a system that:

- uses a range of inter-related collection and treatment options, at different habitat scales (household, neighborhood, city)

- involves all stakeholders, be the governmental or non-governmental, formal or informal, profit- or non-profit oriented

- takes into account interactions between the waste management system and other urban systems

The environments that need to be integrated by solid waste management system are shown in the table below:

Habitat scale	Collection and disposal system	Resource recovery system
Premise level	Storage at source	Prevention Separation at source Reuse at source
Neighborhood Level	Primary collection Temporary storage	Primary collection Sorting and pre-treatment Reuse Recycling Composting
City level	Secondary collection Transfer storage Tertiary collection Final disposal and treatment	Sorting and pre-treatment Secondary collection Reuse Recycling Composting

Table 11**:** integrated solid waste management system Environment adapted from Arnold, K. & Justine, A. (1999).

Sustainable and integrated are inter-related in a sense. For example, the involvement of member of the public is very vital for sustainable development to be success in any waste management system. Moreover, if waste management systems are integrated with other system, then it could enhance sustainability and it objectives will be accomplished. For instance, raw materials generated from waste in a particular region are being utilizes in that region etc. can lead to a closed-cycle system within the region, which can make the burden of importation be reduced and activities of such system will be supported by the member of the community.

The diagram below will also help to bring more insight to the concept explain above by showing the interaction of different sectors that would enhance sustainability and promote integration in a waste management system.

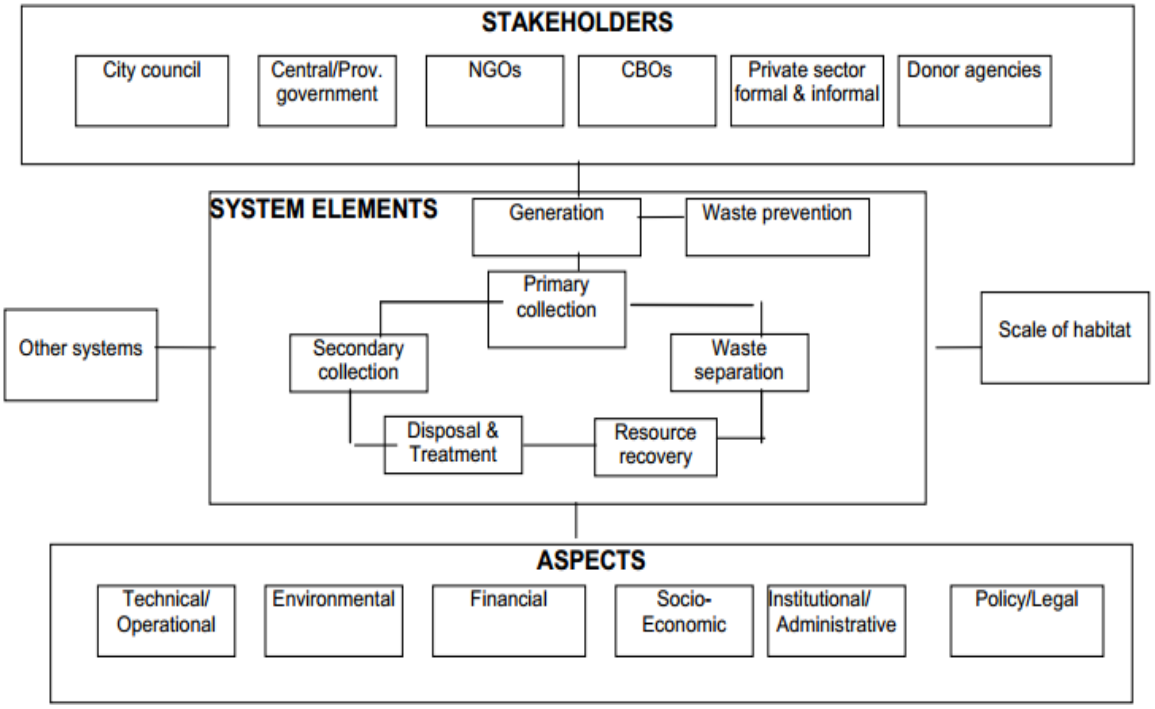


Figure 6. Dimensions of Integrated Sustainable Waste Management Adapted from (Arnold, K. & Justine, A. 1999).

According to “world bank examination, ISWM should not be used as a blueprint but due to it analysis in providing appropriate technologies for waste management and the development of waste management system as a whole. It induces policy and institutional reform to encourage sustainability in waste management (Arnold, K. & Justine, A. (1999), [ref. 29 August 2012]).

ISWM will be analyzed further from two different perspectives below:

1. BASIC PRINCIPLES: is the aspect of ISWM which was further developed to serve as an instruction to follow in order to achieve integrated sustainable waste management system.

2. MEANS/MECHANISMS: are question which waste management system will be made on to be sustainable and integrated? What mechanism or process to be established to achieved the aims and objectives?

All the aspect will be explain briefly below:

The below principles for Integrated sustainable waste management have been developed by WASTE, based on research conducted and project examined by different on WASTE (Lardinois & van de Klundert, 1995, Hemelaar& Maksum, 1996, Moreno et al. 1999, Coffey, 1996, Schuebeler et al. 1996, van Beukering et al. 1999,Anschutz and v.d.Klundert, 1999).

Technical Principle	Technologies : -Technology selection should be based on local spare part availability -Indigenous and locally manufactured technology should be selected -Select long life span technology with good quality Systems: -The systems should be adapted to the physical environment, topography and other physical requirements of the region -Develop precaution and maintenance procedure -Develop effective system and ensure maximum utilization of equipment.
Environmental principles	-Ensure safety of soil, air and water at all regions -Adopt hierarchy of waste management in order to reduce waste and to promote proper collection, disposal, re-use, sources separation and recycling. -Encourage proper waste treatment and bring recovering of resources to source as possible

Financial economic principles	-The principle of beneficiary should be based on all sector contribution i.e. apart from waste generator payment by users, all other sectors involved in waste management activities should also pay profit taxes and allocating municipal revenue to waste management -Propose reasonable payment, transparently and in a consultative manner: (1) evaluate cost and benefit to be acquired; (2) reasonable fees should be required from all waste system users; (3) Allow all service providers to operate at a realistic level.
Socio-cultural principles	-Provision of services to all strata of the population regardless of their ethnic, cultural, religious or social background and reduce hazard posed on the environment. -Employment opportunity should be provided by the system -Users opinion should be consider on the aspect of quality and pricing of the services and on changes in service when is needed. -Services should be adapted to user demand and priority.

Institutional / Organizational principles	Technologies and systems : -Provision of incentives, recruitment and promotion should be based on credibility. -Social privatization should be encourage -Sustainability of waste management should be promote by government as well -Encourage inter-sectorial co-operation among other urban system -Responsibility should be assign respectively -Private sectors should be allow to express their competency on waste management -Gives all stakeholders opportunities to partake in planning and implementation especially weaker and less privilege group -Provide means for accountability and complaint

Policy/Legal/ Political principles	Legal framework: -Initiate the participate of non-governmental actors and the private sector -Support decentralization of tasks, authority and finance -Established rules and regulations that are transparent and unambiguous -Discourage partial enforcement of rules and regulations Policy and political framework: -Decision-making at the lowest level of authority should be encourage, most especially the municipality, regarding financial matters and selection of technologies -Give waste management a high priority in both policies and budgets -Foster accountability of decision-makers to ensure efficient use of public funds -supports the 'waste management hierarchy', giving preference to waste prevention, source separation, re-use and recycling, above mere collection and disposal

Table 12**:** The principles for integrated sustainable waste management adapted from Arnold, K. & Justine, A. (1999)

For proper protection of health and environment in every community, joint effort need to put into place by several agencies and people living in such area. Health services need to give proper education on health safety to people living in such region apart from their normal routine activities which include, health data collection, collation, analysis, interpretation, curative and preventive measures. Environmental protection agencies (Central and State Pollution Control Boards) need to regulate, enforce implementation and monitor compliance with water and air quality, waste emissions and noise regulations (Lardinois and van de Klundert et al. 1999).

