Sustainable Management of Plastic Bag Waste

The Case of Nairobi, Kenya

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Abstract

This research discusses the adverse environmental impacts of plastic bag waste in Nairobi, Kenya, their root causes and remedial policy and technical packages for the short and long term. The need for such a study is justified as it is desirable to change the unsustainable pattern of consumption and production associated with these materials. Plastic bag waste appears in very high proportion in the municipal sold waste stream in Nairobi and is causing environmental problems such as choking of animals and soils; blockage of waterways and rivers; blight of landscapes and trees; and resource depletion. The research questions addressed are: (1) What is the current status of plastic bag waste pollution in Nairobi? (2) What are the associated undesirable environmental impacts? (3) What are the underlying causes? and (4) What are the applicable solutions for short-to-medium and long term. To answer these questions, different approaches were utilised. The theoretical background of the problem and that of possible remedies was investigated from literature sources. Experiences of other countries on the issue were studied. A detailed contextual assessment was conducted in Nairobi to determine the status of the problem, its root causes, major stakeholders and what has already been done in response to the issue. The results indicate that the problem is a consequence of externalities in production and consumption; ineffective by-laws on littering and illegal dumping; failure of garbage collection and disposal systems; and low public awareness and poor life-cycle considerations. The compiled information and suggestions are expected to be useful to the various endeavours in Africa to deal with the menace of plastic bag waste and related challenges due to unsustainable patterns of consumption and production.

Executive Summary

Plastic bags have a number of advantages over their substitutes. As a result, they have, through the years, replaced traditional and paper bags and secured a firm place in the consumer economy of today including within emerging African urban centres. They have also a number of good environmental qualities. In this regard, some studies have documented reduced generation of solid waste, reduced emissions to water and reduced energy consumption in the production of plastic bags as compared to paper bags.

However, an assessment of their environmental impacts cannot be complete without consideration of their total lifecycle repercussions, especially end-of life impacts. On this criterion, plastic bags perform poorly. In many countries of the world, they have become the major items in the litter stream- urban, rural and the marine environment alike. To the Irish, they have become their new national flag, to the South Africans their new national flower, just to cite some examples.

In Kenya and in the capital Nairobi, plastic bag waste appears in a relatively high percentage in municipal solid waste. It also accounts for a sizable proportion of the litter stream. This has resulted in a number of adverse environmental impacts including choking of animals and soils; blockage of rivers and waterways; and blight of landscapes and trees. Flimsy plastic bags are also associated with *'flying toilets'*, another growing concern in slum neighbourhoods. As a result, concern has been expressed from the public at large, environmentalists (including the country's 2004 Nobel peace laureate) and the government (including the current head of state).

The menace of plastic bag waste in Nairobi can be attributed to a number of root causes. First and foremost are externalities in production and consumption. This is to mean that no one is paying for the adverse impacts that waste plastics are causing on the environment. Costs for proper collection and disposal are not factored in the product costs of the materials. As a result, plastic bags have become overly cheap fuelling present-day use and throw away consumerism. Of special significance are flimsy bags that are cheap enough to be given away 'for free' at supermarkets and kiosks.

Another cause is institutional failure in regard to Nairobi City Council's inability to carry out its garbage collection and disposal duties. So severe was this problem in the city that Community Based Organisations and Residential Associations have emerged to complement failed garbage collection services. To this can be added the city council's by-laws, which have proved to be ineffective to deter littering, illegal dumping and open burning of waste.

An additional factor is low public awareness on the responsible disposal of waste. This has resulted in littering in open areas and contamination of plastic bags (due to co-disposal) affecting their recyclability. Absence of life cycle considerations amongst manufacturers is another factor in this category, especially regarding end-of-life impacts. This could, for example, be explained by the low recycling rates of post-consumer plastic waste by manufacturers.

The fact that today's plastic bags are manufactured from non-renewable and non-biodegradable materials also adds to the overall environmental burden. The associated problems are resource depletion and accumulation of persistent waste respectively.

Attaining sustainable consumption and production in connection to plastic bags implies that these underlying causes have to be addressed. This calls for the formulation and enforcement of 'corrective' policy measures which many countries have attempted with varying results. The cases of Australia, Bangladesh, Eritrea, India, Ireland, Rwanda and Somaliland are discussed in this paper.

