## (( INFLUENCE OF DEPOSIT REFUND SYSTEM ON GLASS BOTTLE WASTE MANAGEMENT IN URBAN AREAS: THE CASE OF NAKURU MUNICIPALITY, KENYA

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## A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT FOR THE MASTERS OF ARTS DEGREE IN PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI

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## **DECLARATION**

his is my original research project report and it has not been presented for a degree award in ny university.

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## DEDICATION

This study is dedicated to my family, friends and relatives. May God's blessings always shower upon them.

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## ABBREVIATIONS AND ACRONYMS

ADF	Advance Disposal Fees
CBD	Central Business District
CBOs	Community Based Organizations
CCN	City Council of Nairobi
CIGs	Common Initiative Groups
DRS	Deposit Refunds System
EU	European Union
ESAs	External Support Agencies
GATT	General Agreement on Tariffs and Trade
IBRD	International Bank for Reconstruction and Development
JICA	Japan International Cooperation Agency
KAM	Kenya Association of Manufacturers
MCN	Municipal Council of Nakuru
MSWM	Municipal Solid Waste Management
NAFTA	North America Free Trade Agreement
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organizations
N	Number
OECD	Organization for Economic Cooperation and Development, Environmental
	Policy
SWM	Solid Waste Management
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNCHS	United Nations Centre for Human Settlements - Habitat
UNEP	United Nations Environmental Programme
UNEP-ETC	United Nations Environmental Programme - International Environmental
	Technology Centre
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
US	United States of America
USEPA	United States Environment Protection Agency

#### ABSTRACT

The generation of solid waste has become an increasing environmental and public health problem in the world, but particularly in developing countries. The fast expansion of urban, agricultural and industrial activities spurred by rapid population growth has produced vast amounts of solid and liquid wastes, which pollute the environment and destroy resources. The management of solid waste is often weak due to lack of appropriate planning, inadequate governance, poor technology, weak enforcement of existing legislation and the absence of economic and fiscal incentives to promote environmentally sound development. The Government of Kenya has currently prioritized solid waste management as a pressing issue and recognizes the value and importance of integrating environmental and development objectives into the decision-making process. The study examined the success of the deposit refund system, as a measure of controlling the dilapidated Nakuru Municipality. It is a Policy issue that is of major concern not to Kenya alone but to other African countries. Nakuru Municipality faces massive pollution from all sorts of waste of both biodegradable and nonbiodegradable waste. The study examined the cost effectiveness of the deposit refund system in the management of glass bottle waste. The study also examined the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality. Other objectives of the study were determination of the challenges faced in the implementation of the deposit refund system in the management of glass bottle waste; and finding out the strategies adopted by Nakuru Municipality in enhancing the success of the deposit refund system. The study was carried out amongst Nakuru Municipality Environment department employees and amongst members of the business community. The study used a sample of 96 members of the business community and 44 Nakuru Municipality employees. The study adopted a descriptive survey design and purposive sampling technique in the identification and selection of the study sample. Data was collected by use of questionnaires and interview schedules and was analysed with the aid of the statistical package for social sciences. The results were then presented in the form of tables. The finding of the study showed that there was high usage of deposit refund systems on glass bottles in Nakuru Municipality. The study also established that the deposit refund system was cost effective in the management of glass bottles. It was also, established that the system of bottle returns was characterized by delay of refunds and failure of consumers and customers to return bottles in time. The system's implementation was characterized with challenges such as high transportation and bottle storage costs. The vendors also complained of much time spent on deposits and bottle returns, which negatively affected the systems' expected impact on glass bottle. Following these findings, the study recommended that the Government of Kenya -Ministry of Environment should spearhead the review of recycling policies in the country for products such as glass and bottles for the efficiency of the glass bottle waste; that members of the public should be educated / sensitized on the value or benefits associated with the deposit refund system. The study also recommended that the Municipal Council of Nakuru needed to put structures in place to enhance the performance of the deposit refund system within the Municipality. The study also recommended that, the Municipal Council of Nakuru consider the use of Penalties for broken bottles in order to control carelessness in the handling of bottles. The information obtained from this study, is important to the Ministry of Environment and Natural Resources, the Ministry of Local Government, other Governmental and Non Governmental Organisations and stakeholders within the community for it could be useful for enhancing the effectiveness of the Deposit refund system towards promoting a managed glass bottle waste.

## CHAPTER ONE INTRODUCTION

#### **1.1** Background of the study

Solid waste consolidation and litter reduction have been at the forefront of many state and national environmental agendas in recent years. Many states have implemented various programs including by the bag pricing on trash and recycling initiatives. Deposit/Refund Systems are a specific type of take-back system, in which a consumer is charged a deposit on receipt of the product, and receives a refund of the deposit when the used product or its container is returned to the store or a designated location. Deposit/refund systems are most common with beverage containers and soft drinks, but are also used to provide an incentive for the return of other products which may be harmful or wasteful if otherwise discarded, from toxic chemicals, to used motor oil, to appliances. The distinguishing feature of the deposit-refund scheme is that it has a clever disclosure mechanism: the refund is paid when the potential polluter demonstrates compliance by returning the item that carries the refund, thus making the monitoring of illegal disposal unnecessary. Usually, deposit-refund systems are used for certain final outputs such as beverage cans and bottles. The focus of this study is on the usage of Deposit Refund systems (DRS) on the management of glass bottle waste.

In the United States of America, Ten states, including Maine, have implemented a deposit-refund system on bottles, cans, batteries, and tires. While some of these programs are voluntary, others, such as in Maine, are mandated by the legislature. The consumers, upon returning the used cans and bottles to designated redemption centers and various retail stores, receive their 5-¢ deposit back as a refund (Anderson et al, 2001). The Maine Department of Transportation estimated that, as a result of the new legislation, some parks had reduced beverage container litter by as much as 90% (Anderson et al, 2001). Not only are people littering less, but where litter does exist, others are willing retrieve the disposed bottles and cans for extra refund. Thus the system promotes both reduced littering and increased cleanup. Surveys of non-deposit states have shown that the primary source of litter is beverage containers. An estimated 36-69 percent of all litter is predicted to be attributable to bottles and cans (Environmental impacts—litter March, 2002).

Improper solid waste management leads to substantial negative environmental impacts (for example, pollution of air, soil and water, and generation of greenhouse gases

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from landfills), and health and safety problems (such as diseases spread by insects and rodents attracted by garbage heaps and diseases associated with different forms of pollution) (World Bank, 1999). Municipal (or local) authorities charged with responsibility of providing municipal solid waste management services (together with other municipal services) have found it increasingly difficult to play this role. The difficulty has been aggravated by lack of effective legislation, inadequate funds and services, and inability of municipal authorities to provide the services cost-efficiently. Changing lifestyles such as use of canned soft drinks, mobile phones, and disposable diapers (movement towards a "consumer society" in general), moreover, will pose special waste management challenges, as waste management systems in developing countries are incapable of frequent **a**djustment to match these lifestyle changes.

Deposit and refund system is used for recyclable wastes. In countries such as Barbados, Brazil, Bolivia, Chile, Colombia, Ecuador, Jamaica, Mexico and Venezuela these systems exist for products like paper and cardboard, glass bottles, aluminum cans and tyres. Under this system a consumer, when buying an affected good, pays an amount that is reimbursed when the consumer returns the recyclable waste. An interesting characteristic of this activity is that in most countries it is voluntary, based on the interest that many producers have in reusing the recyclable materials. Mexico is the only known exception to this rule, as used car batteries must be returned to acquire new ones. Recycling process and markets for plastic soft drink bottles (made of recyclable material) is thriving in Brazil where over 30 per cent of these bottles are recycled (International Development Bank, 2003).

Korea uses an extensive waste disposal deposit-refund system which covers food, beverages, liquor bottles and containers, batteries, tyres, lubricating oil, electric home appliances (and any other item that generates toxic waste), bulky or heavy commodities that require treatment, non-degradable materials and harmful household commodities that should not be mixed with the general waste stream. The manufacturer is required to deposit a certain amount for each unit sold, refundable upon collection and treatment (Panayotou, 1998).

In developing countries, such as Zimbabwe, the problem of Solid Waste Management is becoming more and more complicated and requires long-term and sustainable programmes for its solution. Considering African cities, experience tells that less than 20% of urban solid waste is collected and disposed of properly. If bottles are of standard size, shape and colour, they can be recycled through any retail shop selling the product, and not only through the shop where the article was originally bought. In principle a deposit and refund system exists in Zambia, but without direct involvement of money. The practice is that when buying a full bottle the client pays an excess price of 200 to 300 Kwacha, but in case an empty bottle is delivered this excess price is not paid back unless a full bottle is bought at the same time.

Deposit refunds systems (DRS) encompass a charge on some particular item and a subsidy for its return, and are mainly used to encourage recycling. A deposit refund system has been applied in the beverages industry. Consumers pay deposits for reusable glass bottles, which are refunded upon return of the bottles. This deposit ranges between Kshs.10 and 25 for soft drink and beer bottles, respectively. The deposit refund system has been popular not only in Nairobi but also throughout Kenya because of its ease of administration, which involves collaboration with wholesalers, retailers and consumers (Ikiara, Karanja, and Davies, 2004).

In Kenya, Deposit refund systems are used specifically in solid waste management to: Reduce the amount of waste generated; Reduce the proportion of hazardous waste in the waste generated; Segregate hazardous waste for special handling and disposal; Encourage recovery, reuse and recycling of wastes; Support cost-effective solid waste collection, transport, treatment and disposal systems; Minimize adverse environmental impacts related to solid waste collection, transport, treatment and disposal systems; and Generate revenues to cover costs.

The deposit-refund system is popular for beer and soft drink products in which packaging costs have a higher share of the total product price as the return rates are also high. In the case of wine and other liquor products, however, the packaging cost is a lower share of the total price, therefore the return rate is low and the deposit refund system is not commonly used. Refunds for aluminum cans are now increasingly popular in various parts of the world due to their high value added from recycling and to the expanding use of such containers.

As a result of these disposal problems, almost all enterprises tend to use uncontrolled and unhygienic landfills as the predominant mode of disposal. To cut costs, many generators of solid wastes have now taken to combustion at the site, which causes air pollution problems. The bulk of these wastes contain plastics, which when burnt generate carcinogenic vinyl chloride monomers and dioxins. The generators and private waste collection firms, in order to avoid costs, dump in illegal places since an effective monitoring system lacks. The advantages of deposit-refund systems are that most of the management remains with the private sector and incentives are built in for third parties to establish return services when users do not participate.

Only a few economic instruments are used in Kenya's current waste management practice, and even these are not used effectively. The instruments that have been used in a limited manner include user charges, financial instruments (fees licenses), fiscal instruments, import duty waivers, deposit refund system, and property rights including institutional reforms. Flaws with the application of the instruments in the country include low rates devoid of incentive and that do not change in tandem with the cost of service or the damage caused by wastes, use of uniform or flat rates, and tipping charges based on loads rather than weight and blind to the differences in how dangerous the wastes are. The low use and poor design of economic instruments in the country's solid waste management sector represents a missed opportunity considering the huge potential of these instruments.

#### **1.2** Statement of the problem

Waste products which are discarded improperly have higher social costs than those disposed properly, since such discards can become an eyesore or even an environmental or health threat. Improperly discarded waste is also quite expensive to redirect to the legal waste stream. Deposit-refund systems for glass, paper, and plastic are well established in the developed countries and have considerably decreased the total volume of waste produced. Mandatory deposit schemes are complex in implementing and pose various challenges which include costs and operational logistics. Internationally, deposit refund systems have generally proven to be an expensive solution and target only a narrow range of packaging material (DEAT, 2000). Management of glass bottle waste in Kenya is concentrated on collection and transportation of which only 20-80% is collected using 20-50% of the cities' (Nairobi and Kisumu) and towns ( such as Nakuru) operational budgets; yet servicing less than 50% of the city population or areas (HABITAT 1996; Hardoy et al. 2001). Vendors are obliged to collect the returned container, which incurs additional costs.

In most developing countries including Kenya, the design and operation of the deposit refund schemes (DRS) carefully takes into account factors such as the structure of the market, the scope and level of any mandatory deposit applied, the system of returns and the management of the scheme, hence, resulting into undesirable and unwanted effects such as market distortions, increased consumer and business costs and a low return rate (Brooks, 2005). Increased usage of bottled products and foodstuffs in Kenya necessitates the usage of Mandatory deposit schemes. In addition, there are reports of consumers failing to return the empty bottles despite having paid the deposits to the vendors. Vendors have also, been reported complaining about delays in the refunds from distributors (HABITAT 1996). This situation hampers the effectiveness of the scheme. In order for the DRS to function efficiently the Government needed to be put in place facilities at the point of return that is retail outlets, to receive and sort the containers, refund the deposits to the consumers, and prepare the containers for collection. The cost of creating a structure to monitor and enforce the DRS and ensure adherence to the Container Deposit Legislation was, therefore, unavoidable.

Most studies carried out on DRS are in the developed countries, whose capacity is accommodative of the DRS associated challenges. However, there is little empirical evidence of studies on DRS carried out in the developing countries. This aspect has been ignored in

previous studies. The focus of this study was to assess the effect of deposit refund system on bottle returns management in Nakuru Municipality.

### 1.3 Purpose of the study

The purpose of the study was to assess the effect of the Deposit-Refund system on waste management within the Municipality of Nakuru.