Municipalities and Urban Local Bodies are to ensure proper management of municipal solid waste, regulating and enforcing pollution prevention and control regulations which will regulate communicable, non-communicable diseases and injury in the community. Moreover, the above objectives and principle need to be adopted effectively by waste management bodies and giving the stakeholders the opportunity to participate in waste management activities which is believe to be one of the avenue to achieve sustainability goals (Lardinois & van de Klundert et al., 1999).

3 WASTE MANAGEMENT SYSTEM IN NIGERIA

This chapter will be analyzing economic and environment impact that effective integrated waste management approach in Finland has contributed to its economy. This will be used in correcting the problem facing Lagos state waste management in general. Improper disposal of rubbish has been a major problem in Lagos, as the population increase it leads to the proportional increase in waste that causes enormous damage to our environment and if cares in taken it will destroy the potential of future generation.

In developed countries like Finland and USA and some part of Europe, market for solid waste management and disposal has experienced rapid changes over two decades, but utilization of such opportunity in developing nations is yet to be news due to many factors. Introduction of current practiced of solid waste management in Finland and best available technologies to Lagos state will enhance good standard of living, favorable social and economic condition and it will create an avenue for foreign investors in partnership with Lagos state in the aspect of recycling. With such introduction and cross examine of both states, the result will bring best applicable technologies which will be suitable for economy growth. In addition, the analysis will established recommendations to policy- makers in Lagos recycling industries and as well enlighten the general public on the values that lies in waste they disposed daily.

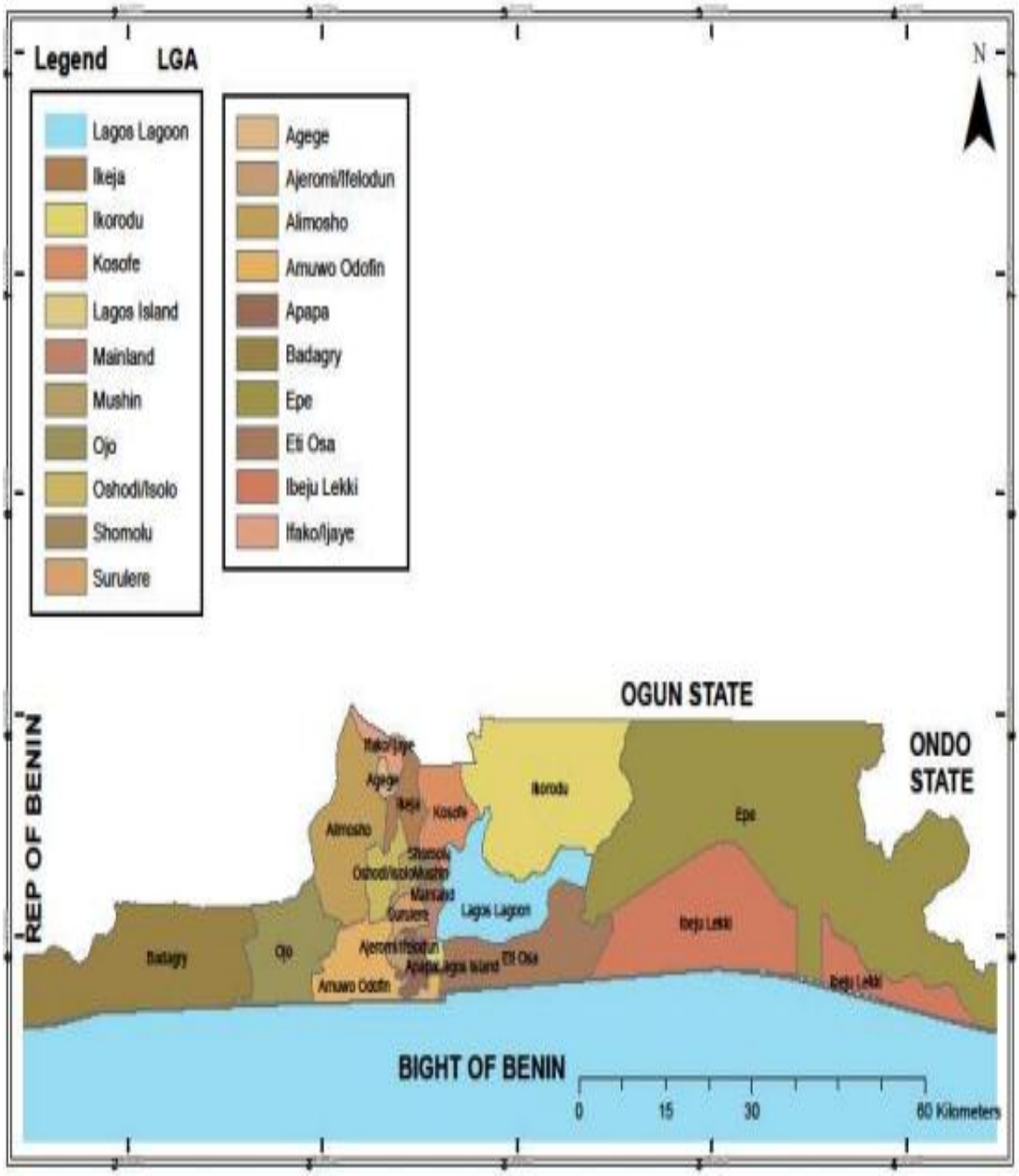
3.1 Study area

Lagos state is the most developed city and commercial nerve of Nigeria, located in southwest with about 18 million inhabitants. Presently the state is densely populated with over 4000 person per square kilometer and United Nations' estimated that by year 2015 based on 6% growth rate, the state may be the 3rd largest mega city in the world. The state shares boundary in the North with Ogun State, West with the Republic of Benin, and stretches for over 180 kilometers north of the

Guinea Coast of the Atlantic Ocean which make it play a very significant role in importation and exportation system in the country. It was among the 12 state that was created on 27 of May 1967 under Decree No. 14 of 1967 and was the former federal Capital state where all administrative activities took place. In 1991, the Federal Government of Nigeria under the military administration of General Ibrahim Badamasiu Babangida relocated the administrative base and activities of the country from Lagos to a new Federal Capital Territory Abuja due to level of rural-urban migration. Lagos State has 20 Local Government Councils and comprises of 57 Local Government Development Areas which contributed more to heavy production of waste generation in the country. (Lagos State Ministry of Information, [ref. 02 September 2012])

According to Adebola Olugbenga (2004), it was postulated that over 70% of the total industries in Nigeria are based in Lagos and it has proportionally lead to the heavy generation of waste which was so enormous and overwhelming to all government agencies involved to effectively handling of integrated waste management system activities in the state. The huge volume of waste being generated in past and the inability of government to handle this waste effectively has led to the creation of many agencies (formal and informal private sector) in order to manage the collection, transportation, recovery, recycling and disposal of solid waste in the state successfully but all effort are yet to yield positive result on the economy compared to developed countries. For example Finland being the second largest producer of forest resources and some energy-intensive industries such as pulp and paper, metallurgy and the manufacture of metal products thus strong attention is still driven toward waste management problem. Moreover, the concepts of waste reduction and prevention, as well as the hierarchy of waste management options were adopted in order to support the economy of the country.

Figure 7: Map of Lagos State showing Twenty (20) most Urbanized Local Government Areas where percentages of waste generation are very high



Source: Lagos State University(LASU) Cartography Department

3.1.1 Solid waste management in Lagos state

Waste management has never being seen as a problem in Lagos state, because the habit of littering the environment is part of life of every Lagosian until 70's when Lagos state was tagged the most dirtiest city in the world (Adedibu and Okekunle, 1989). By this time every nuke and cranny of Lagos has became dumpsite and vulnerable to hazard which is conspicuously embarrassing, then Lagos state Government start to adopt different strategies aimed to tackling these eyesore. The table below shows various institutions established so far by Lagos state government in order to combat with the problems generated by improper solid waste disposal. The oscillation of waste management system in Lagos was due to changes in various government agencies and each has its objective which is believed to create a conducive atmosphere in the state.