The principles of sustainable waste management and practical experiences worldwide indicate that both the pre- and post consumer phases of plastic bags have to be managed for them to be on the sustainability roadmap. The hierarchy of avoid- reduce- reuse- recycle- incinerate-landfill is relevant to the case under review. Operating in line with this hierarchy implies appropriate policy instruments and technical solutions have to be packaged and implemented. As regards policy measures, regulatory, economic and informative instruments have to be formulated and enforced, especially in countries where the post consumer aspect has been grossly neglected.

Selection of the relevant instrument(s) out of these options necessitates the use of policy evaluation criteria. Of the many that can be considered, environmental effectiveness, cost effectiveness, incentives for long-run improvements, enforceability and political acceptability are used in this research due to their significance to the case as discussed in Chapter 2.

A closer look at the experiences of the countries cited above indicates that the policy measures that have often been adopted with some degree of success are a levy (e.g. Ireland and South Africa), a minimum thickness standard (India and South Africa), and voluntary approaches (Australia) and an outright ban (Bangladesh, Eritrea, and Somaliland).

Of these, an outright ban is the most extreme measure rating low when evaluated on the basis of the evaluation criteria. A levy has been successfully used in Ireland and South Africa. It is also the preferred option of environmentalists and government officials in Australia, who express scepticism regarding a code of practice taken on by retailers. A minimum thickness standard has been adopted in South Africa and India. Supported with additional pre- and post consumer measures, it contributed to some success in South Africa. In India, the minimum thickness standard failed to bring about the desired end-results and had to be revised to include additional features. The Australian voluntary code of practice, although it has some credits to its name, fell short of the expectations of environmentalists and government officials who consequently believe that this instrument cannot be used as a sole measure for this problem. In almost all of these countries, public awareness campaigns and by-laws have been used as support tools.

On the technical side, recycling has been the most plausible alternative used in many countries. Examples are South Africa, India and Australia. Although incineration of plastic waste with energy recovery is a common practice in many European countries, this is not the case in many developing countries of Asia and Africa (India and South Africa included). The overriding reasons are inappropriate waste characteristics (high organics and low calorific value), high investment cost, lack of trained manpower, etc.

In trying to come up with appropriate remedial proposals for Nairobi, this research has used results of the contextual evaluation of the city itself, theoretical explanations on the causes of pollution, and the experiences of a number of countries. On this basis, a package of policy and technical instruments is recommended to address the problem. The underlying precondition is the need to address both the pre- and post- consumer aspects with due regard to the policy evaluation criteria cited above.

Due to the reasons mentioned above, an outright ban is disregarded at the outset as it performs poorly on many of the criteria.

In the short-to-medium term, a levy is proposed as the principal instrument to address wasteful consumption. It is proposed to be imposed on all bags with the exception of re-usables. Proposed additional supporting policy measures are a minimum thickness standard (to facilitate re-use) and informative instruments. The accompanying technical solution proposed is recycling which is to be facilitated by a number of instruments, i.e. by-laws on littering (to facilitate return); regulations on minimum recycled percentage of post-consumer plastic waste; tax and duty waivers; preferential electric charges; and public procurement of recycled products. As a second best solution, the deposit and refund system is recommended. However, this is only based on its effectiveness in dealing with other litter streams as observed in some countries and not as such with plastic bags. It has yet to be tested to assess its merits and de-merits.

The long-term solution has to focus on changing the very material from which conventional plastics are made. One desirable shift is towards renewable and biodegradable materials. The options available here include photo-degradables, bio-degradables and compostables. Although there are a number of hurdles surrounding compostable bags, this research proposes them as one technical solution for the long- term. The expectations are that these bags would enable better production of compost manure in Africa which is currently characterised by high contamination by foreign materials, mainly conventional plastics. Compostables could also permit judicious utilisation of resources as opposed to photo- and bio-degradables. For this to become a reality, a number of pre-conditions must be met. Source separation of waste, market creation for compost, identification and development of appropriate technologies for compostable bags are the prominent ones. In addition, it is always desirable to reduce and re-use to minimise profligate consumption. Hence, policy instruments in the form of a levy and minimum thickness standard respectively could also be considered here.

Overall, this research has tried to analyse the adverse environmental impacts of plastic bag waste, the causal chains leading to this outcome and plausible remedies applicable to Nairobi city. Modalities of implementation, however, are not worked out in this thesis as they are out of the scope of the study. The author believes that the information, analysis and suggestions contained in this study, would be useful to endeavours in many other African urban centres in their bid to overcome the menace of plastic bag waste.