## 1.4 Objectives of the study

The specific objectives of the study were:

- 1. To examine the cost effectiveness of the deposit refund system in the management of glass bottle waste in Nakuru Municipality.
- 2. To examine the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality.
- 3. To determine challenges faced in the implementation of the deposit refund system in the management of glass bottle waste.
- 4. To find out the strategies that can be adopted by Nakuru Municipality in enhancing the success of the deposit refund system.

### 1.4 Research Questions

- 1. How cost effective is the deposit refund system in the management of glass bottle waste in Nakuru Municipality?
- 2. How is the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality.
- 3. What challenges are faced in the implementation of the deposit refund system in the management of bottle waste?
- 4. What strategies can be adopted by Nakuru Municipality in enhancing the success of the deposit refund system?

#### 1.5 Significance of the study

The study was significant since, it revealed through its findings: the effect of the Deposit-Refund system on waste management within the Municipality of Nakuru. This information is important to the Ministry of Environment and Natural Resources, the Ministry of Local Government, other concerned Governmental and Non Governmental Organisations and stakeholders within the community. The information obtained could be useful for the enhancement of the successful application of the DRS as an economic instrument for waste management. The study findings were expected to ignite future investigative studies related to the application of the DRS as a waste management instrument. Future researchers in the field of waste management could benefit from the findings because the findings can be used as reference materials.

### 1.6 Limitation of the study

Deposit refund system might not be a welcome move especially from the business community, since most people are always negative to any initiative that requires them to spend money. Therefore, there was a high likelihood that the target respondents could be biased when providing their answers. However, ensured that the respondents were informed of the purpose of the study to allay fear and the fact that the information provided would be treated confidentially.

The relationship between the council employees and the business community had always been one filled with suspicion and any initiative introduced by the Municipality had not been supported by the community as required, hence, this research could not be supported honestly. However, the respondents were informed of the purpose of the study and assuring them of confidentiality of information provided to allay fear. This was through an introductory letter to the respondents explaining to the respondents containing information of purpose of the study and a confidentiality assurance phrase.

## 1.7 Delimitations of the study

The proposed descriptive study was carried out within Nakuru town, targeting Municipal Council of Nakuru employees within the Environment Department and members of the business community operating with the Nakuru town Central Business District. The study used a sample drawn from the business community, focusing on operators / owners of shop outlets, supermarkets, hotels and businesses dealing with packaged products.

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The proposed study was carried out within the Municipal Council of Nakuru, specifically within the Nakuru town CBD. Nakuru is the provincial capital of Kenya's Rift Valley province as well as Nakuru district headquarters, with roughly 300,000 inhabitants, and currently the fourth largest urban centre in the country. It lies about 1850 m above sea level. Purposive sampling was used to select Nakuru Municipality. Nakuru is the largest town in rift valley province and has the third largest urban population per 1999 census. The study was carried out within a period of six months and focused only on solid waste.

## **1.8 Basic Assumptions of the study**

For purpose of this study the following assumptions were made:

- 1. The respondents provided accurate information which enabled the researcher come up with reliable and concrete study conclusion and recommendations.
- 2. That the employees of the Municipality of Nakuru, Environment Department were aware of the operations of the Deposit Refund System and that they understood the main purpose of the system.
- 3. The employees of the Municipality of Nakuru, Environment Department kept a track record of the operationalisation of the Deposit Refund System in the Management of glass bottle waste.

## 1.9 Definition of significant terms used in the study

**Cost effective:** gainful, economical, commercial or worthwhile (whether the Deposit-refund systems is economical)

**Deposit-refund systems:** These are a combination of a product charge (the deposit) and a subsidy for recycling or proper disposal.

Solid Waste: Solid waste is any useless, unwanted, or discarded material with insufficient liquid content to be free flowing'; or waste which is 'spadable'

Solid Waste Management: is the control of generation, storage, collection, transfer, transport, processing and disposal of wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations.

**Strategy:** this is a plan or tactic used in the enhancement of the effectiveness of the Deposit refund system in the management of glass bottle waste.

**System of return:** this refers to the system used u returning empty glass bottles from the users / vendors to the distributors.

Waste: is superfluous refuse, no longer serving a purpose, left over after use; or, useless byproduct of manufacturing or physiological process

#### 1.10 Organization of the Study

This study contains five chapters and an appendices section. Chapter 1, which is the introduction, contains the background of the study, statement of the problem, research objectives and questions, significance of the study, basic assumptions and delimitations of the study. The chapter also contains the definition of significant terms used in the study.

Chapter two contains the literature review section. It contains a discussion waste management and its effects on the environment. The chapter also explains the concept of deposit refund system and its application. The chapter also has a conceptual framework and is concluded with a summary of literature reviewed.

Chapter three gives a description of the methodology used for the study. The research design and sampling techniques used are explained. The method of sample selection and determination is explained. The methods of data collection, analysis and presentation are discussed. This section is concluded with the operational definition of variables, which attempts to associate the objectives with the methodology and provides a map to the expected results.

Chapter four contains is the presentation the findings arising from data analysis using the techniques described in chapter three, the chapter also contains the interpretation and discussions of the findings.

Finally, chapter five contains the summary of the findings, the conclusion and the research recommendations. The chapter also contains a section for suggested areas for further studies arising from the study findings and contributions to the body of knowledge.

## CHAPTER TWO LITERATURE REVIEW

#### 2.1 Introduction

This chapter contains a comprehensive literature review for this study. The chapter discusses waste management and its effects on the environment. The chapter also explains the concept of deposit refund system and its application. It contains a summary section and a conceptual framework of the study.

## 2.2 Overview of Solid Waste Management

Solid waste has become a major consequence of development and modernization, yet some of the greatest challenges to its management are felt mostly in the developing countries. This is part of the larger paradox of development. Factors which create the most intransigent problems currently facing the developing countries are invariably those that derive from development itself. This irony is based on the gap between the patterns of growth and modernization in the developing world on the one hand, and the capacity to pay for, plan for and effectively manage solid waste as part of an integrated national system, on the other (Thomas, 1998).

Municipal solid waste management (MSWM) is one of the critical environmental challenges of rapid urban development facing the developing countries including Kenya. Solid waste arising from human domestic, social and industrial activities is increasing in quantity and variety as a result of growing population, rising standards of living and development of technology (Suess 1985; UNEP, 1991; Dickerson 1999).

The need to manage this increasing waste in an environmentally effective, technologically feasible, economically affordable and socially acceptable manner is a problem faced by all nations of the world today. It is hard to reconcile the trade-offs between the four dimensions presented above, partly because some of them actually conflict and the problem is also linked to the paradox of the sustainability concept itself.

Waste management is also not glamorous; yet without it, every city would cease to exist (Zurbrugg, 2002). Hence all cities, the world over, have developed some way of dealing with the problem. The degree of success with which the developed and the developing countries, including Kenya, are coping with the problem is, however, very different. While

the developed world has sought effective solutions through greater efforts to move up what is called the "solid waste hierarchy", the developing world countries are simply overwhelmed with the waste problem or can now barely grapple with the elementary stages of it (Beukering et al., 1999).

## 2.2 Global Significance of Solid Waste Management

The problem of municipal solid waste management varies in magnitude in different regions, nations and cities of the world. Table 1 summarizes the world and regional dimensions of solid waste. The Table suggests a gruesome future of Solid waste management, especially in the developing regions of the world.

As shown in Table 1, the major driving forces behind waste generation are population, consumption, affluence and technology. In the developed world, the factors of consumption and affluence fuelled by technology are stronger in determining the prolific waste generation. These developed societies are increasingly prolific generators of municipal solid waste, for example, they represent only 16% of the world's population but consume 75% of global paper production (The International Bank for Reconstruction and Development {IBRD}, 1999). They are usually described as 'throw away' societies because they produce huge quantities of packaging, regularly utilize disposables and have an insatiable desire for acquiring the latest models of goods and by so doing, discard the old as waste (Organization for Economic Co-operation and Development {OECD}, 2005).

ractors	Observation
Population	Population: By 2050 the global population is projected to be 50% a larger that today) 9 billion people),and 95% of that growth is expected to occur in the developing countries (swell and Morrison 1999)
Consumption	Consumers in certain rapidly expanding non-OECD economies are emulating the ecologically challenging consumption pattern of consumers in OECD countries
Affluence	Some of the highest GNP growth rate in the world are taking place in countries outside the developed world, i.e China India, Brazil and Indonesia (OECD,1997).
Technology	The World Bank reports "massive levels "of industrial investment will occur in developing countries (Hanrahan 1995). In principle "leap frogging" the dirty technologies of past may be possible since many developing countries have fewer sunken costs in older "eco friendly"
Impact	A five-fold increase in global waste generation is possible by 2025 (CSD 1997

 Table 2. 1 Global Dimension of Solid Waste Problem

Increased waste generation does not, however, determine the degree of efficiency in the management of waste. The developed world is not only a greater waste generator but also a better waste manager compared to the developing countries. The developed countries have rigorously applied the waste management hierarchy principles within the wider framework of integrated solid waste management systems, and through using policies and strategies that emphasize waste prevention, minimization, and safe disposal. Generally MSW management has improved drastically with collection attaining almost 100% everywhere (UNEP-IETC 1996). According to De Tilly (2004), in the OECD member countries between 1995 and 2000, rates of waste incineration with energy recovery, recycling and composting increased; and even though landfill waste quantities continued to increase, land filling rates dropped and those of incineration stagnated (De Tilly, 2004).

In the developing countries, the stronger driving force for waste increases is the high rate of urban population growth (Figure 1). Figure 1 shows that while the rates are slowing down in the developed world and Latin America, Africa and Asia are experiencing very high growth rates, higher than the rates of the entire developing world. Other sources also confirm that by 2015, half the world's population will be living in cities, growing at an average rate of 2.4% per year consistent in doubling with 29 years with the greatest increase being in Asia followed by Africa. (United Nations Population Division, 2002)

Urbanization in itself need not necessarily be a problem. In fact, in the developing world, it has been the engine of economic and social development of their cities. Habitat (1996), notes that Urbanization has helped such cities attain stronger and more stable economies in the past few decades.



Dev d World=Developed World Dev'g World=Developing World

## Figure 1: World & Regional Average Annual Urban Population Growth Rate 1950-2020 (Cumulative %) Source: Compiled From Statistics in Hardoy et al. 2001, WIR 1998, and United Nations Population Division 2002

There is an inextricable link between urban population growth, development and environmental problems. Whereas urbanization has helped improve the economic and social situation of developing countries, one major challenge has been the emergence of environmental problems, municipal solid waste management being one. This relationship is not straightforward, especially as increased waste generation does not itself suggest poor management. According to Satterthwaite (1997), 'many environmental problems lessen as cities get larger'. While this may be true many authors still observe a positive correlation between urban growth, development and specific environmental problems (HABITAT 1996).

Hardoy et al. (2001) argue that '[these] environmental problems become particularly serious where there is a rapid expansion in urban population and production with little or no consideration either for the environmental implications or for the political and institutional framework that is needed to ensure such environmental problems are addressed' This is true for most cities of developing countries. Specific to waste, Schubeler (1996) suggests that 'solid waste generation and demand for waste collection service generally increase with economic development'.

Municipal solid waste management is a propriety area for many reasons as it tends to increase with per capita income and standards of living levels (The World Bank, 1994). Despite the magnitude of the MSWM problem, it was neglected along other urban problems due to conflicting agendas. It was the resurfacing of major disasters in cities such as the plague in Surat, India and epidemics in Latin American cities in the late 1980s and early 1990s that spurred nations and international concerns towards action on city sanitation (Hardoy 2001; HABITAT 1996). The municipal solid waste management sector remained neglected. In both the developed and developing countries, too little attention has been paid to the management of municipal solid wastes. Since 1995, UNEP, UNCHS (Habitat) have been developing a common position towards forging a sustainable waste management policy and strategy in Africa.

The World Bank loans for urban development for the period 1981-1998, confirm the gross neglect of solid waste management. Within the period in question, loans for water supply, sanitation, and drainage together ranged between 12.8 to 27.9 %; meanwhile solid waste management had one negligible funding of 0.1% in the 1993-95 sub period (Hardoy et al, 2001). According to Johansson and Boyer (1999), 'Of all the regions, Africa has the lowest level of investment in World Bank funds in the solid waste sector.'

#### 2.3 Municipal Solid Waste Management in the Developed World

The developed world is a group of 35 highly-industrialized countries located in North America, Europe and Asia-Pacific areas (UN Population Division, 2002). It is hard to find agglomerated waste management data covering the entire area; however, the membership of the Organization of Economic Co-operation and Development (OECD), which roughly corresponds to the developed world, has some useful data from which generalizations for the regions can be drawn. The European Union (EU) is within, and collaborates with, the OECD. In general terms, this is the most industrialized and technologically developed part of the world, characterized by high incomes, affluent life style, high consumption and stable democratic governments. These societies are increasingly prolific generators of municipal solid waste, for example, they represent only 16% of the world's population but consume 75% of global paper production (IBRD, 1999). They are usually described as 'throw away' societies because they produce huge quantities of packaging, regularly utilize disposables and have an insatiable desire for acquiring the latest models of goods and by so doing, discard the old as waste. Although sub-regional, national and state variations exist, increasing literature in the last decade suggests that municipal solid waste generation continues to increase tremendously, raising heightened concerns on the problem at all levels, from local through national to regional groupings and world organizations. Commensurate efforts are being made through the successful use of conventional methods employing intensive capital, highlevel technology, elaborate policies and instruments, legislation and strategic guides such as the solid waste hierarchy, in an attempt to cope with the ever-increasing municipal solid waste management problem.