Years	**Name of institution**	**Supervising Authority**
1977 -	Lagos State Refuse Disposal Board (LSRDB)	Ministry of works and Transport
1980 -	Lagos State Waste Disposal Board (LSWDB	Ministry of works and Transport
1991 -	Lagos State Waste Management Authority (LAWMA)	Ministry of the Environment and Physical Planning (MEPP)
1994 -	Local Government Councils and LAWMA	Local Government and MEPP
1997 -	LAWMA and PSP pilot scheme in Somolu & Kosofe Local government areas	Ministry of the Environment and Physical Planning (MEEP)
1998	Private Sector Participation (PSP) in domestic waste management state-wide and LAWMA handling Industri-al Waste	Ministry of the Environment and Physical Planning (MEEP) / Local
1999	Private Sector Participation (PSP) in waste management	All local Governments/ Ministry of the Environment/ Office of the Deputy Gover-nor.

2004	Mega/ major PSP in waste management	Ministry of the Environment/ Office of the Deputy Governor

Table 13: Institutional changes in the state solid waste management (adopted from Independent study on the operations of the informal private sector in solid waste management in Lagos state).

The changes in name and status brought more responsibilities/functions to the organization, these include; collection, transportation and disposal of all waste vis-à-vis the Industrial and domestic waste, garden and agricultural waste, construction waste, clinical and commercial waste etc. Above all the organization has the responsibility of managing all government approved landfill sites throughout the state Adebola Olugbenga O (2006). However, the continuous increase in the volume of waste generated on a daily basic was so enormous and overwhelming to the extent that government owned agency could not handle it effectively, and this led to the interference of the general public by seeking for an alternative in order to clean up the nuisance in the communities. These development boost the interest of some individuals (formal private sector) who have the financial strength, some level of technical know-how/experience to established their company while others (informal private sectors) are those that deal on house to house waste collection, transportation and recovery in an affordable price.

Among all agency LAWMA is the current reformed institution vested with the responsibility of monitory and collection of all form waste, managing approved landfill sites throughout the state and above all campaign against indiscipline among all Lagosians.

3.1.2 Constraints of waste management system in Lagos state

- Incessant political interferences
- Operational and Institutional instability
- Inadequate funding and equipment
- Non involvement of the public in decision making
- Non-challant attitudes of staff
- Usage of highly sophisticated equipment, without adequate technical know-how for its maintenance.
- Waste generators (public) not willing to pay for the services, especially when services became epileptic.
- Corruption and mismanagement of fund

3.2 The role of informal private sector

Informal private sector involvement in waste management activities in Lagos state so far has yielded a very significantly and applaudable result on the environment. This sector is an institution of it own with little knowledge of integrated waste management approach of collection, transportation, recovery, recycling and merchandise recovered and recycled material to industries within and outside the country.

The chart pusher

These are the set of informal private sector which were instigated by ineffective performance of government own waste management agencies. They are involved in house to house collection of waste at a particular fee depending of the volume of waste using carts; sorting and recovery of reusable and recyclable items from the waste before disposing the useless ones. According to Adebola Olugbenga (2006), it was estimated that over 70% of the waste generated in the state was being collected, transported to a designated landfills by government or the communities.

Due to the inability of legal establishment and proper regulation of the informal private sector, it is impossible to acquire accurate date/record of their effort in the waste management industry. It was estimated that over 5,000 cart pushers are operating in Lagos state and they cart away thousand of rubbish every day. Figure below shows cart pusher on Lagos Street.

Figure 8. Cart pushers on the street of Lagos

Scavengers

These are group of actors with full recognition of Lagos state government that involved in the sorting, recovering of re-usable and recyclables materials for example, Aluminum, glass, paper, plastics, scraps metal, animal wastes like horn, bones to name a few.

Their activities involve going from Street to Street searching for re-usable and recyclables materials and while some limit their operations to the dumping site. Several million worth of recyclable materials are generated by these set of actors yearly in Lagos state and about 50% of the materials are being utilized within the state while the rest are exported to other African countries. Sometimes they

processed the materials in an uncontrollable manner before selling, for example burning out cables in order to liberate out copper and other metal materials.

Figure 9: Scavengers sorting for re-usable and recyclable materials

Figure 10: Waste processing (open incineration) by scavenger

The Resources Merchants

These set of traders that basically purchase all recovered materials from the scavengers. They are either retired scavenger with inability of sorting at the dumpsite due to old age or those who are financially buoyant. Some of them transact business across the country legally and while some sell their materials to industries within the country.

Figure 11: Tonnes of recovered recyclable tin materials waiting for transportation

The recyclers

These are set of small scale registered companies in the informal private sectors that convert recovered materials by the scavengers like paper, aluminum, animal by-products, plastics and metals scrap to raw materials for the consumption of manufacturing sectors.

They are companies with high financial status using valuable equipment and machines in processing recovered materials into finished items or raw materials for manufacturing of other valuable goods within and outside the country by other industrial sectors.

The industries using such finished materials are plastic industries, paper industries, aluminum industries etc.

3.2.1 Problems facing informal Private sectors

There are several constraint being encountered by informal private sectors which needed both private and government intervention in order for our environment to be conducive for living.

- Lack of recognition and financial support by Government
- Non provision of basic amenities to support their effort and activities like good accommodation, proper sanitation program, and provision of good water system to mention but a few.
- Non provision of safety materials to protect them from hazardous and health risk.
- No access to adequate medical facility
- Lack of proper education and orientation on first aid treatment in case of an emergency

3.3 Waste generation in Lagos state

Inadequate records of amount of waste generated in Lagos state has been a significant problem and the involvement of non-regulatory sectors in the collection of solid waste within the state is a major contributor. Although the participation of informal private sectors and disposal of solid waste in the state has also made Lagos state a livable environment at the moment.

In order to have accurate data/records of the amount of waste being generated in Lagos state, proper surveys needed to be examined. This approach will not only enhance integration of waste management system within the state but will give other interested bodies vital information on solid waste management system in Lagos state. However, it was estimated that about 9,000 metric tonnes is being generated in Lagos state on a daily bases and below table shows the records so far (LAWMA 2009).

Table 14: Annual waste generated in Lagos state

LOCAL GOVT AREA	POPULATION ESTIMATE 2006	2007	2008	ESTIMATED ANNUAL WASTE GENERATION TONNES 2006	2007	2008	ESTIMATED DAILY GENERATION TONNES 2006	2007	2008	ESTIMATED HOUSEHOLD		
Agege	1,325,755	1,431,816	1,546,361	241,951.20	261,307.15	282,210.70	662.88	715.91	773.18	265,151	286,363	309,272
Badagry	381,382	411,893	444,844	69,601.85	75,171.75	81,183.30	190.69	205.95	222.42	76,276	82,379	88,969
Epe	326,898	353,05	381,294	59,673.85	64,433.45	69,587.25	163.49	176.53	190.65	65,38	70,61	76,259
Eti- Osa	490,348	529,576	571,942	89,487.05	96,648.35	104,379.05	245.17	264.79	285.97	98,07	105,915	114,388
Ibeju – Lekki	79,183	87,101	97,553	14,450.35	15,895.75	17,804.70	39.59	43.55	48.78	15,837	17,42	19,511
Ikeja	653,797	706,101	762,589	119,318.50	128,863.25	139,170.85	326.90	353.05	381.29	130,759	141,22	152,518
Ikorodu	581,153	627,645	677,857	106,061.70	114,544.30	123,709.45	290.58	313.82	338.93	116,231	125,529	135,571
Lagos Island	526,67	568,804	614,308	96,115.45	103,806.00	112,109.75	263.33	284.40	307.15	105,334	113,761	122,862
Lagos Mainland	871,73	941,468	1,016,785	159,099.55	171,816.45	183,737.35	435.87	470.73	503.39	174,346	188,294	203,357
Mushin	1,707,137	1,843,708	1,991,205	311,553.05	336,475.25	363,394.00	853.57	921.85	995.60	341,427	368,742	398,241
Ojo	690,119	745,329	804,955	125,946.90	136,020.90	146,905.20	345.06	372.66	402.48	138,024	149,066	160,991
Shomolu	1,144,145	1,235,677	1,334,531	208,805.55	225,511.60	243,553.55	572.07	617.84	667.27	228,829	247,135	266,906
Alimosho	1,362,077	1,432,164	1,546,737	248,579.60	261,369.20	282,280.05	681.04	716.08	773.37	272,415	286,433	309,347
Oshodi- Isolo	1,434,721	1,549,499	1,673,459	261,836.40	282,783.75	305,406.40	717.36	774.75	836.73	286,944	309,9	334,692
Surulere	1,471,043	1,588,726	1,715,824	268,464.80	289,941.40	313,137.15	735.52	794.36	857.91	294,209	317,745	343,165
Ajeromi-Ifelodun	1,881,747	2,039,846	2,203,034	343,417.55	372,270.80	402,054.80	940.87	1,019.92	1,101.52	376,349	407,969	440,607
Amuwo Odofin	708,28	764,942	826,136	129,261.10	139,601.55	150,770.55	354.14	382.47	413.07	141,656	152,988	165,227
Apapa	490,348	529,576	571,942	89,487.05	96,648.35	104,379.05	245.17	264.79	285.97	98,07	105,915	114,388
Ifako Ijaiye	744,602	804,17	868,504	135,889.50	146,762.85	158,501.25	372.30	402.09	434.25	148,92	160,834	173,701
Kosofe	1,307,594	1,412,202	1,525,178	238,637.00	257,726.50	278,345.35	653.80	706.10	762.59	261,519	282,44	305,036
							9,089.40	9,801.64	10,582.52			