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1 Introduction

1.1 Background and Statement of the Problem

Plastic bags[1] have emerged as one of the most successful products worldwide in recent decades. They gained increasing popularity amongst consumers and retailers due to the fact that they are functional, lightweight, strong, cheap and a hygienic way of transporting food and goods (Parliament of New South Wales, 2004, p.3; UNEP, 2004, p. 27). It is estimated that currently between 500 billion and one trillion plastic bags are used globally each year (Food Production Daily, 2004, p.1). Even flimsy plastic bags, which have been identified as the most prevalent post-consumer plastic waste, offer one spectacular advantage in that they are manufactured from as little material as possible without loss of functionality thereby exhibiting some element of efficiency in resource utilisation.

Although they have excelled in functional and some environmental aspects, plastic bags have become one manifestation of present-day linear mode of production and consumption. As much as trillions are consumed, billions end in the litter stream soon after use. As this research will show in the subsequent sections, so great was the concern on environmental impacts of plastic bags that a number of countries felt compelled to take policy measures. Examples are South Africa, India, Ireland and Australia- countries from four continents found at various levels of socio-economic development.

Strong focus has been placed worldwide on the environmental implications of plastic bags as they are: commonly given away for free in large numbers; designed as single-use disposable products; persistent in the environment resulting in adverse ecological- and visual litter impacts; potentially replaceable by other substitutes and methods; and neglected by recycling schemes (Nolan-ITU, 2002, p.3). As regards their persistence, currently used plastic bags are known to take between 20 and 1 000 years to break down in the environment (PNSW, 2004, p.3). Their ecological and visual litter impacts include wasted resources in the form of useful material locked in landfills; aesthetic deterioration of landscapes and waterways; threats to wildlife[2]; and toxic gas emissions through open burning (Zero Waste New Zealand, 2002).

Although not the focus of this thesis, the impact of plastic bags in the marine environment is also a matter of concern worldwide as aquatic life can easily be affected through entanglement, suffocation and ingestion (National Plastic Bags Working Group, 2002, p.9).[3] For instance, The 2003 International Coastal Cleanup (ICC, 2003)[4] surveys for India and South Africa indicated that plastic bags are among the top ten marine debris items, i.e. second in India and third in South Africa.

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[1] Throughout this writing, we use plastic bag and plastic shopping bag to mean the same thing.

[2] An estimated 100 000 mammals and turtles are killed by plastic debris annually (ZWNZ, 2002).

[3] There are studies, which indicate that up to 70% of marine debris is non-degradable plastics (National Plastic Bags Working Group, 2002, p.9). Studies in South Africa indicate that some seabirds that come to South African waters have among the highest levels of plastic ingestion recorded, with almost every Great Shearwater or Blue Petrel containing plastic in its stomach (Marais, Mark, Armitage, Neil & Pithey, Sonja, n.d., p.4).

[4] The author looked into ICC surveys of these two countries only. The one for Kenya was unavailable. Results for other countries can be obtained from the ICC website.

It is common knowledge that per-capita consumption of various products (including plastic bags) is very low in developing countries in comparison to developed nations.[5] As will be discussed later, per capita generation of municipal solid waste is also correspondingly low. This is particularly the case with African countries owing to their relatively low economic development and the associated low standard of living.

Nonetheless, the impact of MSW and that of plastic bag waste in particular has already become a major environmental issue in many African countries, more so in their urban centres. So profound was the concern on plastic waste in African cities that it became one of the priority issues in the First African Experts Meeting on the Ten Year Framework Programme on Sustainable Consumption and Production.[6] With the intent of developing a response to the problem, UNEP consequently facilitated the establishment of a Regional Task Force on Plastics under the auspices of the African Roundtable on Sustainable Consumption and Production (UNEP, 2004, p. 29).

This research is a result of the understanding, by the author, of the implications of the above-mentioned problems and the quest for plausible solutions. At its initiation was the exchange of ideas with scholars from the IIIEE and UNEP.[7] One outcome of these consultations was a small term paper in May 2005 for the ARPEA II[8] course in which the author examined the policy measures adopted by South Africa and India in response to plastic bag waste pollution problems (which in modified form were integrated into this thesis). This work should, therefore, be viewed as a continued effort and a practical exercise on the problem in Nairobi, Kenya.