Comparing regional or national municipal solid waste management (MSWM) statistics is difficult because of varying definitions, methods, units and times of data collection. However, broad trends can be traced. Municipal solid waste (MSW) generation in the developed parts of the world is constantly increasing. Broad trends in municipal waste generation in the OECD member countries continue to rise in absolute and per capita terms. He notes that the OECD statistics show that between 1990 and 2000 MSW increased by14%, that is, from 530 –605 million tonnes, 509-540 kg per capita per year (1.4-1.5 kg per capita per day)while population increased by 8%. However, national variations are great, for example the US generation rate in 1999 was 2.1 kg per capita per day, up from 1.2 kg in 1960 (Habitat, 2006)

Whereas increases in population and the level of incomes continue to account for such increases in municipal solid waste generation, Hardoy et al (2001) underlines new emerging factors. These factors are linked to consumption patterns, family structures and lifestyle. The author suggests that single households produce more waste per capita than families. Ready-made food produces more packaging than individually family-prepared food but traditional preparation results in more organic kitchen waste. The author also notes that increase in incomes results in the use of long-lived goods and services, which later produce other types of waste such as bulky waste and waste from construction and demolition (Hardoy et al, 2001).

The composition of MSW in countries of the developed world may differ but the tendency is for non-biodegradable waste to dominate over biodegradable. For example, the average for the US cities shows the following composition: 'paper (38%), yard trimmings (12.1%), food waste (10.9%), plastic (10.5%), metal (7.8%), glass (5.5%), wood (5.3%) and others (5.3%)' (UN Habitat, 1996).

## 2.4 Municipal Solid Waste Management in Developing Countries

Management faces many problems as waste management authorities have, in a majority of cases, experimented with almost every strategy and with high and modern waste management technology acquired from the developed countries, with very little success. This failure has been linked to the acquisition and use of incorrect and ill-adapted technologies with heavy costs of maintenance, lack of expertise and inadequate funding and staff. Some authors believe that even more pertinent are corruption and the autocratic 'command-and-control' approach to waste management issues (Kironde et al.1997). Non inclusive management that excludes other stakeholders has also been a crucial issue.

Management is concentrated on collection and transportation of which only 20-80% is collected using 20-50% of the city's operational budgets; yet servicing less than 50% of the city population or areas (HABITAT 1996; Hardoy et al. 2001). According to Johansson (1999) land filling remains the most prominent technique with open dumps being the common practice. There are also many illegal dumps created in empty spaces, lakes and ponds, drains, canals, street corners, riversides, estuaries and coasts. Littering is a common phenomenon. These uncollected solid wastes deface the aesthetics of the city and bring about serious environmental and health hazards. According to Halla (1999) this phenomenon caused some African cities in the mid 1980s to be dubbed 'Garbage Cities' and 'Cities of Mess' (Halla 1999)

The urban council, which is the statutory authority to manage wastes in the city, is duty bound to play a leading role in addressing these critical issues including the organization, coordination and cooperation with the other actors. These other waste stakeholders include the national government authorities, external support agencies (ESAs), non-governmental organizations (NGOs), common initiative groups (CIGs), community

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based organizations (CBOs), formal and informal private sectors, scavenger and scavengers' cooperatives, households and individuals. These groups and individuals are usually termed informal until they are recognized and have been registered (Ali et al., 1999). These groups are involved in waste collection and removal, recycling, composting and waste recovery for reuse. They are also involved in street sweeping, clearing drains and repairing, transforming and reusing discarded articles supplying waste collection equipment. All these groups and individuals do play an important role in municipal solid waste management. However, it is only relatively recently that some urban authorities in the developing countries have recognized, and eventually integrated them into their solid waste management systems. Elsewhere each group operates parallel to the others. In cities where they have been recognized and integrated, the waste management situation has greatly improved as in the cases of the many scavengers' cooperatives in Latin America and Asia (Furedy 199; Medina 2000; Hardoy et al. 2001).

Nevertheless the situation of solid waste management in many towns and cities of the developing countries remains inadequate and inefficient. Schubeler (1996) describes the situation as highly unsatisfactory. This suggests that the conventional management system and the unorganized informal sector in place are not based on sustainable strategies and methods. Omuta (1987) noted that unless the structure and causes of this failure are discerned and pointedly addressed our cities may become veritable agents of danger and overall human degradation, through epidemics, and visual as well as ecological devastation. Another important issue, which comes into question, is the limited applicability of the theoretical recommendations so far put forward to address this predicament.

## 2.5 Waste management in Kenya

Kenya is a developing country with a population of 36.1 million in the year 2006 (CCN, 2007), and land area of 549,137 km2. 34% of the total population in Kenya lives in the three major cities (Nairobi, Mombasa and Kisumu) and two major towns namely Nakuru and Eldoret (CCN, 2007). Solid waste management services in Nairobi ( the situation reflects the practice country wise) is characterized by poor solid waste management services, uncontrolled dumping leading to serious pollution problems, unregulated private sector participation because most of the waste collection in Nairobi has been privatized, lack of solid waste management infrastructure (that include well managed transfer facilities, waste

separation etc), and lack of waste policies and strong waste recycling and recovery industry (UNEP, 2006). The per capita waste generation within urban areas ranges between 0.29 and 0.66kg/day. JICA, (1997) points out that on average 21% of the waste generated in urban centres emanates from industrial areas while 61% from residential areas, 6% from roads and the rest is not stated where it comes from7. It is estimated that Nairobi generates 1,5000 tons of solid waste daily and only 25% of this waste is collected and sent to the Dandora dumpsite (this is an open dumpsite and covers 27 hectares) (UNEP, 2005). The remaining waste is mostly composed of chemicals (salts, heavy metals, detergents and medical waste) is dumped in undesignated areas or in the rivers and wetlands. There are several illegal dumpsites emerging in Nairobi along the introduction of road, in residential backyards and commercial premises this has been attributed to the waste management regulations of 2006, there seems to be light fact that the end of the tunnel if only the regulations will be enforced. Dandora dumpsite has reached its full capacity (CCN, 2007).

#### 2.6 Waste generation statistics in Nairobi

From projections done by JICA, 1998-2008, Nairobi alone has a population of 3.63 Million and generates 2730 tons a day. This translates to a waste per capita of 1.33 kg waste per person per day a double figure of what it was in the year 2005 (0.65 kg per person per day), Maranga, 2005. The pie chart below characterizes solid wastes generated in Nairobi, which is used as a representative of most urban towns in Africa.



Figure 2: Pie chart showing percent solid waste generation statistics in Nairobi

## 2.7 Deposit refund systems on glass bottle

Deposit-refund systems (hereafter referred to as "deposit systems") are a combination of a product charge (the deposit) and a subsidy for recycling or proper disposal (the refund). Manufacturers or vendors of products that are subject to deposits incur additional costs in handling returned products, but these costs are often partially offset by the interest earned on deposits, unclaimed deposits, and sales of collected used products.

In a deposit-refund system, consumers pay deposits that are added to the price and receive refunds when they return the used products. This system is one of the economic instruments used for environmental protection. It combines taxes and subsidies to prevent litter and promote material recovery. Consumers of deposit-refund goods have an incentive to return used products and receive refunds, and a high recovery rate can be attained with low monitoring costs. If consumers dispose of used products in an inappropriate manner, the deposits can be used to recover the externality from the disposed products. Furthermore,

since refunds are compensated from deposits, funds for a deposit-refund system are smaller than those for a system offering subsidies for returned used products.

There are several economic instruments that can be used which include tradable permits, emission charges, tradable rights, deposit refunds, fees, refund bonds, taxes among others but of major concern, in this proposed study, is deposit refund because of several benefits attached to it and as a tool for cleaning up the environment. The public is familiar with deposit refund systems because of their wide use for beverage containers. In this system, a deposit is paid on a soft drink or beer can or bottle. When pollution is avoided by returning the containers, a refund follows (OECD, 2005). Deposit refund systems are appropriate where the policy objective is to encourage proper disposal, encourage re-use or recycling, or discourage use altogether (Menell, 1990).

## 2.7.1 Objectives of a Deposit Refund System on glass bottle

One of the objectives of a deposit system is to discourage illegal or improper disposal. Waste products that are discarded improperly have higher social costs than those disposed of properly, since such discards can become an eyesore or even an environmental or health threat. Improperly discarded waste is also quite expensive to redirect to the legal waste stream. Deposit systems are commonly applied to beverage containers, in part because these containers make up a large proportion of roadside litter. Another important objective of a deposit system is to divert recyclable items from the waste stream. In addition to being used for beverage containers, deposit systems have also been used for other products such as pesticide containers, lead-acid batteries, and tires. Some of these systems are voluntarily implemented by industry, whereas others are implemented by state or local authorities (OECD, 2005).

Fullerton and Kinnaman, (1995) conclude that fees for waste collection should be priced as if disposal and recycling are the only two disposal options. If illicit burning or dumping is also an option, the optimal policy is "a tax on output plus a rebate on proper disposal," in other words, a deposit system. While variable pricing programs for waste collection have the potential to give waste generators an incentive to improperly dispose of waste, deposit schemes give them an incentive to return waste for proper disposal or for recycling.

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In this system some deposit is charged when the product is being sold with the aim of later refunding the buyer when the product is returned for reuse, recycling or for safe disposal. In this scheme the producer/retailers are often responsible for the management of the product and collection of the deposit. In some instances the full deposit may not be returned (OECD, 2005).

Deposit refund systems encompass a charge on some particular item and a subsidy for its return, and are mainly used to encourage recycling. The distinguishing feature of the deposit-refund scheme is that it has a clever disclosure mechanism: the refund is paid when the potential polluter demonstrates compliance by returning the item that carries the refund, thus making the monitoring of illegal disposal unnecessary. Usually, deposit-refund systems are used for certain final outputs such as beverage cans and bottles.

The fact that there are no recycling policies in the country has necessitated the participation of the industries in encouraging the end users to return certain used products like glass bottles. Previously in the country industries have encouraged setting up of recycling schemes with deposit refund system to improve environmental conditions while also generating income to the poor. The beverage industry in Kenya has applied the deposit refund system which has been popular in the whole country because of its ease of administration which is all inclusive and works in collaboration with the wholesalers, retailers and consumers. The consumers pay a deposit for reusable glass bottles, the deposit ranges from Ksh. 10 for soft drinks bottle and Ksh 25 for beer bottles (Rotich, 2005). E-waste take back schemes that involve the community groups and provide incentives for participation will attract higher returns than the current system which has no incentives. The recycling trend in the country is changing albeit slowly as there are no incentives that encourage recycling or setting up of take-back schemes that can promote recycling.

Several studies have concluded that deposit systems are more cost-effective than other methods of reducing waste disposal, such as traditional forms of regulations, recycling subsidies, or advance disposal fees (ADF) alone. A recent study by Palmer, (1995) concluded that a 10% reduction in waste disposal would cost \$45 per ton of waste reduced under a deposit system, compared to \$85 per ton under advance disposal fees and \$98 per ton under recycling subsidies. However, the study noted that the relatively high administrative costs of

a deposit system could outweigh these cost savings. Deposit-refund systems appear best suited for products whose disposal is difficult to monitor and potentially harmful to the environment. When the used product has economic value, the private sector may initiate the program.

The costs of deposit systems may be substantial for manufacturers, distributors, vendors, consumers, and regulatory authorities. One study found California's system to be more cost effective than those in which retailers accept redeemed containers. Deposit systems could also divert revenues from, and lower the cost effectiveness of curbside recycling programs. However, McCarthey, (1993) found evidence suggesting that "local governments would achieve a greater diversion of solid waste from disposal at a lower cost per ton if both a bottle bill and a curbside collection program were in place." One difference between the two approaches is that the costs of deposits are borne by manufacturers and distributors, who in turn pass on some costs to consumers, whereas the curbside programs are often funded by general revenues or waste tipping fees. Lack of information on the costs and benefits of litter reduction and recycling and on the costs incurred by consumers in returning containers makes it difficult to thoroughly evaluate beverage container deposit systems.

# 2.8 International Bodies Experience and Relevance on the Deposit refund schemes for glass bottle

European Community recommends expanding deposit refund systems from beverage containers to batteries and more complex apparatus such as cars and televisions. [European Community, Working Group of Experts from the Member States "Study seeks to of the Working Group of Experts from the Member States on the Use of Economic and Physical Instruments in EC Environmental Policy" (1991) 14 *Boston College Int. and Comp. L. Review*]. Similarly, a recent study seeks to from the European Community recommends expanding deposit refund systems from beverage containers to batteries and more complex apparatus such as cars and televisions.

Deposit refund schemes for recyclable waste (bottles, scrap cars), or favourable tax treatment of environmentally friendly products (lead-free gasoline, solar panels for home heating) and other non-discriminatory measures ensuring a pattern of domestic consumption that minimizes pollution would not normally be open to challenge. [*Trade and the*
*Environment*, February 1992,]. Either deposit refund systems or related measures are considered standards related measures they will be valid under NAFTA so long as their demonstrable purpose is a legitimate objective, defined to include environmental protection, and they do not exclude goods of another party which meet that objective.