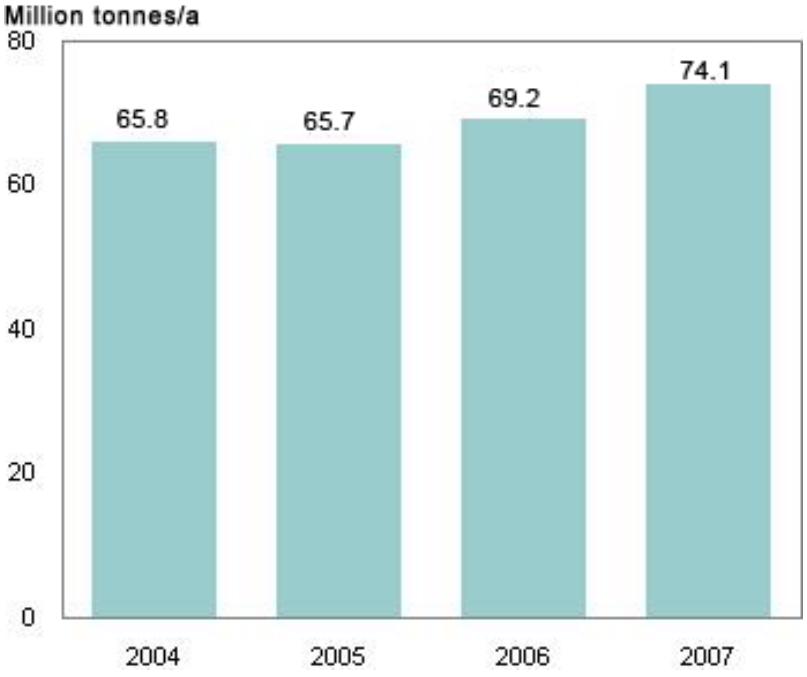
4. FINNISH WASTE MANAGEMENT

The management of waste in Finland is the responsibilities of the waste producers, who may be private, property occupiers or an organization. Municipalities are responsible for the proper collection, recovery, transportation and treatment of all kind of waste generated within city.

4.1 Finland waste generation

According to Finnish ministry of environment, waste is generated in all existing economic activities in Finland. In Finland, over 70 million tonnes of waste is produced annually in exception of Manure recycled by agriculture and logging waste left in forests while the construction and the mining and quarrying sector contributed the largest percentage. Statistics noted that in 2007 over 29 million tonnes of waste was recovered as material or as energy. The majority of waste recovered as material annually in Finland are Mineral, wooden wastes and metal scrap. However, other form of waste that is regarded unless are temporarily stored or deposited at landfills. (Finland's environmental administration.[ref. 20 September 2012]).

Generation of wastes in Finland 2004–2007



Source: Statistics Finland

The Finnish statistic compilation concerning waste generation, recovering and disposal met the EU waste statistic regulation. This gives Finnish the opportunities to make first compilation in summer 2006 covering the year 2004,

According to the statistic above, in 2004 some 66 million tonnes of waste were generated in Finland. The figure excludes manure recycled in agriculture and logging waste left in forests. In 2007 the amount of wastes generated was approximately 74 million tonnes. The statistics for the recent years show some increase in waste amounts generated. (Finland's environmental administration,[ref. 20 September 2012]).

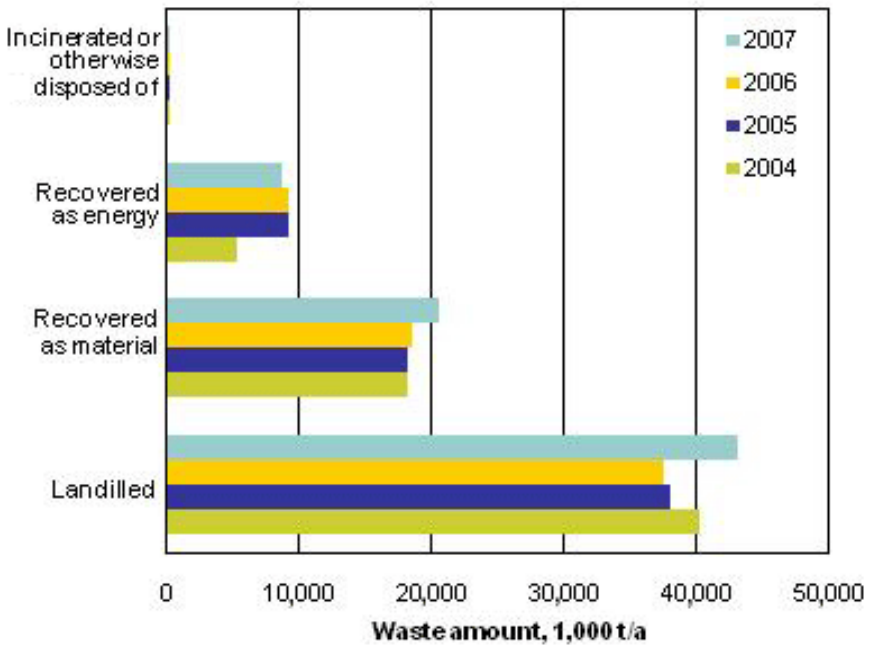
4.2 Treatment and recovery of waste

Treatment and recovery of waste is being harmonized under the directive on waste (2008/98/EC). The main objectives are to promote the prevention of waste

generation, and to encourage the re-usage and recycling of waste generated in order to create materials within and outside the country. The directive also set up five-steps-waste hierarchy to support its aims. Firstly, unnecessary waste generation must be prevented. Secondly, any waste generated should be prepared for re-use, then recycled or recovered, lastly, disposed of to landfills.

According to statistic below, there is reduction in the waste that usually goes to land filling and there is slight increase in recovering of waste as materials during the year 2004-2007. In 2004, about 18.1 million tonnes of waste were recovered as material and 20.5 million tonnes in 2007 respectively. In 2004 5.2 million tonnes of waste were recovered as energy and two years after were over 9 million tonnes. Although in 2007 the quantity recovered as energy decreased to 8.7 million tones. However, it could be seen that there is continuous increase in wastes recovered as energy to the total amount generated during the years 2004–2007. (Statistics Finland, 2002)

Figure 12: Recovery and disposal of wastes, years 2004–2007



Source: Statistics Finland.

4.3 Waste policy and legislation

Finnish waste policy and legislation are based on the EU waste hierarchy, with the primary aim of preventing waste in the society. The Finnish waste management objectives include, recycling, recovering of waste as material and using the material as a source of energy. In contrary, land filling of waste is acceptable in an area where it can be practice safely.

Waste policy strategies include the following:

Prevention: waste production and it harmful impact should be reduce to it minimum and possibly prevented at source.