1.2 Nairobi City: Contextualizing the Problem

Box 1 provides a brief overview of Nairobi city and its major environmental problems.

Box 1 Nairobi City and its Environmental Problems

Nairobi is the capital city of the Republic of Kenya and has an area of 690km^2.[9] As late as the final decades of 1800s, the City was an open plain where wildlife roamed freely and where the Nairobi River emptied into a green swampy area. There were no permanent settlements and one of the peoples of Kenya, the Maasai, from time to time, brought their cattle to the Nairobi River and built their temporary houses.

The city is a major commercial, financial, manufacturing and tourist centre, reportedly the largest city between Cairo (Egypt) and Johannesburg (South Africa). It also hosts a number of international organisations including the United Nations Environmental Programme (UNEP),

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[5] Low per-capita consumption does not necessarily mean judicious utilisation of resources.

[6] The meetings took place in Casablanca (19-20 May 2004) and Nairobi (17-18 February 2005). They were facilitated by UNEP and UN-DESA.

[7] Being raised in Addis Ababa, Ethiopia, the author is aware of the problems caused by plastic bag waste. Useful discussions with Professor Thomas Lindhqvist of the IIIEE and Dr. Desta Mebratu of UNEP's Regional Office for Africa led the author to conduct the research on the issue.

[8] ARPEA: Applied Research in Preventative Environmental Approaches, course at the IIIEE master's programme.

[9] It is divided into seven administrative divisions, namely Makadara, Langata, Kasarani, Dagoretti, Embakassi, Pumwani and Parklands.

one of [the four] headquarters of the United Nations (the first to be established in a developing country), and the United Nations Centre for Human Settlements (UN-Habitat).

The Nairobi National Park, which occupies about one-fifth of the city's land area, is also home to many types of wildlife obtained in Kenya. There are several parks, forests and open areas in Nairobi which render important ecological services and serve as places of recreation to its residents.

However, at the moment, the city has faced several acute problems in the areas of garbage collection and disposal, sewage treatment system, and provision of safe drinking water. Severe amongst these is the status of solid waste collection and disposal. To this end, it is estimated that over 70% of the MSW generated in the city remains uncollected. Change in urban style is regarded as one of the crucial factors causing the deterioration of the MSW system.

Important factors that contributed to these environmental problems, among others, are: uncontrolled population growth[10] mainly due to rural-urban migration; poor planning, which is linked to its historical development; and Nairobi City Council's failure to provide adequate services.

Source: ELCI (2005, 9-13).

Plastic bag waste has already become a serious environmental dilemma in Kenya in general and in Nairobi in particular. Concern has been expressed from many stakeholders including the current president, Mr. Mwai Kibaki, the 2004 Nobel Peace Laureate, Professor Wangari Mathaai, various government organizations, environmental NGOs and the public at large. Industry also acknowledged the problem and was therefore concerned.

In response, many initiatives are sprouting recently. Specific mention can be made to those endeavours from government organisations, industry, supermarkets, community based organisations and international organisations such as UNEP as will also be discussed later.

The initiative from UNEP namely, the Pilot Project on Sustainable Management of Plastic Waste in Nairobi deserves a brief mention here due to its relevance to this thesis. It tries to find solutions to the growing challenge of plastic waste in African urban centres as per the Johannesburg Plan of Implementation and the African Ten Year Framework Programme on Sustainable Consumption and Production. It was officially launched on July 19, 2005 and aims at gathering useful experiences for subsequent replication in other African countries (UNEP Project Proposal, 2005).

Growing as the problem of plastic bag waste in Kenya, it is more serious in the capital city, Nairobi. While a detailed evaluation of the root causes will be made at a latter stage, the following are worth mentioning here as outlined by UNEP's proposal on the pilot project described above: (a) Nairobi alone generates 2 400t of garbage daily of which about 20% is plastics; (b) the consumption of plastic bags is very high [in comparison to other urban centres] where one supermarket chain alone issues an estimated of 8 million plastic shopping bags per month; and (c) The Nairobi City Council (NCC), which is responsible for MSW

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[10] Its population which was only about 350 000 at the time of independence [from British colonial rule] in 1963, rose to about 1.35 million in 1989 and to its current level of about 2 million people.

management, collects a negligible proportion of the waste generated; even then, it is only the affluent neighbourhoods which are serviced while informal neighbourhoods and slums which form the bulk of the settlements are neglected.