# 2.9 Relevance to other African Countries on the Deposit refund schemes for glass bottle

South Africa as one of the African countries has embarked on deposit refund system on the non-biodegradable plastic bags that are given for free on buying goods in big supermarkets. Plastics are used several times instead of one time and these are regarded as the major non- biodegradable waste in developing countries. This refund is there to encourage plastic returns to the supermarkets and a discount is deducted from the actual total amount on the goods. This also encourages proper disposal of plastics as plastics are a threat to the environment as they are non degradable (White, 2002).

The refund system is not of great importance to Botswana because of the lower incentive value attached to the refund of 0.25 Pula. People are not concerned about returning the empties but just throwing them everywhere as long as they do not disturb them. Also the Botswana used cardboard box shake-shakes for storing beer, which cannot be reused again. For these containers it is difficult to use deposit refund system. The cities, Gaborone, Francistown, Palapye among others are all highly littered with cans (beverage cans), shakes, glass and plastic containers which are not being returned because of the lower economic incentive attached to the empties (White, 2002).

#### 2.10 Relevance to Developed Countries on the Deposit refund schemes for glass bottle

Effective and efficient environmental management policies to prevent environmental harm rather than retroactive punishment involving costly and time consuming activities has been put into place and an example of self regulatory instrument such as deposit refund should be put into place.

Cole, (2001) studies showed that South Australia is currently the only Australian State to operate a container deposit system for recyclable drink containers. There are significant environmental, economic and educational benefits in operating such a system, with little associated cost. At present over 82% of glass and aluminium containers in South Australia are recycled, significantly higher than in other Australian states. A container deposit system also gives people further incentive to hold on to their rubbish, and for people to collect litter themselves. This returns a saving to ratepayers through reduced cleaning costs. Latest surveys in Australia showed 97% community support for the container deposit system. Surveys in other states also indicate strong community support.

Panayotou, (1995), Deposit refund systems on beverage containers have been successful in Finland, Norway and Sweden. The percentage of containers returned is 90% for beer and soft drinks and 70%-80% for wine and liquor while the market share of non-returnable bottles is kept small less than 5% in Finland. There is evidence to suggest that consumers are responsive to the level of deposit refund, for example in 1983 Sweden introduced a deposit of ECU0.04 on aluminium beverage cans which resulted in the return of 60-70% of cans. Denmark and the Netherlands introduced refundable deposit for batteries with a high content of cadmium and mercury to control soil contamination. Ontario" (March, 1992), Germany's introduced the "Green Dot" program which have been very successful in ensuring the return of packaging to manufacturers and ensuring high levels of recycling.

Manufacturers, distributors and retailers are required to accept packaging for return. Retailers can get an exemption from this requirement if they participate in a privately funded collection system that guarantees recycling rates. If retailers do not participate in a private program, deposits are imposed on sales packaging. As a result of the ordinance German retail and industrial sectors have formed a company that funds a collection and sorting program. To participate, companies pay a licensing fee and guarantee to accept and recycle their

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packaging. In return they avoid deposits and can mark their products with the green dot symbol.

Finland has a combination of deposits and taxes on non-returnable beer and soft drink beverage containers. [Environmental Resources Limited, Organization for Economic Cooperation and Development, *Environmental Policies in Finland*] Refillable containers as a result of these measures dominate the Finnish market. The Netherlands has a deposit on glass beverage containers backed up by a product tax on non-refillable plastic beverage containers. It also has a voluntary deposit refund scheme on refillable bottles.

Switzerland has a mandatory deposit refund system for refillable beverage containers backed up by a statutory requirement for reduction of beverage containers tonnage in waste and a product tax on beverage containers [Environmental Resources Limited]. Plastic containers are also banned unless their disposal meets standards for safe disposal of five hazardous substances.

Denmark has a deposit charge on beer and soft drink containers. This charge is backed up by a ban on nonrefillable beverage containers that were domestically produced, as well as a sliding scale of product taxes on packaging for liquids to encourage the use of returnable containers for recycling and reduce consumption of disposable packaging. [Environmental Resources Limited,]

Sweden has a deposit refund system for glass beverage containers as well as for aluminium cans. An increase in the deposit on the cans in 1987, from US \$.05 to \$.09, has led to the current return rate of 85%, the highest rate for these cans in Europe. Sweden has also prohibited the use of non-refillable containers as of July 1, 1991, and is considering bans on other plastic packaging. [Environmental Resources Limited, McCarthy, 319.] Sweden requires producers of plastic bottles to establish deposit refund systems and establish that 90% of the plastic bottles can be recycled or reused. [Makuch,] The Swedish parliament is currently considering an extension of this requirement to importers.

#### 2.11 Requirements for Deposit Refund System on glass bottle

Deposit refund systems include relatively simple Product deposits and Substance deposit refund systems. Product deposit refund is payable on the sale and return of beverage containers, car bodies, batteries, and pesticide containers. In a substance deposit refund system the refund is paid despite substantial changes in the form of the substance.

Enabling legislation for product deposit refund systems should: have broad power to implement deposit refunds for different products; provide for restrictions on when products are eligible for refund; provide for product charges and product bans; allow for regulation of labelling requirements; and include sufficient offence provisions to guard against refund fraud.

Some additional provisions necessary for substance deposit refund systems include: power to define acceptable disposal by regulations and provide mechanisms to determine acceptable disposal; provision for import levies and export refunds in lieu of substance deposits and refunds; and provision for a central agency to delegate different functions to appropriate agencies. For instance, customs and excise officials are already trained to collect excise taxes on the primary production and import of substances such as alcohol and would be well suited to collect substance deposits and provide refunds on export.

#### 2.12 Empirical review

In the United States of America, Maine introduced a deposit system for beer and soft drink containers on January 1, 1978. In distributing beer and soft drinks to retailers, distributors (or manufacturers) levy a 5 cents deposit. Retailers in turn include this amount in their sales prices. The customer can obtain a 5 cents refund by returning the container to any retailer that sells the product or to a redemption center. Distributors (or manufacturers) return the 5¢ deposit to retailers for every returned container. In addition, retailers are reimbursed a 3¢ handling fee, which provides a strong incentive for retailers to promote the return of containers. At times, demand by retailers for used containers is so high that customers can obtain refunds 10% to 20% higher than the deposit amount. In some places, reverse vending machines also offer refunds for returned containers. The deposit system was expanded to include liquor and wine containers on September 1, 1990, and bottled water, iced tea, and juice on December 31, 1990. This action resulted in new (and perhaps less cost-effective) types of deposit-refund arrangements. Unlike soft drinks and beer, several companies in the same geographic area often distribute juice. Consequently, each one often has difficulty determining which containers it is responsible for collecting. As a result, some distributors may pay more in refunds than they receive in deposits, while for others, deposits may exceed refunds. Because distributors fear that they will lose money in collecting deposits and paying refunds, manufacturers have had to collect deposits themselves and contract independent collectors to redeem containers. This method may be less cost-effective than collection by distributors who already travel to collection sites when they distribute new products.

Retailers have complained that the deposit system (especially the expanded one) requires more storage space and more time for recordkeeping, receiving bottles and sorting bottles. In addition, traces of beverages in containers have attracted pests. The administrative burden probably became more severe following the expansion of the system because significant variations in the types of juice containers make them more difficult to sort and store.

The deposit system in Maine is reported to have significantly reduced litter. A 1979 study by the Maine Department of Transportation found that total litter declined by 10% and that container litter declined by 56%. Since completion of the study, the redemption rate rose. Thus, it is likely that container litter has decreased further. In addition to reducing the incidence of litter, the deposit system also gave incentives to scavenge bottle and can litter to obtain refunds. The deposit also may have increased recycling capacity by creating a reliable supply of recyclable materials. Three container-processing facilities were established in Maine as a result of the deposit system. These facilities can, in turn, stimulate demand for recyclables that are collected outside the deposit system.

Criner, George, Jacobs and Peavey, (1991), estimate that the costs of Maine's deposit system exceed those of curbside collection programs, but the system also results in higher collection rates. They surveyed retailers, redemption centers, distributors, and manufacturers to develop cost estimates for the deposit system. Using a computerized waste management model, Criner et al., (1991) estimated that retailers incurred costs of 2.4 cents to 3.1cents per

container under the original deposit system and virtually the same costs under the expanded system. The high end of this range applies to smaller retailers. Based on these estimates, the handling fee of 3cents per container appears to be set at a level that covers retailers' costs. The handling fee was originally one cent, but it rose to 2 cents in 1980 and to 3¢ in 1990.

#### 2.13 Theoretical framework

In 1932, Pigou proposed a tax/subsidy scheme to control externalities. A tax was imposed on negative extemalities while a subsidy was imposed on positive extemalities, If the tax or subsidy rate was equivalent to the marginal external effect, Pareto efficiency was achieved (Pigou, 1932; cited by Mills, (1972). Mills, (1972) proposed a DR system - whereby a material disposal tax levied on raw materials was combined with refunds when the material was properly disposed. They suggested that the tax rate should equal the estimated damage cost of the most harmful method of disposal, while the refund rate should depend on the disposal method employed. Desirable methods (generation of less externalities), such as recycling, should receive a full refund, while environmentally damaging methods that produced negative external effects should receive only a partial refund. They also recommended that an interest rate might be incorporated in the deposit to prevent erosion of the deposit's real value for a durable product. They argued that such charges would make the prices of materials including disposal reflect social costs, rather than private costs. Due to the different external effects for each input, the original choices of materials would be Pareto optimal. Moreover, the refunds would accurately reflect the social costs of various methods of disposal which would induce firms to choose a method of disposal in light of both the direct costs and the accompanying refund.

The advantage of this DR scheme, Solow concluded, was that controlling upstream producers was easier than controlling downstream users because their number was relatively smaller than the number of those downstream. However, a DR system would have created a burden on policy-makers who would have to monitor the procedure of the return process returns his/her wastes, the surplus from DR systems will be created. This surplus can be redistributed to compensate the losers within this scheme.

Bohm, (1987) examines the welfare change for each affected pany of a DR system. The impact of a DR system on the demand for a polluting product depends on the available disposal alternatives. If the unit costs of alternative disposal, such as landfill disposal, (C,,,) are higher than the unit costs of return (C, ), the consumer gets a cheaper alternative to dispose of his used products, and then the aggregate demand for this polluting product will increase under DR systems. If C, > Cd, the demand\* for this polluting product tends to decrease because the disposal COSI increases under this scheme. For the producers of the polluting product, the profit function will show the impacts of DR systems on firms. If the demand for this polluting product increases, profit as well as output in producing this wastegenerating product will increase under DR systems. On the other hand, if the demand for this polluting product decreases, DR systems will lead to a reduction in profit. The winners include the beneficiaries of a reduction in external effects and the owners of specialized treatment firms. The losers are those whose costs for returning the product exceed the costs for the alternative disposal and the owners of the firms whose output is reduced due to a DR system. Because there are the winners and losers, Bohm proposed a compensating plan. Return cost is the crucial variable in a DR system. The government can compensate the losers by using the surplus from this DR system to subsidize return costs or by providing collection services. As a result, the likelihood that demand and profit would decrease due to DR systems will be reduced.

Bohm, (1987) examine a mandatory deposit on beverage containers as a means of controlling litter. They model the effects of a deposit on litter generation and recovery from a dynamic perspective. The objective of a mandatory deposit on a polluting product is to maximize the present value of the net social gains from littering subject to the litter stock accumulation process. The gains are calculated as the private benefit from littering less the aesthetic cost associated with littering and the cost of litter recovery.

#### 2.13 Conceptual Framework

This section presents the conceptual framework of the study arising from the literature review and the research objectives.

#### 2.13.1 Conceptualization

The study conceptualizes that a glass bottle waste disposal system which is costeffective collection, an efficient system of returns and proper management of the scheme will lead to improved glass bottle waste management. DRS supports cost-effective solid waste collection, transport, treatment and disposal systems which lead to improved waste management. However, interplay of moderating variables such as Government policy, Support or resistance from the business community, and high social costs will influence the management of the waste disposal system. In order for the DRS to function efficiently facilities would need to be put in place at the point of return that is retail outlets, to receive and sort the containers, refund the deposits to the consumers, and prepare the containers for collection. The cost of creating a structure to monitor and enforce the DRS and ensure that Container Deposit Legislation is adhered to is unavoidable. Figure 3 is a graphical presentation of the waste disposal systems explored in detail in this chapter.



### Figure 3: Influence of the Deposit Refund system on glass bottle waste Management

#### 2.14 Summary of Literature

The literature review indicates that an efficient waste disposal system will lead to a well-managed environment, which accrues the benefits of sustainability and reduced social risks and costs. An understanding of the successful application of the deposit refund system is critical, since as seen above it is more costly to tackle problems arising careless / poor waste disposal than it is carefully disposing off the waste. The deposit refund system has registered success in the management of waste in other countries such the U.S. However, studies need to be carried out to assess their effectiveness in the developing countries especially in selected towns in Kenya, since there is little evidence of research studies in Kenya.

## CHAPTER THREE RESEARCH METHODOLOGY

### 3.1 Introduction

This chapter describes the methodology that was used to conduct the study. This includes research design, location of the study, target population, sample size in sampling procedure, sample selection, research instruments, data collection procedures and data analysis techniques, ethical issues consideration and operational definition of variables.