The polluter responsibility: waste producer takes full responsibilities for the costs of managing such waste.

Producer responsibility: the manufacturers and importer of any products must take waste management responsibilities in case such products becomes waste instead of waste producers

The Precautionary Principle: Any problem that could occur as a result of waste or waste management should be anticipated and avoided

The Proximity Principle: Waste disposition should be limited to its sources

The Self-sufficiency Principle: The EU and member states should be self-sufficient with the disposal of any waste (Finland's environmental administration, [ref. 23 September 2012]).

4.4 Finnish Waste Legislation

Finland's waste legislation defines waste management activities in the following order of precedence:

1) To prevent the pollution of the environment and to repair and reduce damage caused by pollution;

2) To safeguard a healthy, pleasant and ecologically diverse and sustainable environment;

3) To prevent the generation and the harmful effects of waste;

4) To improve and integrate assessment of the impact of activities that pollutes the environment;

5) To improve citizens' opportunities to influence decisions concerning the environment;

6) To promote sustainable use of natural resources; and

7) To combat climate change and otherwise support sustainable development.

4.5 Methodology

The research used in acquiring significant fact from Lakeuden Etappi Oy was the combination of both quantitative and qualitative research approach. The quantitative approach was used in a manner whereby constructing questions was sent few days prior to the day of interview for the interviewee to have a broad idea of what the interview will entails in order for a comprehensive and actual fact be to extract-

ed. While the qualitative research was conducted using the questions in the questionnaire to make the interview more meaning and informative and the voice of the interviewee was recorded for future references.

While conducting the interview, the interviewee (Customer Service Advisor / Businesses of Etappi) made a presentation about the company in general which gives the interviewer more facts and figures on the purpose of the interview. The whole interview takes about two hours and it was conducted orally in English whereby both open and closed questions were asked to elevate information and objectives of the thesis. All questions asked were relative to the activities of waste management system in Finland specifically South Ostrobothnia.

4.5.1 Interview result: A description of Lakeuden Etappi Oy activities on waste management in South ostrobothnia

The interview results and information extracted from Etappi website have been arranged in a descriptive manner to express the current waste management system in Finland and to provide future plans on waste to energy plant approach which Lakeuden Etappi Oy is one the five municipal waste management companies that own the company (Westenergy Oy Ab).

4.5.2 Case company

Lakeuden Etappi is a full service waste management company providing residential and industrial services in the region of South Ostrobothnia. It was established in the 1997 by 11 municipalities with the aims of covering both homes and businesses waste management activities in Ostrobothnia. It is a company providing trash and waste removal, recycling and environmentally safe waste management services with a specific fixed price backup by law. Environmental system is in accordance with the ISO 14001 standard and the quality system complies with the

ISO 9001standard which both were certified in May 2009 and covers all aspect of their operations. (Lakeuden Etappi Oy, [ref. 28 September 2012])

They are responsible for trash, waste collection, waste disposal, transportation and other activities as well as providing information and advice on waste management practices. It provides statutory waste advisory services and environmental education services to all level of educational institutions, organizations and businesses (Personal interview with Antti Tekoniemi 25 September 2012).

Figure 13: Waste Treatment Centre of Lakeuden Etappi

1. Scale
2. Office
3. Ilmajoki waste station
4. Hazardous waste building
5. Recovery waste
6. Landfill
7. Water
8. Biogas plant
9. Contaminated Soil
10. Hazardous waste landfill
11. Machine shelter
12. Liquid waste

Waste collection process

Lakeuden Etappi is providing waste management services to about approximately 137,500 people and maintaining and servicing more than 240 ecopoints located in the area, operating a waste station in every municipality and the waste management center in Ilmajoki. All the neighborhoods in south ostrobothnia are responsibility to buy a trash bin or waste container at the Etappi waste stations or any available hardware stores which are usually emptied at least every two weeks (densely populated areas) or every four weeks (rural areas) by a selected contractor operating at each specific area. The waste container in every household is specifically for burnable waste and must not be used for re-usable or hazardous waste; such waste should be delivered by customers to ecopoints or waste stations. (Personal interview with Antti Tekoniemi 25 September 2012).

Waste stations and ecopoints

Waste stations (13) provide service to households and businesses. Every Household are to take their sorted re-usable waste to the nearest waste station located in

their area and no more than two cubic of waste is accepted in every waste station. Larger quantities of re-usable waste will need to be transported to the Etappi's waste management center at Ilmajoki. (Personal interview with Antti Tekoniemi 25 September 2012).

Figure 14: Waste station

Eco-points are available to households for the recycling material like paper, glass and small quantities of metals. There are about 240 eco-points in south ostrobothnia region and both waste station and eco-points operations are being funded by annual charges to households. (Personal interview with Antti Tekoniemi 25 September 2012).

Figure 15: Eco-point

Regional collection points

The regional collection points are design for only owners of holiday homes in order to deliver their daily waste, household, hazardous and any other form of waste is not allow. All such waste is meant to be transported to waste station. Owners of holiday homes are subjected to seasonal and annual fee which is use for the maintenance of the services provided by Etappi. The containers are meant to be position 100m from the building for health and environmental purpose. (Personal interview with Antti Tekoniemi 25 September 2012).

Figure 16: Regional collection point

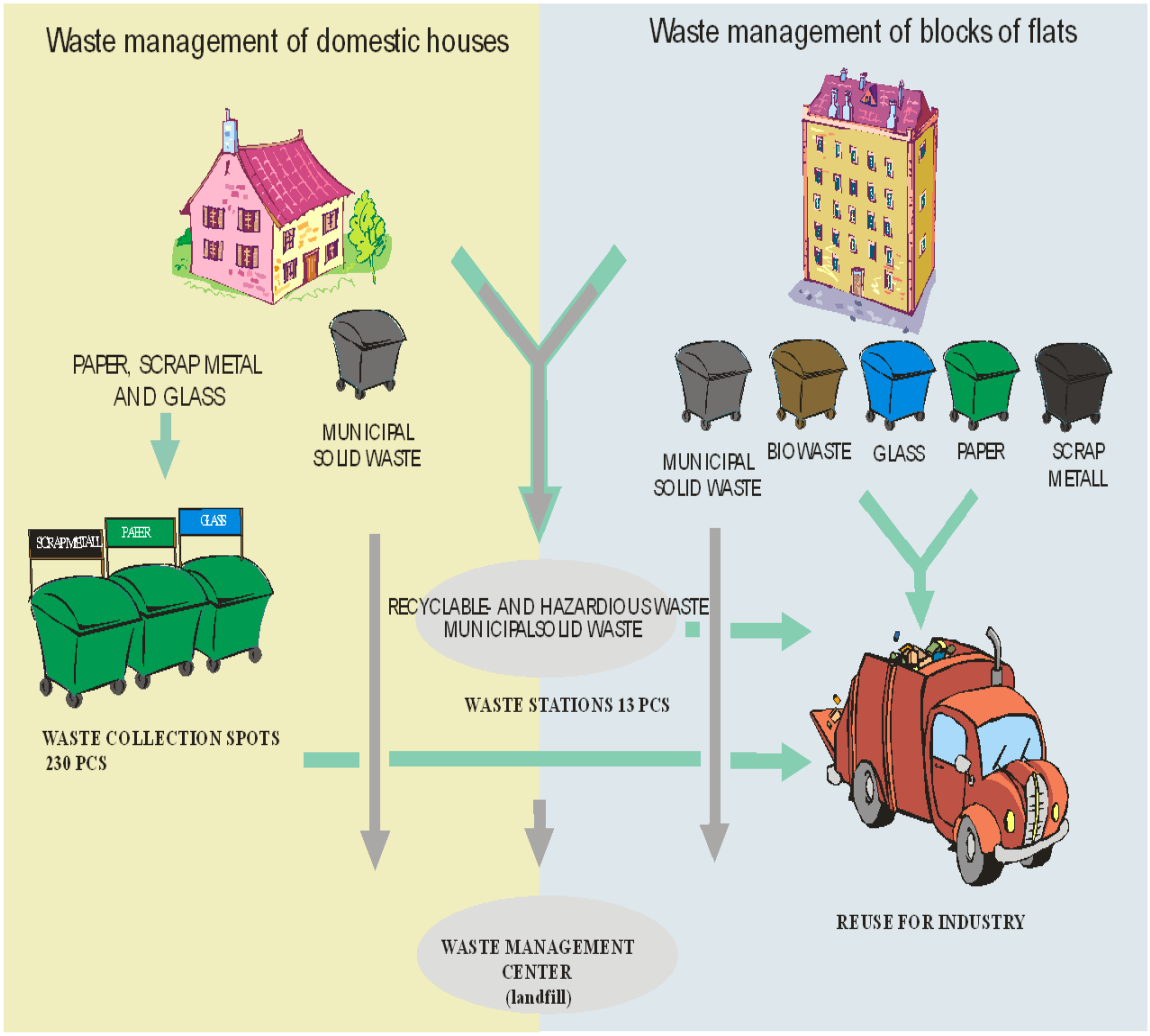


Figure 17: Waste Management area of Lakeuden Etappi

According to the above diagram, it can be seen that Etappi has two forms of customers which are domestic houses and block of flats apart from business customers. Domestic house must have one burnable waste container where all sorted waste is stored before transported to waste station. The transfer of waste to waste station is usually done by householders or Etappi when needed and other waste like paper, glass and metal waste are transported to Ecopoints. (Personal interview with Antti Tekoniemi 25 September 2012).

Similarly, block of flats must purchase different containers differentiated by color and as well labeled. These kinds of waste containers are for paper, glass, scrap

metal, bio-waste and municipal solid waste and are usually transported by Etappi waste management transport system to waste station where is being sorted and recovered before taken to Etappi waste management center at Ilmajoko.

Ekofee: This is an annual fee charge to every household for waste sorting by the company. More also charges are usually made on every empty container done by Etappi on households and businesses depending of the volume and the type of waste. (Personal interview with Antti Tekoniemi 25 September 2012).

Waste transportation

Lakeuden Etappi provides transport, reuse, and treatment of waste in its operating area. Waste transport covers waste generated by residential buildings, holiday homes and public organization, with exception of hazardous waste. In addition, Etappi hazardous waste from households, agriculture and forest industries and divert it to appropriate treatment center. Waste from septic tanks and cesspools are also handled under municipal waste management. (Personal interview with Antti Tekoniemi 25 September 2012).

Real-time monitoring waste transport

A modern called TCS-positioning system is being used by Lakeuden Etappi, which enables the company to monitor waste transportation in real time. With the system, each operating locations can be verify and as well ensure that customers satisfaction are always meant. It enables the company to provide additional services when needed for example, provision of additional trucks to a location when necessary and monitoring of workers effectiveness while at work. (Personal interview with Antti Tekoniemi 25 September 2012).

Energy from sludge and bio waste

The biogas plant of Lakeuden Etappi is one of the largest in the country. The plant processes sludge from municipal, bio waste from households, businesses, and food waste produce from supermarket and restaurants. This kind of treatment is also available to the food manufacturing industry.

The plant produces biogas and soil conditioning granules by drying the rotted sludge first in centrifuges, followed by thermal drying and compression into pellets. Soil conditionings are used as forest and field fertilizers, among other applications.

Presently biogas produced is used as energy for the plant itself but in the future surplus biogas energy is planned to be used for the generation of electricity or as a transport fuel. (Personal interview with Antti Tekoniemi 25 September 2012).

Westenergy Oy – Waste-to-Energy Plant

Westenergy Oy is a non-profitable organization owned by five municipal waste management companies which Lakeuden Etappi Oy is the main shareholder for the main purpose of extracting energy from non-recyclable waste which is another method to enhance sustainability in a society.

Waste to energy plant is an innovative idea whereby heat and electricity can be generated from waste which is sorted at the origin that was previously destined to landfill sites. This is a new idea that helps to reduce the usage of coal and oil as heating materials in accordance to Finland’s climate condition. Emission of gases that alter the climate system, and causes increase in global average temperatures will be reduced and practice of waste to landfill sites will be minimized. (Personal interview with Josefine and Riina 15 November 2012).

Benefit of Waste to Energy

- The usage of fossil fuel in district heating and electricity production will be substitute by non-recyclable waste;

- Landfilling will drastically be reduced, because waste to energy plant has the capacity to utilize almost 90% of all combustible non-recyclable waste and which will reduce the amount of waste being disposed to landfill sites;

- Methane emissions will be minimized. As waste disposed to landfill site reduces, methane emissions will significantly be reduced which is 20 times much more harmful to atmosphere than carbon dioxide;

- Objectives of hierarchy of waste can be achieved. For example, if non-recyclable waste can be utilized, therefore efficiency of recyclable waste will increased and achieved;

- It brings possibility of extracting energy from industrial waste which has been previously impossible due to economic or perhaps technical reasons. (Personal interview with Josefine and Riina 15 November 2012).

5 CHALLENGES AND RECOMMENDATION TO LAGOS STATE WASTE MANAGEMENT SYSTEM

Due to the level of Urbanization and development, solid waste management has contributed significant problems such as high morbidity and mortality rate. In Lagos state through it agency (LAWMA) that is responsible for the effective integrated of waste management activities are trying in tackling the improper handling and disposal of refuse in the environment. However, the efforts have not yielded any credible result due to lack of proper strategies and plans. Therefore in order for Lagos state to achieve waste management aims and objectives that has always being campaign and to be seen as a conducive and environmental friendly city, benchmarking approach need to be adopted which will help to determine applicable best practices that will stimulate continuous performance to enhance sustainability in the country at large.

This thesis will be recommending Lagos state waste management system to adopt Finnish waste management system strategies and processes in order to achieve their set goals. Adoption in this context is to benchmark Finnish waste management processes and as well examine the best practices in order put into action the hierarchy of waste management options and create an avenue for sustainable development on rational use of natural resources.

Waste management has been a noticeable problem in developing countries most especially in Lagos where the rate of urbanization is overwhelmed the available waste management infrastructure, causing many heaps of refuse within the city that left Lagosians with no option than open burning and land fillings. Waste recovering target have not been met, waste generated has increased on daily basis and many landfill sites are still operating till date. Sorting at source that can ensure proper recycling is insufficient and waste that should be recovered has been used as an alternative to landfilling. These kinds of practice causes greenhouse gas emissions and methane emissions resulting from open land fillings. Therefore in order reduce or eliminate ineffective waste management system in Lagos state

and for greener and conducive atmosphere existing in Finland and other western countries to be experience in Nigeria at large, the following major factors need to be tackle with positive action and the adaptation of Finnish waste management system need to be considered.

5.1 Factors

Landfill sites

Amount of landfilled biodegradable waste must significantly reduce and drastic measure has to be taken to increase the recovery rates of methane generated at landfills. Several landfill sites should be close. Moreover, there should be an increase in tax paid by users and there should be specific users. Only waste that is properly treated, not harmful to the environment and which the recycling means is not presently available due to technology should be allow to be store in the landfill sites.

People's attitude

Another challenge in Lagos state is the attitude of dwellers towards waste disposal; about 66% of waste is being disposed improperly. Illicit waste disposal is rampant among Lagosians, dumping of garbage in valleys or swamps and disposal of untreated industrial waste to the public drainages and surface of water which usually result to floods in rainy season. Similarly sometimes, private actors (cart pusher) can as well be another major contributors, all the waste collected by these private actors are being disposed to land sites or any available open field without separation which is eventually causing hazard to both human and the environment at the long run. Sometimes they burnt such waste late hours in the night to avoid harassment by law enforcement agencies. It is so disappointing, when such inappropriate habit is being done and people living around were reluctant to act rather than being a contributor or supporter of such unhealthy attitude by dumping their own waste also to avoid waste fees by waste collectors. This is constituted due to

the lack of waste management infrastructure (good road network, facility for waste disposal, collection, recovery and treatment, haphazard waste disposal on land, farms, surface waters, swamp) can as well be regarded as technical challenges. Presently, Flood and erosion has become the consequences of the negative attitude of people towards refuse disposal in many part of the nation. Sweeping away of farm lands and rendering of people homeless has ensued northern part of Nigeria and if care is not taking, Lagosians will not be left out of such disaster. Therefore people's perspective towards waste management should be encourage and be positive.