#### 3.2 Research Design

The study adopted a descriptive survey research design. The major purpose of descriptive research is description of the state of affairs as it exists. Descriptive survey research design is a method of collecting information by interviewing or administering a questionnaire to a sample of individual. It can be used when collecting information about people's attitudes, opinions and habits (Orodho and Kombo, 2002).

Descriptive research design is an efficient method of collecting descriptive data regarding characteristics of a sample of a population, current practices, conditions or needs and preliminary information for generating research questions Mutai, (2000). The design was also, preferred because the researcher was able to: ensure that proper construction of questions for soliciting the required information; ensure identification of the individuals to be surveyed; identifying the means by which the survey was conducted; and summarizing the data in a way that provided descriptive information. The researcher was able to collect both qualitative and quantitative data.

#### 3.3 Target Population

Shao (1999) defines a population or universe as the aggregate of all the elements. A population must be defined in terms of elements (employees of the MCN's Environment Department and select members of the business community operating within the CBD). There were over 10,000 members of the business community operating shop outlets within the CBD. MCN had an estimate number of 50 employees working within its Environment Department.

#### 3.4 Sample Size and Sample Selection

Sampling is the process of selecting a number of individuals for a study in such a way that the individuals selected represent the large group from which they were selected (Mugenda and Mugenda, 1999). The study sample was selected by use of purposive sampling technique.

Mugenda and Mugenda (1999) observe that the purpose of sampling is to secure a representative group, which enabled the researcher to gain information about an entire population when faced with limitations of time, funds and energy. The study adopted a formula presented by Mutai, (2000) shown below for the computation of sample size of the business community category due to the big size of the target population.

 $n = \frac{z^{2}(1-p)}{x^{2}p}$ Where 0<p, x<p n = sample size z = confidence level x = accuracy p = proportion or percentage Since p is unknown, it is set at 0.5, at 95% confidence level, z = 1.96 and the sampling error of x <sup>2</sup> is taken to be 0.2. Thus, the sample size n<sub>e</sub> was: n = <u>1.96<sup>2</sup>(1-0.5)</u>

 $(0.2)^2 0.5$ 

n = 3.8416(0.5)

0.02

n = 96.04 or 96

The study therefore used a sample size of 96 respondents drawn from the business community category.

The study interviewed 44 respondents in the MCN employees' category basing on the Krejele and Morgan (1970) as cited by Mulusa, (1988) sample size Table shown below.

Table 3. 1:	Sample size Table			,
N-n	N-n	N-n	N-n	N-n
10-10	100-80	60-52	220-140	340-181
15-14	110-86	65-56	230-144	360-186
20-19	120-92	70-59	240-148	380-191
25-24	130-97	75-63	250-152	400-196
30-28	140-103	80-66	260-155	420-201
35-32	150-108	85-70	270-159	440-205
40-36	160-113	90-73	280-162	460-210
45-40	170-118	95-76	290-165	480-241
50-44	180-123	200-132	300-169	500-217
55-48	190-127	210-136	320-175	550-226

Where N = population and n = sample size

#### Source: Mulusa, (1988)

A sample size of 44 respondents was drawn from the MCN's Environment Department. This was because the estimated number of employees at the MCN's Environment was 50 (population [N]). According to the table above the sample size for N=50 is n = 44. The total number of respondents interviewed, therefore was 96+44 = 140 respondents

#### 3.5 Research Instruments

Questionnaires which contained both structured and unstructured questions were used. In the study, data was collected from various businesses using the deposit refund systems. The questionnaires were used because of the simplicity in their administration, scoring of items and analysis of data (Mugenda and Mugenda, 1999). The purpose of the questionnaires was to capture core information and supplementary information. Qualitative data was collected using in depth interviews with open-ended questions. To facilitate this process site visits were conducted to validate information obtained from the interviews. Secondary data was collected from the records from the Kenya National Library Services, Nakuru (Publications, Environmental laws) and from the Municipal Environmental Offices of Nakuru and several Coca-Cola Depots for monitoring the movement of empty bottles.

The study used two sets of questionnaires; one for the business community and the other the other for the Municipality of Nakuru employees. Each questionnaire contained two parts namely; Part A and Part B. Part A of the questionnaire sought personal information of the respondents, while Part B sought information related to the effect of the Deposit refund system on the management of glass bottle. Research Questionnaire for the Business community solicited information related to application of the deposit refund system on glass bottle and the challenges experienced in its implementation. The questionnaire of the MCN employees was instrumental in obtaining information in respect to the strategies put in place to enhance the effectiveness of the DRS in Nakuru Municipality.

#### 3.5.1 Validity of Instruments

The instruments were tested for their validity by correlating the findings with the study objectives. Further, the questions were shared with the University supervisor for review and comments, and appropriate adjustments or revisions made before administering them to the target respondents. Both content and construct validity were evaluated prior to the use of the instruments. The process involved ensured that the questions in the questionnaire were appropriate for the accomplishment of the study and that they were well constructed to avoid misconception or misinterpretation by the respondents. This was achievable by the input of the expert.

### 3.5.2 Reliability of instruments

Reliability of an instrument is the degree of consistency with which it measures a variable (Mugenda and Mugenda, 1999). The two sets of questionnaires will be pilot tested in order to check their reliability. A pretest was conducted amongst selected firms within Nakuru town. Care was taken to ensure that pretest sample did not form part of the research sample size. Ten Business Community members and four Municipal of Nakuru employees were used for the pilot test. The results of the pre-test survey helped in restructuring of the questionnaire by incorporating the missing information, omitting irrelevant questions and paraphrasing questions that appeared ambiguous to the respondents. To ensure that data collected during field work was

reliable, more than one research tools were used. The tools used included In-depth interviews, site visits and review of relevant secondary data was also conducted for additional information, and verification of response from interviews.

#### 3.5 Data Collection Procedures

Data was collected using the drop and pick procedure. The questionnaires were delivered to the shop outlets and collected after six hours to give the respondents ample time to complete the questionnaires. For the MCN employees' category, the respondents were only interviewed upon receiving authority from the Head of the Department. The Head of Department was instrumental in the identification of the respondents. The employees were issued with the questionnaires, which were collected after six hours. The process of data collection lasted for one week.

#### 3.6 Data Analysis and Presentation

The data collected was coded, keyed into the computer and analyzed using descriptive statistics with the aid of the Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2007 computer software. Qualitative statistical techniques were used during the analysis to describe and summarize data. The results of the analysis were presented and interpreted in the form of descriptive statistics (frequencies, percentages, mean, and standard deviation) and non parametric tests (Chi-Square tests). The findings were presented in tables, percentages and bar charts.

## 3.7 Ethical Considerations

Authorization was obtained from the MCN management prior to carrying out the study. A copy of the letter of authorization is appended. The researcher gave assurance to the respondents regarding confidentiality of information obtained and an assurance phrase to the introductory letter.

## **3.8** Operational Definition of Variables

The Table 3.2 below gives the variables measurable indicators, Data collection and analysis techniques and instruments. An operational definition is a demonstration of a process such as a variable, term, or object in terms of the specific process or set of validation tests used to determine its presence and quantity. The independent variables are operationalized as shown in the Table below:

Table 3. 2 Operational Definition of Variables

Objectives	Variables	Indicators	Measure(s)	Tools of data	Measuring	Data
				collection	Scale	analysis
To examine the cost effectiveness of the deposit refund system in the management of glass bottle waste in Nakuru Municipality.	<ul> <li>Dependent variable:</li> <li>Improvement of Waste</li> <li>Management</li> <li>Independent variable:</li> <li>Cost-effective solid waste collection</li> <li>the system of returns and the management of the scheme</li> </ul>	<ul> <li>Logistics for returning bottles</li> <li>Deposits applied</li> <li>Collection points</li> <li>Users of bottles</li> <li>Distance from vendors</li> </ul>	<ul> <li>Deposit rates used</li> <li>Usage levels</li> <li>Bases of application</li> <li>Access of bottles</li> </ul>	Questionnaires Records Interviews	Ordinal Nominal	Frequencies, means and percentages
To examine the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality.	<ul> <li><u>Dependent variable</u>:</li> <li>Improvement of Waste</li> <li>Management</li> <li><u>Independent variable</u>:</li> <li>Cost-effective solid waste collection</li> <li>the system of returns and the management of the scheme</li> </ul>	<ul> <li>Reduced glass and bottle litter</li> <li>Deposit refund system performance</li> <li>Distance from vendors</li> <li>Human resource</li> </ul>	-Affordability of the system -costs verses benefits evaluation -competence	-Questionnaire -Records -Observation Interviews	Ordinal	Frequencies, means and percentages
To determine challenges faced in the implementation of the deposit refund system in the management of glass bottle waste.	Dependent variable: Improvement of Waste Management	<ul> <li>Response of the vendors</li> <li>Regulatory policy</li> <li>Transportation costs</li> </ul>	- Vendors- Whether supportive or otherwise	Questionnaire Records Interviews	Ordinal Nominal Intervals	Frequencies, means and percentages Chi square

	<ul> <li><u>Moderating variables:</u></li> <li>Support/Resistance from the business community</li> <li>Government policy</li> <li>High Social Costs</li> </ul>		<ul> <li>Pro DRS Governmen t policy</li> <li>DRS related costs</li> </ul>			
To find out the strategies that can be adopted by Nakuru Municipality in enhancing the success of the deposit refund system.	Dependent variable: Improvement of Waste Management Moderating variables:	<ul> <li>Structures put in place</li> <li>communication mechanisms</li> </ul>	<ul> <li>Application</li> <li>Impact</li> </ul>	Questionnaires Interviews	Nominal Ordinal	Frequencies, means and percentages Chi square
	<ul> <li>Support/Resistance from the business community</li> <li>Government policy</li> <li>High Social Costs</li> </ul>	<ul> <li>access to collection points</li> <li>infrastructure</li> </ul>				

#### **CHAPTER FOUR**

## DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS 4.0 Introduction

This chapter presents findings of the study. The study sought to examine the cost effectiveness of the deposit refund system in the management of glass bottle waste in Nakuru Municipality; to examine the system of returns and the deposit refund system in the management of glass bottle waste as applied; to determine challenges faced in the implementation of the deposit refund system in the management of glass bottle waste; and to find out the strategies adopted by Nakuru Municipality in enhancing the success of the deposit refund system. Data was therefore, collected from members of the business community and Municipal of Nakuru employees from the Environment Department. Data instruments were developed and distributed targeting 96 members from the business community and 44 employees of the Municipal of Nakuru's Environment Department. The data was analysed and the results are presented and discussed in the sections below.

### 4.1 Response Return rate

The response rate is given in Table 4.1 below.

Table 4. 1. Response Re	turn rate		
Category of respondents	Target No. of	No. of questionnaires	Response
	questionnaires	returned	rate
Business Community	96	91	90%
Nakuru Municipality	44	36	82%
employees.			

#### Table 4. 1: Response Return rate

The study was able to get a response from 91 respondents out of the 96 questionnaires distributed to the business community; a response rate of 95%. The study was also able to get a response from 36 respondents out of 44 questionnaires distributed to the Nakuru Municipality employees; that is a response rate of 82% from the questionnaires distributed to as shown in the table. Non response was attributed to reasons such as misplacement of questionnaires by the respondents and lack of time.

#### 4.2 Presentation of findings

This section contains the presentation of findings arising from data analysis.

### 4.2.1 Demographic Characteristics of the respondents

This section presents the findings related to the Demographic Characteristics of the respondents.

#### 4.2.2.1: Gender of the respondents

Gender of the respondents is given in Table 4.2.

Table 4	<b>. 2:</b> Gender of the r	espondent		
	<b>Business community</b>	MCN employees	Total Frequency	Percentage
Male	42	24	66	52%
Female	49	12	61	48%
Total	91	36	127	100%

The gender of the respondents is given in Table 4.2 above. The study used a sample made up of 54% Female and 46% Male from the business Community and the Nakuru Municipality employees. This implied that most people involved in the implementation of the Deposit Refund System on glass bottle were male. This is not a fair representation given that the ratio of women to men in Kenya is 2:1. Basically it could be because more men are involved in businesses dealing with glass bottle. Therefore, there is need for planners to involve more women in the implementation of the Deposit Refund System on glass bottle.

#### 4.2.2.2: Age of the respondent

The age of the respondents is given in Table 4.3 below.

Table 4. J. Age	of the respondent			
	Business Community	MCN staff	Frequency	Percentage
18 - 27 years	43	7	50	39%
28 - 37 years	32	7	39	31%
38 - 47 years	16	-	16	13%
Above 47 years	-	22	22	17%
Total	91	36	127	100%

#### Table 4. 3: Age of the respondent

The findings reveal that 39% of the respondents interviewed were in the age bracket of 18 - 27 years, 31% between 28 - 37 years, whereas 17% were aged above 47 years, while 13% were in the age bracket of 38 - 47 years. This implied that the deposit refund system on glass bottle involved mostly persons in the age bracket between 19 to 37 years. This is a youthful and energetic business people with the physical capacity to support the Deposit refund system. However, it is established that majority of the MCN Environment Department employees were aged above 47 years and this posed a challenge on whether they had the capacity to monitor the implementation of the DRS effectively.

#### 4.2.2.3: Highest academic qualification

The Highest academic qualification of the respondents is as shown in the Table 4.4 below.