Town planning structure

Lagos state town planners need to re-examine their objectives and try to address the issue of waste management generation and make provision for appropriate waste center in the municipals where people can drop their waste for waste management team to pick up for proper disposal. If waste management issues is taken and handle properly then waste generated would be another source of generating revenue which will enhance the economy and as well contribute to the standard of living of the citizen by creating employment opportunities.

Legal structure

Adequate legal and appropriate constitutional/administrative framework that could be used as a tools for championing sound environmental waste management are not enacted and those in existence are not enforce due to either negligence of the assigned actors or poor funding by the Government to put in place necessary technological and economic resources.

Money

Inability and unwillingness of the people to pay for waste management services is another major problem befalling developing nations. If every household make it a

priority to pay for the services render by waste management system, then Lagos state will be able to maintain it's beautiful and everyone will live a healthy life. The activities provided can be sustained and continuous effort to maintain greener environment will be encourage at all time. Moreover, it will be an avenue for the Government to generate revenue, provide more employment and at the same time create social amenities within the city.

Political influence

For effective and sound waste management system to be experience in Lagos state, political influence needs to be put in place. Moreover, cordial relationship between local and central governments and the participation of citizen in the process of policy making should be allowed. In such manner, transparency in waste management will be possible and experience. On the other hand, those who contribute negatively to the development of the country in terms of waste management should be brought to justice so that future selfish attitude will not occur again.

Level of illiteracy

In order to make the society take full responsibilities of waste generated and disposal challenges, government and other agencies need to help in re-orientate and educating the populace on the importance to generate less waste and appropriate method to dispose waste produced without any damage to the environment. Such attitude will produce sound and healthy environment as well promote sustainable development among the people of Lagos state and Nigeria at large.

It will help every individual to benefit from the economic value that lies in waste and it can be a source of employment opportunities to those who are jobless. This means can as well reduce the rate of crime in Lagos state because an idle hand is a devil's workshop.

5.2 Policy framework

For effective integrated waste management system to be experience in Lagos state, policy frame work need to be put in place. The Policy frame work which is to drastically reduce the harmful impact of waste on health and the environment. Moreover, it is important to set the following objectives as a base of focus in Lagos state:

- To prevent the rate at which waste is being generated
- To promote and encourage the reuse of waste
- To promote full recovery of waste and recycling of materials
- To promote the use of waste that is recyclable for energy
- Ensure proper disposal and treatment of waste in order to prevent hazardous impact.
- Embark on Zero waste agenda at all level

For the above objectives to be seen and achieved in Lagos state, benchmarking (performance comparison, gap, and changes in the management process) need to be taken into consideration and to successfully identify effective operating procedures (best practices) in its operations.

For example, Finland which is now seen and rated has one of the cleanness countries in the world has once experience major waste management problems Lagos state is facing at the moment. However, they were able to tackled those difficulties by addressing its waste management problems, embarked on the hierarchy of waste management options and at the same time used economic instrument to stricter the new regulations and enforce it.

Furthermore, promulgating of waste act and waste decree in 1993, which over twenty legislative pieces was enacted in the review period to keep pace with the EU waste legislator developments. There were changes in the EU waste legislation in Finland which make it stricter and promote effectiveness in the waste management system. This include, the implementation of the EU council decision of the list of hazardous waste(2004), introduction of waste management activities

under the integrated environmental permitting procedures, and the requirements for environmental permits to applied to all waste recovery and disposal activities (2002). Producer responsibility schemes were also introduced for several waste streams. Under this regulation, Producers are responsible for arranging and meeting the costs of the management of wastes derived from their products. Industries are responsible for arranging and meeting the costs of the management of the wastes they produce. (OECD Environmental Performance review FINLAD.2009, [ref. 20 November 2012]).

Policy objectives for biodegradable waste were set in the Finland's 2004 national strategy for the reduction of Biodegradable waste going to Landfill. Waste tax induced on disposal of waste on landfill was high and is able to encourage environmentally favorable forms of waste recovery. As of today, about 90% of waste being generated in Finland is recovered as materials and non-recyclable material is use to generate energy. (OECD Environmental Performance review FINLAD.2009, [ref. 20 November 2012]).

Regulations at the municipal level were also introduced in order to provide efficient waste management requirements such as waste collection points and equipment, transportation, recovering and treatment, for residential areas, public services and businesses.

There are also some significant changes in the waste management activities in Finland. For example the number of plants recovering and treating municipal waste has been multiplied during the last decade due to the fact that there is co-operation between municipalities in building up areas together and tackling waste management problems. They were given the opportunities to have a treatment plant together and private sectors can patronize them. Similarly, private sectors that can afford treatment plant are also allowed to own it and all is for the sake of sustainable development and good living environment.

More also Finland were able to tackled improper disposal of waste by involving money in the system.

According to history, Finland had been a country facing a lot of challenges on waste management and every nuke and cranny were usually littered with waste like cans, bottles, nylons and other forms of toxic materials that gave birth to health problems causing child birth and untimely death amount adults. But the issues are now a history due to the fact that many schemes were established by government with the cooperation of the entire society. For example, Finnish government embark on Zero waste agenda whereby all waste produced in the country must be recycled. And government thought of means to which such idea could work and be effective, and they introduce incentives to all recyclable materials i.e. all materials attract some token when recycled by people of the society. This development was one of the agenda that makes Finland one of the cleanest and most conducive environments on the planet.

Above all, legislation review were made in 2007, most especially on waste taxation which is believe to be one of the major instruments to ensure positive effect of waste management system and ways of generating revenue for the government. It has also encourage SMEs to have an option of coming together to own private land fills where waste can be recovered and treated since private landfill are excluded from tax scheme. (National Reports/Finland/WASTE, [ref. 20 November 2012]).

Although, Lagos State Government recognizes the importance of legislation as an instrument for ensuring effective and integrated waste management system, however major legislation that could enhance effective waste management activities within the society was not enacted.

Moreover, those that were promulgated are not effectively enforced among the actors due to many factors for example: Corruption within the system, negligence

of public, lack of awareness or campaign, Poverty , illiteracy, lack of finance by federal government and to name a few.

Therefore, for sound and greener environment structure to be experience in Lagos state and Nigeria as a whole, new plan and policy have to be implemented effectively; however and waste monitory team has to be put in place in order for progress and good result to be achieved. The Lagos state Ministry of the Environment needs to establish a cleaner production programme, ensuring active industry-wide promotion of the concept, as well as initiating producer responsibility programmes.

A strategy to reduce waste generation should be actively pursued and plan to maximize recovery of material should be substantially developed at the municipal level. Procedure on issue of contaminated land should be address, and their effectiveness will need to be monitor judiciously; in particular, the ways of generating revenue from the waste tax to support clean-up measures for orphan sites should be assessed on a regularly basis

This project will also be recommending that consideration should be given to the following proposals:

- Effective implementation with determination and transparency on the overall waste management policy framework need to be set up, most especially on the use of technological and economics instruments and to consider on promoting integrated pollution prevention and control;

- Support and promote waste management prevention programmes;

- Waste management hierarchy should be adopted and applied at all time, so that waste can turn to wealth;

- Quality and environmental procedures should be drawn up for certain recycled materials. Recycling priority should be given Public construction mate-

rials and the usage of waste based fertilizer material in Landscaping and Agriculture should be consider and promoted. Existing tax scheme should be review and it deficiencies should be eliminated in order to achieve waste management objectives;

- Measures to reduce and replace hazardous substances that cause harms to health and environment with non-hazardous material should be promoted. Public enlighten on hazardous materials and method to handle it should be put on;

- Revision should be made on Waste management act whereby all necessary bodies (the municipalities, product manufacturer organization, waste producers and private waste management companies and the organization of waste advisory services) will recognize their duties and priority;

- Producers responsibility schemes (EPR) has to be established which cover: tires from any form of vehicles and equipment, electrical and electronic appliance, waste car, van and comparable equipment, all form of papers, packaging products and batteries and so on. Manufacturers or producers of such wastes should be responsible for the collection and as well provide information to their customers on effective waste management.

- Effective measures and comprehensive implementation of the remediation programme for contaminated sites should be ensured and proper monitoring and continuous evaluation be consider on a timely basis;

- Government support and funding is needed on research and technology in order to enhance material efficiency. Financial support should be given to SMEs and more services should be allowed to be carried out in order to achieve their waste management objectives and material efficiency;

- International policy should be examined to eradicate illegal shipment and cooperation between authorities in the border control of waste shipments should be promoted;

- Dumping sites should be provided and located outside the city to prevent hazard to health and adequate waste transportation to such located should be provided. Band should be placed on shipment of used items into the country to avoid Nigeria at large as a dumping ground by developed nations.

- Most importantly, waste to energy innovative idea should be adopted and encourage whereby all non-recyclable waste going to landfills can be utilized to generate energy in Lagos state and Nigeria at large. This will help government to solve aged issue of epileptic power supply in the country and the country can be suitable for the populace as well encourage foreign investor to establish which will enhance economy.

5.3 Feasibility and evaluation

Historically, the state of Finnish waste management system in the past 20 to 40 years was same with the level Nigeria is presently. If not for the primary changes in EU waste legislations and the setting of strict environmental and health requirements for waste management, Finland would not have been a greener and healthy environment with effective and sustainable integrated waste management system.

From the author's opinion and experience acquired during the research work, is believed that the negative tagged on Lagos state waste management system and the environment at large will be a thing of history because most of the developed nations today have been in the same situation many decades ago and they were able to overcome it. Although Lagos state municipal system is at the Fetus level

compared to the Finland and the adaptation of new system will be a very difficult task due to many factors. However, if government can come back to the drawing board, adopt this research work and any other similar ideas and conduct a thorough review on the achievement and viability of other developed nations then Nigeria can as well be regarded as a nation with the achievement of hierarchy of waste management.

In order for risk arising from improper disposal of waste to be minimized or eradicated and other social and economic benefits to be maximized from waste management activities in the future, there are many measures that need to be considered.

Time: With the adoption of sustainable Finnish waste management system by reviewing all recommendations in this research work and implementing all frame works effectively will initiate adaptation and active practices of 3R approach(reduce, re-use and recycle) among organizations, all government agencies and society at large. In addition, positive shift towards rapid growth of material efficiency in production processes, construction and consumption and abiding to the rules and regulations of the current legislation will be effective in Lagos state. Moreover, decrease in the content of hazard pose by waste, reduction in the emission of greenhouse gases, full recovery of waste and production of waste to energy objective will be attained and substantial changes at all level will transpire gradually with time.

Financial measure: Environment decency and purity can be achieve in Lagos state if an incentive is added to all recyclable materials which is a means to motivates or encourage people in recycling waste products materials instead of dumping on the street. For example: cans, bottle, pure water nylon, plastics and so on. In addition, designate revenue and increase transparency on waste management at all levels, optimize accountability and discipline of all governing bodies through training, incentives, code of conduct to name a few. Introduce tax on all waste producers, penalties and fines on waste polluters, high charges on landfills users

and hazardous waste disposal and encourage communities' participation and waste minimization at source.

Public awareness and re-orientation: The society is the major producers of solid waste regardless of category whether municipal, agricultural, industrial or hazardous waste but little percentage of these people has knowledge of the impact of waste disposal in society either positive or negative. Therefore changes in people's perspectives on waste management can be achieved through consistence dissemination of information on waste management issues and proper finance of development capacity building programme that will enhance knowledge and capability of people to perform all waste activities in order for sustainability to be attained in the society.

Policy and legal measures: Adoption or establishment of new national waste plan that creates more ambitious objectives and targets to support sustainable development and combat against improper attitude of people towards waste. Reviewing current legislation to suite the objectives of waste management system and to enforce regulations in order to promote rational usage of natural resources, protect the environment and decent control of all economic activities within the society.

Individual and Government interest: Voluntary agreement aimed to protect the environment, sorting at source at the municipal level as well as to meet recovery target of national waste plan should be actively pursue and established between Government and the people. Furthermore, government should establish communication channel whereby public opinion can be heard and allow them in decision making on waste management issues because they are the generator of waste and knows more on the impact it causes. In addition, government should produce measures to improve the working condition of waste collectors and as well recognize the existence of informal private sectors by incorporating them in order to act under legal regulations. This approach will establish partnership among all stakeholders, including foreign agencies, private sectors, national and local government

that will produce accurate statistics on waste generated in Lagos state for sustainable management plans to be implemented and achieved.

Adhered to the above measures will not only make Lagos state achieve the objectives of waste management system based on 3R approach but will as well improved quality of public health, conserve natural resources and reduce the emission of greenhouse gases. Last and not the least, environment, economic and social benefits of waste management will be experience in Nigeria at large.

5.4 Future research

With the level of understanding of the author during this research works, it is believe that for any waste management system to fulfill and attain 100% waste recovery and utilization as well as zero percent waste generation agenda the following research need to be pursued.

To create technology that can fully utilize all ashes produced in the power plants during the conversion of combusted waste to energy in order to significantly reduce or eliminate totally the patronage of land filling.

All science and technology researches should come together and find solution on how to repair the damages done to our climate by methane and greenhouse gas emission.

Last but not the least, to discover methods to make more production from less material, this will enhance sustainable development in our society and as well prevent irrational usage of natural resources.

5.5 Study limitation

Constraint during the research work is the inability to acquire current and vital information on waste management system from both private and Government

owned waste management agencies in Lagos state. Non communicable or non-chalant habit of African nations is one of the reasons that are making our continent going backwards compare to other continents.

During the research work, several emails and phone calls were made to Lagos state waste management authority (LAWMA) and Richbol environment agency by the author in order to acquire recent status of waste management system in Lagos state either by interview or any better means but all efforts was abortive.

Therefore, for such occurrence not be encountered by future researchers I employ all agencies in Lagos state and Nigeria at large to be informative and to always be available for any inquiries in order for continuous development of our nation.

6 CONCLUSION

Effective waste management is a significant issue that needs to be address in developing countries in order to improve standard of living and as well safe lives. The aims of this thesis is to encourage effective practices of integrated sustainable waste management system in Lagos state by benchmarking current and successful system in a developed nation like Finland. Adaptation of the system will help to discover frameworks that will be suitable to Nigeria system and making an assessment based on ISWM continuously for environmental, economic and social benefits to be attained.

Current statistic shows that Lagos state generated Nine thousand metric tons of waste daily, but the question is that, has these bring positive change to our society? Capital no, of which other countries like Sweden, Germany, Norway, United state even developing nations like China, India etc are utilizing same opportunity to improve their economy by generating electricity and using as a raw material in the production sector. According to calculation it is ascertain that waste generated in Nigeria as a whole can contribute to the stabilization of power in the country if the innovative idea can be tapped and proper finance is generated by Government.

Waste disposal and collection system of waste is another major challenge in developing nations. Urbanization and industrialization has led to proportional increase of waste produced in Lagos state. Couple with the negative attitude of people toward handling of waste is affecting our environment presently, causing lot of hazard to human health and leading to high rate of untimely death. Flood and erosion has become everyday news and people being displaced from their homes and houses being submerged are rampant in Nigeria as whole due to the fact that people refused comply with the modern means of waste management.

Negligence of government and other stakeholders towards campaigning and reorientation of the people is another issue to be address if Lagos state really wants

to sustain and spread it beauty to every nuke and corner. Educating people on the issue of waste management is very vital because it will help people to adapt to proper waste handling and also abide to legal and policy of waste management which is an instrument used for any successful society on waste management.

Political interest is another challenge to waste management system that needs urgent attention. Do all stakeholders have common interest in waste management? Decentralization of duties, administrative and financial issue to all municipalities and the involvement of the people in decision making will help in tackling issues on waste and integrated and sustainable development in the society will be achieved.

The overall conclusion is for all developing nations to learn from the successful countries in the aspect of policy making and enforcement, technology, infrastructure and financial mechanism, awareness and orientation pattern, as well to political interest and cooperation among citizens, Government and all stakeholders in order for adaptation process to be attained on time.

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