Education level	<b>Business Community</b>	MCN staff	Frequency	Percentage
Primary Level	38	11	49	39%
Secondary school level	37	16	53	42%
College level	13	9	22	17%
University level	3		3	2%
Total	91	36	127	100%

 Table 4. 4:
 Highest academic qualification

The results were primary level (39%); secondary school level (42%); college level (17%), while 2% had attained university level. The level of education was sufficient for the respondents to understand the value of the deposit refund system on glass bottles. Most of the respondents (61%) had attained an education level of secondary school or above. Hence this aspect contributed to the success of the DRS on the bottles.

#### 4.2.2.4: Work / Business Experience in Nakuru town

The work / business experience of the all persons interviewed are as shown in Table 4.5.

Work experience	Business	MCN	Frequency	Percentage	
	<b>Community</b>	staff			
Below I year	5		5	4%	
Between 1 years to 2	8		8	6%	
years					
2 years to 3 years	21	1	22	17%	
Above 3 years	57	35	92	72%	
Total	91		127	100%	

<b>Table 4. 5:</b>	Work /	Business	Exper	ience in	Nakuru tow	n
Work experie	nce	Rusi	ness	MCN	Frequency	Perce

The respondents' response was as follows: Majority (57) indicated that they had operated a business in the current location for a period above 3 years, 21 indicated between 2 years to 3 years, 8 between 1 year and 2 years, while 5 indicated a period below 1 year. Most MCN employees (35) had worked at the Department for a period above 3 years and 1 for a period between 2 years to 3 years. The implication here is that all the respondents interviewed had a working / business experience long enough for them to have witnessed or familiarized themselves with the Deposit Refund System on glass bottles.

4.2.2 The situation of the deposit refund system on glass bottles in Nakuru **Municipality** 

This section contains general facts revealed in relation to the practice of the DRS Nakuru Municipality.

#### 4.2.2.1: Usage levels of the deposit refund system on glass bottles in Nakuru **Municipality**

The usage levels of the deposit refund system on glass bottles in Nakuru Municipality is given in Table 4.6 below.

10010 11 01 0000	Se le	i the deposit	r rerunu system	Ull glass	botties in	Takuru
Municipality						_

		Frequency	Percent
Valid	Low	1	1.1
	Moderate	1	1.1
	High	85	93.4
	Very High	4	4.4
	Total	91	100.0

The study findings reveal that majority of the respondents (94%) described the usage of the deposit refund system on glass bottles in Nakuru Municipality as high, 45 described the usage as very high, 1% indicated moderate, while 1% described the levels as high. This implied that the impact of the DRS on bottles had been felt at the community level and was thus registering desired success in the management of the empty glass bottles.

The extent of application of the deposit-refund system on glass bottle, according to the MCN employees in Nakuru town is given in the Table 4.7 below.

22.2
5.6
72.2
100.0

Table 4. 7: Extent of application of the deposit-refund system in Nakur	u t	town
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The results were as follows: Large extent (26 respondents), Small extent (8), while Moderate extent (2). The MCN employees shared the same view with the business community that DRS was in use to a large extent in Nakuru Municipality.

# 4.2.2.2: Usage of Deposit-refund systems for certain final outputs such as beverage cans and bottles.

The response to the usage of Deposit-refund systems for certain final outputs (such as beverage cans and bottles) is given in Table 4.8 below.

 Table 4. 8: Usage of Deposit-refund system is for certain final outputs such as beverage cans and bottles.

	Observed N	Expected N	Residual
Neutral	1	18.0	-17.0
Agree	35	18.0	17.0
Total	36		

Almost all the respondents (35) agreed that deposit-refund systems are used for certain final outputs such as beverage cans and bottles, while 1 was neutral. As indicated in the section below the DRS was mainly used on soda bottles and beer bottles.

# 4.2.3.6: Usage levels of the Deposit refund system as a waste management instrument in handling of glass bottles in Nakuru Municipality

The usage levels of the Deposit refund system as a waste management instrument in handling of glass bottles in Nakuru Municipality, is give in Table 4.9 below

	Frequency	Percentage
Slightly effective	10	-27.8
Neutral	1	2.8
Effective	22	61.1
Very effective	3	8.3
Total	36	100.0

Table 4. 9:	Usage levels of the Deposit refund system as a waste management
instrument in	handling of glass bottles in Nakuru Municipality

. The results were as follows: Effective (22), slightly effective (10), very effective (3) and Neutral (1). The MCN employees indicated that this instrument on glass bottle had **Proved** effective, hence there was need to promote or support it in the area.

#### 4.2.3 Cost-effectiveness of the Deposit Refund System on glass bottles

All the respondents interviewed indicated that Deposit refund system was used on mostly used on soda bottles and beer bottles. Considering the high volumes of usage, large volumes of empty bottles are involved. All the respondents interviewed also agreed that the deposit refund rates applied ranged from Ksh. 10 for soft drinks bottle and Ksh 25 for beer bottles. These deposits are refunded upon the return of bottles. This cost is affordable on the part of the part of the soda and beer consumers.

The response to the statement that Deposit Refund systems on glass bottles are more cost-effective and thus easy to administer is given in Tables 4.10 and 4.11.

 Table 4. 10: Cost-effectiveness of the Deposit systems (members of the business community)

	<b>Observed</b> N	Expected N	Residual	
Disagree	28	30.3	-2.3	
Neutral	17	30.3	-13.3	
Agree	46	30.3	15.7	
Total	91			

Table 4. 11: Cost-effectiveness of the Deposit systems (MCN employe
---

	Observed N	Expected N	Residual
Neutral	3	18.0	-15.0
Agree	33	18.0	15.0
Total	36		

Most of the members of the business community (46 out 91 members shown in Table 4.10) and most of the MCN employees (33 out 36 employees shown in Table 4.11) indicated that Deposit Refund systems on glass bottles are more cost-effective and thus easy to administer. This implied that from the perspective of the business community the system was cost-effective on glass bottles.

#### 4.2.3.1: Expensiveness of the process of the deposit refund system on glass bottles

The expensiveness of the process of the deposit refund system on glass bottles is given in figure 4.12 below.

	Observed N	Expected N	Residual
Disagree	72	30.3	41.7
Neutral	8	30.3	-22.3
Agree	11	30.3	-19.3
Total	91		

Table 4. 12: Expensiveness of the process of the deposit refund system is

Most of the respondents (72) disagreed with the fact that the process of the deposit refund system is expensive, 11 agreed, while 8 were neutral. In other words, most of the business community members interviewed indicated that the DRS on glass bottles was not expensive. This implied that the business communities were comfortable with the current arrangement for the Deposit refund system on glass bottles.

#### 4.2.3.2: Efficiency of the deposit refund system in handling of glass bottles

The efficiency of the deposit refund system in handling of glass bottles is given in Table 4.13 below

	Observed N	Expected N	Residual
Neutral	11	45.5	-34.5
Agree	80	45.5	34.5
Total	91		

 Table 4. 13:
 Efficiency of the deposit refund system in handling of glass bottles

The response to the statement that, the deposit refund system is an efficient method of ensuring effective handling of glass bottles is given in Table 4.13 above. Majority of the respondents (80) agreed that the deposit refund system is an efficient method of ensuring effective handling of glass bottles, while 11 remained neutral. This implied that the benefits realized from the system justified the cost attached to it.

#### 4.2.3.3: Deposit refund controls illegal disposal of the items that carry the refund

The response to the statement that, Deposit refund system controls illegal disposal of the items that carry the refund is given in Table 4.14 below.

	Observed N	Expected N	Residual
Neutral	6	12.0	-6.0
Agree	24	12.0	12.0
Strongly Agree	6	12.0	-6.0
Total	36		

1

 Table 4. 14:
 Deposit refund controls illegal disposal of the items that carry the refund

Most MCN employees (24) agreed that Deposit refund system controls illegal disposal of the items that carry the refund, 6 strongly agreed, while 6 were neutral. The implication here is that the system is an effective system in glass bottle waste management, therefore, justifying the cost associated with the system.

## 4.2.4 The system of returns and the deposit refund system in the management of glass bottle

The system of returns and the deposit refund system in the management of glass bottle are explained below. The response as to the stage of paying the deposit refunds to the vendors is given in Table 4.15

Ubserved N	Expected N	Residual
2	12.0	-10.0
33	12.0	21.0
1	12.0	-11.0
36		
	2 33 1 36	2         12.0           33         12.0           1         12.0           36         36

Table 4. 15:	The refund is	paid when we	return the item	that carries	the refund

Most respondents (33) agreed that the refund is paid when we return the item that carries the refund, 2 were neutral, 1 strongly agreed. The system of returns prompts the vendors to return the bottles so as to avoid loss of the deposits paid to the distributors.

The response to the statement that the refund is paid when we return the item that carries the refund is given in Table 4.16 below.

 Table 4. 16:
 When the deposit refund is paid

	Observed N	Expected N	Residual
Neutral	19	45.5	-26.5
Agree	72	45.5	26.5
Total	91		

The findings show that the deposit refund is paid when vendors return the item that carries the refund. All the respondents interviewed indicated that the deposit refund is payable upon the return of the bottle by the vendor. The implication here is that the system has an inbuilt internal control system, in that failure to return bottles means losing the deposit.

## 4.2.4.1: Existence of recycling policies in the country for products such as glass and bottles

The response to the statement that there were no recycling policies in the country for products such as glass and bottles is given in Table 4.17.

	Observed N	Expected N	Residual
Neutral	6	45.5	-39.5
Agree	85	45.5	39.5
Total	91		

 Table 4. 17:
 Existence of recycling policies in the country for products such as glass and bottles

Majority of the members of the business community (85) agreed that there were no recycling policies in the country for products such as glass and bottles, while 6 remained neutral. Existence of recycling policies in the country for products such as glass bottles is important for the management of glass bottle waste. These policies provide guidance in the implementation of the deposit refund systems on glass bottles. However, as shown below the MCN employees disagree with this view.

The response from the MCN employees regarding the existence of recycling policies in the country for products such as glass and bottles is given in Table 4.18.

	and bottles			
	Observed N	Expected N	Residual	
Disagree	26	12.0	14.0	
Neutral	6	12.0	-6.0	
Agree	4	12.0	-8.0	
Total	36			

 Table 4. 18:
 Existence of recycling policies in the country for products such as glass and bottles

Majority of the respondents (26) disagreed to the fact that there were no recycling policies in the country for products such as glass and bottles, 6 remained neutral, while 4 agreed. The MCN employees are in a strategic position to monitor and influence the Implementation of the deposit refund system in the management of glass bottle.

#### 4.2.4.2: The deposits are refunded promptly

Table 4. 19: The deposits are refunded promptly				
	Observed N	Expected N	Residual	
Strongly Disagree	2	22.8	-20.8	
Disagree	14	22.8	-8.8	
Neutral	61	22.8	38.3	
Agree	14	22.8	-8.8	
Total	91			

The promptness of refunds is given in Table 4.19.

The response to the statement that deposits are refunded promptly is given in Table 4.19 above. Most of the respondents (61) were neutral when asked whether the deposits are refunded promptly, 14 disagreed, 2 strongly agreed, while 14 agreed. This implied there were problems with refund since most people were neutral. What it simply means that sometimes the refund was prompt upon bottle returns

#### 4.2.4.3: Not all containers are returned by the customers

The response as to whether all the bottles were returned by the customers is given in Table 4.20 below.

Tuble 4. 20. Thot an containers are returned by the customers					
	<b>Observed</b> N	Expected N	Residual		
Neutral	17	30.3	-13.3		
Agree	46	30.3	15.7		
Strongly Agree	28	30.3	-2.3		
Total	91		·		

Table 4. 20:	Not all	containers a	re returned	by	the customers

The response to the statement that, not all containers are returned by the customers is given in Table 4.20 above. Majority of the respondents (46) agreed with the fact that not all containers are returned by the customers, 28 strongly agreed, 17 were neutral. This implied a great weakness in the system and leaves an unanswered question as to what happens to the bottles not returned.

#### 4.2.4.3: The distributors of bottles refuse to refund broken bottles

The response as to the whether the distributors of bottles refuse to refund broken bottles is given in Table 4.21

	Observed N	Expected N	Residual
Neutral	1	45.5	-44.5
Agree	90	45.5	44.5
Total	91		

 Table 4. 21:
 Refusal by the distributors of bottles to refund broken bottles

The response to the statement that, the distributors of bottles refuse to refund broken bottles is given in Table 4.21 above. Majority of the respondents (90) agreed with the fact that the distributors of bottles refuse to refund broken bottles, 1 was neutral. This implied that the strategy was being effectively implemented, since the vendors / customers would be very careful not to carelessly handle the bottles knowing that broken bottles will not be refunded.

# 4.2.5: Challenges faced in the implementation of the deposit refund system in the management of glass bottle waste

The challenges faced in the implementation of the deposit refund system in the management of glass bottle waste are given in Table 4.22

Challenges	Frequency	Percentage out of total respondents (127)
Many broken bottles	84	66%
Theft of stored bottles from the vendor's shops	45	35%
low empty bottles return rates	98	77%
poor access to the suppliers of replacement bottles	75	59%
The cost of creating a structure to monitor and enforce	30	24%
drink remains in empty bottles attract pests	50	39%
business money is lost in collecting deposits and paying refunds	56	44%
time is required for receiving bottles and sorting bottles	70	55%
more time for recordkeeping	80	63%
transport costs and less storage space for empty bottles	69	54%

#### Table 4. 22: Challenges faced in the implementation of the deposit refund system

The challenges faced in the implementation of the deposit refund system in the management of glass bottle waste were as follows: low empty bottles return rates (77%); Many broken bottles (66%); more time for recordkeeping (63%); poor access to the suppliers of replacement bottles (59%); transport costs and less storage space for empty bottles (54%); time is required for receiving bottles and sorting bottles (55%); business money is lost in collecting deposits and paying refunds (44%); drink remains in empty bottles attract pests (39%); The cost of creating a structure to monitor and enforce (24%) and Theft of stored bottles from the vendor's shops (35%). The percentages were computed on the basis of the total number of respondents (MCN and Business Community [127]). These challenges are critical in the implementation of the DRS and therefore, there was need for urgent intervention by all stakeholders involved (The Government, MCN authority, the business community and vendors).

#### 4.2.5.1: There is a problem of access to the suppliers of replacement bottles

The response to the statement that, there is a problem of access to the suppliers of replacement bottles is given in Table 4.23 below.

	Observed N	Expected N	Residual
Neutral	5	30.3	-25.3
Agree	64	30.3	33.7
Strongly Agree	22	30.3	-8.3
Total	91		

Table 4. 23: There is a problem of access to the suppliers of replacement bottles

Majority of the respondents (64) agreed that there is a problem of access to the suppliers of replacement bottles, 22 strongly agreed, while 5 remained neutral. This implied that the system was effective in that if access to bottles was easy, then the vendors / customers will be careless in handling the bottles knowing replacement was easy. However, from the vendors' perspective this was a challenge to them since if affected their business sales turnover.

## 4.2.6 Suggestions for enhancement of the effectiveness of the deposit refund system on glass bottle waste

Suggestions for enhancement of the effectiveness of the deposit refund system on glass bottle waste are given in Table 4.24.

Suggestions	Frequency	Percentage out of total respondents (36)
Penalties such as fines to be imposed on broken bottles	25	69%
The customers to be educated on the value of the deposit refund system on bottles	30	83%
Increase the deposit refund rates for bottles to increase the return rate	24	67%
Punitive measures to be put in place to ensure that the bottles are returned within a specified period	23	64%

## Table 4. 24:Suggestions for enhancement of the effectiveness of the deposit refundsystem on glass bottle waste

Suggestions for enhancement of the effectiveness of the deposit refund system on glass bottle waste were: The customers to be educated on the value of the deposit refund system on bottles (83%); Penalties such as fines to be imposed on broken bottles (69%); Increase the deposit refund rates for bottles to increase the return rate (67%); Punitive measures to be put in place to ensure that the bottles are returned within a specified period (64%)

#### 4.3 Interpretation of the findings

#### 4.3.1 General findings

The study used a sample made up of 54% Females and 46% Males. The findings reveal that 47.3% of the respondents interviewed were in the age bracket of 18 - 27 years and 35.2% between 28 - 37 years. It is also established that those interviewed the respondents used for the study had attained highest academic qualification as follows: primary level (38); secondary school level (37) and college level (13). It also established that majority had operated a business in the current location for a period above 3 years, an experience long enough to comprehend the pattern in the management of glass bottle thus boosting the reliability of the study.

The study also used a sample of 67% males and 33% females drawn from employees of the Municipal Council of Nakuru, Environment Department, majority of whom (61%) were aged above 47 years. The findings also reveal that most of them had secondary school level (16) and Primary Level (11) as the highest academic qualification. Majority of the respondents (97%) indicated that they had been working in Nakuru Municipality for a period above 3 years.

The findings show that the number of female interviewed from the business community were more than males and this was due to the fact that most small business that deal with bottled drinks in Nakuru (sodas and beer) are dominated by female. However this was not the case with MCN employees where most of those interviewed were male, most probably due to the gender composition in the workforce at Nakuru Municipality's Environment Department. Majority of the respondents interviewed were of mature age and had attained reasonable educational levels; hence had the capacity to understand the concept and practice of the Deposit refund system in the Municipality.

It is clear from the study that majority of the members of the business community described the Deposit refund system in the management of glass bottle waste in Nakuru Municipality as high. This corresponds with the same description given by the Nakuru Municipality employees. The Deposit refund system is applied on bottles and beer bottles as described by both categories of the respondents. The charge used on the bottles is Ksh. 10 for soda and Ksh 25 for beer bottles.

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#### 4.3.2 Cost-effectiveness of the Deposit Refund System on glass bottles

It shown by both the MCN employees and the business community that deposit refund system in the management of glass bottle waste has been successful in the management of glass bottle waste. Deposit refund system is effective in controlling illegal disposal of the items that carry the refund. It is a cost-effective system and affordable by those involved in it.

Most of the respondents indicated that the DRS itself was a cost effective system, however, they cited challenges related to associated administration costs such as transportation and storage, which they argued that could contribute to the business loss. These cost related challenges were mentioned by most of the respondents hence need to be addressed to enhance the implementation of the DRS on glass bottles for a managed environment. However, weighing the gains against the losses, this system could be considered cost effective.

## 4.3.3: The system of returns and the deposit refund system in the management of glass bottle

The system of returns prompts the vendors to return the bottles so as to avoid loss of the deposits paid to the distributors, since refunds are only upon glass bottle returns. The DRS, therefore, has an inbuilt internal control system, in that failure to return bottles means losing the deposit.

Existence of recycling policies in the country for products such as glass bottles is important for the management of glass bottle waste. These policies provide guidance in the implementation of the deposit refund systems on glass bottles. The business community believed that there were such policies, while the MCN employees did not think so. This disparity called for investigation to determine the real situation.

The deposit is therefore only refunded upon the returning of the bottle against which the deposit is held. However, the respondents indicated that this refund is not refunded promptly always. What it simply means that sometimes the refund was prompt upon bottle returns. The system also ensured that there were no refunds for broken bottles. The strategy was, therefore, being effectively implemented, since the vendors / customers would be very careful not to carelessly handle the bottles knowing that broken bottles will not be refunded.

# 4.3.4: Challenges faced in the implementation of the deposit refund system in the management of glass bottle waste

However, it is important to note that, in some cases the deposits are not refunded promptly to the vendors and this causes some costs and administrative hiccups to the vendors. Challenges emerging from the study from the members of business community's perspective were: low empty bottles return rates which could imply many bottle breakages; time is required for receiving bottles and sorting bottles; less storage space for empty bottles; drink remains in empty bottles attract pests; at times business money is lost in collecting deposits and paying refunds; more time for recordkeeping; and they are cases where the businesses have collect deposits themselves and this attracts transport costs. Most of the members of the business community agreed that there was a problem of access to the suppliers of replacement bottles. These challenges need to be addressed with urgency by the relevant authority to ensure the effectiveness of glass bottles.
# 4.3.5 Suggestions for enhancement of the effectiveness of the deposit refund system on glass bottle waste

The members of the business community suggested that: penalties to be imposed on broken bottles (the respondents felt this measure would promote carefulness and responsible behaviour); punitive measures to be put in place to ensure that the bottles are returned within a specified period (this measure would promote timely returns of bottles and reduce storage costs associated with held up soda and beer crates); increase the deposit refund rates for bottles to increase the return rate (this measure will heighten responsible behaviour); the customers to be educated on the value of the deposit refund system on bottles (this will increased required cooperation and support to the DRS system on glass bottles).

### 4.4 Discussion of findings

This section presents the discussion of the research findings presented above.

#### 4.4.1 Cost-effectiveness of the Deposit Refund System on glass bottles

Majority of the respondents said that deposit refund is paid when vendors return the item that carries the refund; in this case the glass bottles. Most of the employees indicated that the deposit-refund system is used in MCN to a large extent. All the respondents indicated that the deposit rate applied to bottles ranged from Ksh. 10 for soft drinks bottle and Ksh 25 for beer bottles. Ikiara, Karanja, and Davies, (2004) also show in their study that deposit rates applied in the DRS are Kshs.10 and 25 for soft drink and beer bottles, respectively. The cost associated was fair as shown by the respondents.

The respondents described the DRS on glass bottles as being cost effective, despite the hiccups realized in the implementation and therefore appreciated its usage. Most of the members (79 out of 91) disagreed with the fact that the process of the deposit refund system is expensive. DRS was applied on glass bottles carrying frequently consumed products (soda and beer), hence the usage is high. Considering the fact that it was cost effective and it was successfully contributing greatly to the management of glass bottle waste, the system needed to be strengthened.

## 4.4.2 The system of returns and the deposit refund system in the management of glass bottle

Majority (83%) of the members of the business community; 77 out of 91 indicated that Deposit refund controlled the illegal disposal of glass bottles. However, Majority of the members of the MCN employees felt that there were no recycling policies in the country for products such as glass and bottles. Existence of recycling policies in the country for products such as glass bottles is important for the management of glass bottle waste. These policies provide guidance in the implementation of the deposit refund systems on glass bottles.

Delayed deposit refunds emerged as a weakness of the DRS; as most respondents had indicated that the deposits were not refunded promptly to the vendors. Delays in the system could make the system costly and time consuming; hence, there was need for this aspect to be addressed.

Almost all the members of the business community agreed that the distributors of bottles refused to refund broken bottles. This was strong indicator in the system; a reflection of an internal control mechanism in the system, since it also ensured carefulness in the handling of the glass bottles by all parties concerned.

The MCN employees, however, indicated that the usage of the Deposit refund system was an effective waste management instrument in handling of glass bottles. This presented an opportunity to the architects of the DRS to consider reviewing it for improving noting the issues presented by the respondents and also considering its worthiness.

# 4.4.3 Challenges experienced with the implementation of the deposit refund system for glass bottles

Challenges emerging from the study from the members of business community's perspective were: low empty bottles return rates; time is required for receiving bottles and sorting bottles less storage space for empty bottles; drink remains in empty bottles attract pests; at times business money is lost in collecting deposits and paying refunds; more time for recordkeeping; and they are cases where the businesses have collect deposits themselves and this attracts transport costs. Most of the members of the business community agreed that there was a problem of access to the suppliers of replacement bottles. MCN employees disagreed to the fact that there were no recycling policies in the country for products such as glass and bottles.

These issues if not timely addressed could cause confusion in the DR system and interfere with the realization of the intended objectives of the DRS system on glass bottles. There is need for clear cut policies for glass bottles and these policies need to be communicated to all involved stakeholders (shop owners, workers, customers and consumers). The MCN employees in the Environment Department also require sensitization.

# 4.4.4 Suggestions for enhancement of the effectiveness of the deposit refund system on glass bottle waste

The respondents gave their suggestions from their limited perceptions; some of these suggestions are workable while others are not. However, it is important to consider all the suggestions given since they are arising from their experience with the DR system on glass bottles. According to the respondents they feel that these suggestions if implemented could improve the DRS on glass bottles. Hence, they needed to be considered in the review of DRS guidelines by the Government of Kenya.

The suggestion were: penalties to be imposed on broken bottles (the respondents felt this measure would promote carefulness and responsible behaviour); punitive measures to be put in place to ensure that the bottles are returned within a specified period (this measure would promote timely returns of bottles and reduce storage costs associated with held up soda and beer crates); increase the deposit refund rates for bottles to increase the return rate (this measure will heighten responsible behaviour); the customers to be educated on the value of the deposit refund system on bottles (this will increased required cooperation and support to the DRS system on glass bottles).

### CHAPTER FIVE SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Introduction

This chapter contains the Summary of the findings, discussion, Conclusion, Recommendations, and Suggestions for further studies. This chapter summarizes and concludes the research findings as carried out. At the end of the chapter, some useful recommendations are proposed by the researcher to the organization under study in order to solve the problem under study, based on the research findings.

The purpose of the study was to assess the effect of the Deposit-Refund system on waste management within the Municipality of Nakuru.

In accomplishing the study was guided by the following study objectives.

- 1. To examine the cost effectiveness of the deposit refund system in the management of glass bottle waste in Nakuru Municipality.
- 2. To examine the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality.
- 3. To determine challenges faced in the implementation of the deposit refund system in the management of glass bottle waste.
- 4. To find out the strategies adopted by Nakuru Municipality in enhancing the success of the deposit refund system.

### 5.2 Summary of the findings

This section presents a summary of findings presented and discussed in chapter four. The section contains a Table 5.1, which presents the objectives and key findings. The findings revealed high usage of the deposit refund system on glass bottles in Nakuru Municipality. The deposit rates were Ksh 10 for soda bottles and Ksh 25 for beer bottles. Majority of the respondents described the system by as cost effective and affordable by those involved in it. The deposit refund system successful in the management of glass bottle waste.

The system of returns and the deposit refund system in the management of glass bottle emphasizes on the refunds upon return of bottles. The system does not permit refunds to broken bottles. The study also points out from the MCN employees that there were no recycling policies for bottles in the country; hence, contribution of the DRS on glass bottle is very important.

The study sought to establish the challenges experienced in the implementation of the deposit refund system and found out the following challenges: Low empty bottles return rates; time is required for receiving bottles and sorting bottles less storage space for empty bottles; drink remains in empty bottles attract pests; at times business money is lost in collecting deposits and paying refunds; more time for recordkeeping; and they are cases where the businesses have collect deposits themselves and this attracts transport costs. Most of the members of the business community agreed that there was a problem of access to the suppliers of replacement bottles. MCN employees disagreed to the fact that there were no recycling policies in the country for products such as glass and bottles.

The study was able to establish from the respondents, the following suggestions for the enhancement of the deposit refund system on glass bottles: penalties to be imposed on broken bottles (the respondents felt this measure would promote carefulness and responsible behaviour); punitive measures to be put in place to ensure that the bottles are returned within a specified period (this measure would promote timely returns of bottles and reduce storage costs associated with held up soda and beer crates); increase the deposit refund rates for bottles to increase the return rate (this measure will heighten responsible behaviour); the customers to be educated on the value of the deposit refund system on bottles (this will increased required cooperation and support to the DRS system on glass bottles). The summary of major findings is shown in Table 5.1 below.

	Objectives	Type of analysis	Major findings
1	To examine the cost effectiveness of the deposit refund system in the management of glass bottle waste in Nakuru Municipality.	Computation of: means, Percentages Chi-square tests	<ul> <li>High usage of the deposit refund system on glass bottles in Nakuru Municipality</li> <li>Deposit systems are more cost-effective</li> <li>The deposit refund system is not expensive</li> </ul>
2	To examine the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality.	<ul><li>Computation of:</li><li>means,</li><li>Chi-square tests</li></ul>	DRS controls illegal disposal of the items which carry the refund The deposits are not refunded promptly to the vendors
3	To determine the challenges faced in the implementation of the deposit refund system in the management of glass bottle waste.	Computation of: • means, • Percentages • Chi-square tests	<ul> <li>Low empty bottles return rates</li> <li>Access to the supplie replacement bottles.</li> <li>Drink remains in empty bottles attract pests</li> <li>Business money is lost in collecting deposits and paying refunds</li> <li>Receiving and sorting bottles is time consuming</li> <li>More time for recordkeeping</li> <li>High logistic transport costs</li> <li>Less storage space for empty bottles</li> </ul>
4	To find out the strategies adopted by Nakuru Municipality in enhancing the success of the deposit refund system.	<ul> <li>Computation of:</li> <li>Frequencies means,</li> <li>Percentages</li> <li>Chi-square tests</li> </ul>	<ul> <li>Implement a strategy for Penalties on broken bottles</li> <li>Punitive measures for DRS non compliance</li> <li>Increase the deposit refund rates for bottles to increase the return rate</li> <li>Customer's level of awareness is low.</li> </ul>

Table 5. 1Summary of the findings

### 5.4 Conclusions of the study

This study examined the cost effectiveness of the deposit refund system in the management of glass bottle waste and the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality. The study also determined the challenges faced in the implementation of the deposit refund system in the management of glass bottle waste and found out the strategies adopted by Nakuru Municipality in enhancing the success of the deposit refund system.

The study objectives were successfully addressed using the methodology described in chapter three and the study concludes as follows:

- 1. Deposit refund system in the management of glass bottle waste in Nakuru Municipality was cost effective and thus reliable in the management of glass bottle waste.
- 2. The system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality was good, however, registered delays in respect to refunds were affecting the members of the business community; therefore needed to be addressed.
- 3. The implementation of the deposit refund system faced various challenges, which included time wastage, record-keeping challenges, loss of business money in the course of DRS implementation, high transport costs and storage costs.
- 4. The strategy used by Nakuru Municipality in enhancing the success of the deposit refund system was that of ensuring that there was timely return of bottles and that idle bottles dumped were collected and returned to the suppliers.

### 5.5 Recommendations

The following recommendations were made from the study:

- 1. The Government of Kenya through the Ministry of Environment should spearhead the review of recycling policies in the country for products such as glass and bottles for the efficiency of the glass bottle waste.
- 2. The study also recommends that members of the public should be educated / sensitized on the value or benefits associated with the deposit refund system.
- 3. The Municipal Council of Nakuru needs to put structures in place to enhance the performance of the deposit refund system within the Municipality.
- 4. The Municipal Council of Nakuru to consider the use of Penalties for broken bottles so as to control carelessness in the handling of bottles.

### 5.6 Suggestions for further research

The following suggestions for further research were made:

- 1. A study to examine the recycling policies in the country for products such as glass and bottles for the efficiency of the glass bottle waste should be undertaken in other municipalities.
- 2. Another study to examine the factors, which influence the implementation of the Deposit Refund Systems in Kenya, should be undertaken.
- 3. To examine the relationship between awareness levels of the Deposit Refund System and its contribution to glass bottle waste management should be done.

## 5.7 Contribution to knowledge

This section presents the study's contribution to the existing body of knowledge.

No.	Objectives	Contribution to knowledge
1	To examine the cost effectiveness of the deposit refund system in the management of glass bottle waste in Nakuru Municipality.	Deposit refund system in the management of glass bottle waste in Nakuru Municipality is cost effective
2	To examine the system of returns and the deposit refund system in the management of glass bottle waste as applied within Nakuru Municipality.	Delays of the deposit refund system can impede the effectiveness of the system.
3	To determine challenges faced in the implementation of the deposit refund system in the management of glass bottle waste.	Deposit refund system on bottles attracts administrative costs to vendors, which pose implementation challenges.
4	To find out the strategies adopted by Nakuru Municipality in enhancing the success of the deposit refund system.	Nakuru Municipality has not done enough in enhancing the success of the deposit refund system.

## Table 5. 2 Contribution to knowledge

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### Internet sites

1

UNEP - The Green Economy Initiative http://www.unep.org/greeneconomy

World Bank - Urban Solid Waste Management http://www.worldbank.org/solidwaste

#### **APPENDICES**

#### Appendix 1: Letter to the Municipal of Nakuru management

No.....

Lydia Muchiri P.O BOX 66-20100 Nakuru

Dear Sir/Madam

I am a Masters of Arts in Project Planning and Management student at the University of Nairobi. In order to fulfil the requirements for the award of the degree, I am conducting a research titled "Influence of deposit refund system on glass bottle waste management in urban areas: The Case of Nakuru Municipality, Kenya"

Your Department has been selected in order to provide the required information because the views of your department's staff are important to this study. I am therefore kindly requesting you to allow me interview some of your staff using the attached questionnaire. Please note that any information given will be treated with utmost confidentiality and will only be used for the purposes of this study.

Thank you

Yours faithfully

Lydia Muchiri

### Appendix 2: Research Questionnaire for the Business community

### Part A: General Information

1.	Please indicate your gender								
	A. Male []								
	B. Female [ ]								
2.	Kindly indicate your age from cl	noic	ces	below					
	A. 18 – 27 years	[	]						
	B. 28 – 37 years	[	]						
	C. 38 – 47 years	[	]						
	D. Above 47 years	[	]						
3.	What is your highest academic q	ual	ific	ation?					
	A. Primary Level	[	]						
	B. Secondary school level	[	]						
	C. College level	[	]						
	D. University level	[	]						
	E. Any other, please speci	fy.	• • • •		• • • • • • • • • • •		٠		
4.	Please indicate how long you ha	ve	carı	ried ou	t busines	ss in Nal	kuru tow	/ <b>n</b> .	
	A. Below 1 year			[	]				
	B. Between 1 year to 2 year	ırs		[	]				
	C. Between 2 years to 3 years	ars		[	]				
	D. Above 3 years			[	]				
5.	How would you describe the u	isag	ge	of the	deposit	refund	system	on glass	bottles in
	Nakuru Municipality?								
	A. Very High	[		]					
	B. High	[		]					
	C. Moderate	[		]					
	D. Low	[		]					
	E. Very Low	[		]					

6. Which products do you pay deposits for the containers and refunded the deposits when you return them? *Please select from the list below by ticking and state below any other that might not be on the lists* 

Soda bottles	[	]
Beer bottles	[	]
Beer & Soda crates	ſ	1

7. The following facts are statements of application and benefits arising from deposit refund systems. *Please indicate whether you are with them or not by using the key provided below.* 

Strongly Agree [5] Agree [4] Neutral [3] Disagree [2] Strongly Disagree [1]

	Fact	Strongly Agree [5]	Agree[4]	Neutral [3]	Disagree [2]	Strongly Disagree [1]
8	The refund is paid when					
	we return the item that					
	carries the refund					
9	Deposit refund controls					
	illegal disposal of the items					
	that carry the refund					
10	Deposit-refund systems are					
	used for certain final					
	outputs such as beverage					
	cans and bottles.					
11	There are no recycling					
	policies in the country for					
	products such as glass and					
	bottles					
12	The deposit ranges from					
	Ksh. 10 for soft drinks					
	bottle and Ksh 25 for beer					
	bottles					
13	Deposit systems are more					
	cost-effective and thus easy					
	to administer.					

14. Using the following scale please indicate whether you agree with following statements in respect to the effectiveness of the Deposit refund systems on glass bottles.

Strongly	agree	[5]
Agree		[4]

Disagree [2]

Strongly Agree [1]

Neutral	[3]

		5	4	3	2	1
15	The deposits are refunded promptly					
16	The process of the deposit refund system is expensive					
17	Not all containers are returned by the customers					
18	The distributors of bottles refuses to refund broken bottles					
19	The deposit refund system is an efficient method of ensuring effective handling of glass bottles					
20	There is a problem of access to the suppliers of replacement bottles					

21. What challenges do you experience with the operation of the deposit refund system on bottles? *Please indicate below*.

i.	 • • •
ii.	 
iii.	 • • •
iv.	 • • •

22. What would you suggest should be done to enhance the effectiveness of the deposit refund system on glass bottle waste?

i.	•••••
ii.	
iii.	
iv.	

×.

## Appendix 3: Research Questionnaire for Municipality of Nakuru employees

Pa	Part A: General Information							
	1.	Please indicate your gender						
		A. Male [ ]						
		B. Female [ ]						
	2.	Kindly indicate your age from choices below						
		A. 18 – 27 years [] C. 38 – 47 years []						
		B. 28 – 37 years [] D. Above 47 years []						
	3.	What is your highest academic qualification?						
		A. Primary Level [] C. College level []						
		B. Secondary school level [ ] D. University level [ ]						
		E. Any other, please specify						
	4.	Please indicate how long you have been working with the MCN Environment						
		Department.						
		A. Below 1 year [ ]						
		B. Between 1 year to 2 years [ ]						
		C. Between 2 years to 3 years [ ]						
		D. Above 3 years [ ]						
	5.	To what extent would you say the deposit-refund system is applied in Nakuru town?						
		A. Very large extent [ ] D. Small extent [ ]						
		B. Large extent [ ] E. Very small extent[ ]						
		C. Moderate extent [ ]						
	6.	How would you describe the usage of the Deposit refund system as a waste						
		management instrument in handling of glass bottles in Nakuru Municipality?						
		A. Very effective [ ] D. Slightly effective [ ]						
		B. Effective [ ] E. Ineffective [ ]						
		C. Neutral [ ]						
	7.	Which products does deposit refund system apply to in Nakuru town? Please select						
		from the list below by ticking and state below any other that might not be on the lists						
		a. Soda bottles [ ]						
		b. Beer bottles [ ]						
		c. Beer & Soda crates [ ]						

8. The following facts are statements of application and benefits arising from deposit refund systems. *Please indicate whether you agree with them or not by using the key provided below.* 

Strongly Agree [5] Agree [4] Neutral [3] Disagree [2] Strongly Disagree [1]

	Statements	Strongly	Agree[4]	Neutral	Disagree	Strongly
		Agree [5]		[3]	[2]	Disagree
						[1]
9	The refund is paid when we	-				
	return the item that carries					
	the refund					
10	Deposit refund controls					
	illegal disposal of the items					
	that carry the refund					
11	Deposit-refund systems are					
	used for certain final					
	outputs such as beverage					
	cans and bottles.					
12	There are no recycling					
	policies in the country for				,	
	products such as glass and					
	bottles					
13	The deposit ranges from					
	Ksh. 10 for soft drinks					
	bottle and Ksh 25 for beer					
	bottles					
14	Deposit systems are more					
	cost-effective and thus easy					
	to administer.					

15. What would you say are the compliance levels to the deposit refund system requirements on glass bottles by the businesses within Nakuru Municipality?

Very good	[	]
Good	[	]
Fair	[	]
Bad	[	]
Very bad	ſ	1

**16.** In your opinion, what would you suggest should be done to enhance the deposit refund system in handling glass bottles within Nakuru Municipality?

i.
ii.
iii.
iv.
17. List in increasing order the most common solid wastes in Nakuru Municipality.
i.
ii.

iii.		
iv.		
v.		
vi.		
vii.		
viii.		
18. Give three ways of reducing waste management in Nakuru Municipality		
i.		
ii.		

iii. .....

Appendix: Interview Schedule for Municipality of Nakuru employees (Environment Department)

Gender: .....

Department .....

Age .....

1. Are you familiar with the Deposit Refund system?

.....

2. Are you involved in its implementation?

.....

3. What are some of the challenges that may affect the successful implementation of the Deposit Refund System?

i.	•••••
ii.	•••••
iii.	•••••
iv.	•••••
v.	•••••
4. Wh was	nat environmental challenges could be caused by improper disposal of glass bottle ste?
i.	
ii.	••••••
iii.	•••••
iv.	••••••
v.	••••••

5. What strategies do you think should be put in place to ensure efficiency in the deposit refund system for glass bottles?

i.	
ii.	
IH.	
iv.	
v.	•••••••••••••••••••••••••••••••••••••••

1

### THANK YOU