In addition, there is uncontrolled dumping of waste in the city. Open burning as a means of garbage removal is also common. The only dumpsite serving the city is already full and is causing adverse impacts on the surrounding environment. Furthermore, simple visual observation of the city testifies the accumulation of plastic bag waste in the environment. The situation is even more pronounced at the dumpsite mentioned above as noted by NCC officials.

1.3 Objectives of the Research

The objective of this research is to identify contextually appropriate policy packages and technical approaches for sustainable management of plastic shopping bag waste in Nairobi, Kenya.

1.4 Research Questions

To address the above objective, this paper tries to answer the following research questions:

a)   What is the current status of plastic bag waste pollution in Nairobi?
b)   What are the associated undesirable environmental impacts?
c)   What are the underlying causes?
d)   What policy packages and technical approaches could be adopted to resolve the problem in the short-to-medium and long term? [11]

1.5 Scope and Limitations

Due to the reasons mentioned in Section 1.3, the scope of this research is limited to Nairobi city. However, literature review and consultation with knowledgeable people on the issue indicated that the problem is not unique to the capital city alone. The author believes that a number of the outcomes of this research could have useful implications to similar endeavours at provincial or national levels. However, countrywide assessments were not made in some aspects and the results, as such, cannot directly be applied universally. [12]

As part of the contextual evaluation, this research made a brief assessment of the legal and institutional infrastructure relevant to the case. However, identification of modalities of implementation of the suggestions is not undertaken as it is outside of the scope of this paper.

An assessment of natural fibres such as sisal bags, which are suggested as alternatives by some studies in the area (UNEP, 2005) is lacking. Understandably, the development of such alternatives including traditional bags could encourage re-use as these bags are inherently re-usable. However, their success as complete substitutes to plastic bags requires further research, more so in the light of the many superior features of the latter and the place they have therefore secured at the moment.

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[11] The desired goal here being a pattern of sustainable production and consumption of the product in question, i.e. plastic bags.

[12] Although the legal frameworks and the institutions assessed in this research have country-wide significance, a number of other aspects are specific to each area, e.g. degree of plastic waste pollution, performance of City Councils, recycling capabilities, etc.

Review of country experiences on the issue was primarily based on literature sources except in the case of India which was supplemented by interviews. This should be considered as a limitation.

When it comes to the selected policy evaluation criteria, there is a limit to the degree to which they can be meaningfully applied. While most call for qualitative assessments, others like cost-effectiveness have to be evaluated on the basis of actual cost-benefit data. In addition to what is theoretically established, evaluations in this research will, to a greater extent, rely on the practical outcomes of the policy interventions of the countries reviewed. This could also be considered as another limitation.

1.6 Methodology

1.6.1 Research Strategy

The case study method is used as a strategy to organise this research. This is because of its usefulness in policy evaluation studies, which is the primary task of this research. Memelmans-Videc et al. (1998, p. 52) underline the fact that policy instrument choice and implementation demands a detailed contextual study of each case.

According to Yin (1994), a case study is "*an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident*". Other types of research strategies, e.g. experiments and surveys have limited possibilities to deal with context (*Ibid.*). Hence, the fact that case studies are suited to situations where context matters is the overriding reason why they have been used in this study.

Yin (1994) divides case studies into three categories, namely exploratory, descriptive and explanatory; which could be either single or multiple-case studies.[13] Exploratory studies are often undertaken as an introduction to social research and aim to guide the development of research questions and hypotheses (Nova South Eastern University, 1997). Explanatory case studies are suitable for the study on causal relationships. Descriptive case studies require that the investigator begin with a descriptive theory, or risk the possibility that problems will occur during the project (*Ibid.*). Since this research strives to establish causal chains in the plastic bag waste menace along with possible solutions, the type of case study could be labelled as explanatory.

The advantages of case studies [over others] have been discussed by a number of authors (Yin 1994; Stake 1995; MacNeal 1997). Some are summarised below (Yin, 1994):

- They may aid the researcher in getting a holistic view of a situation, a view that includes the *context as well as the details*;
- They are rich in detail and may therefore lead to a more complete understanding of some aspect of an event or situation. They, therefore, satisfy the three parts of a qualitative method, i.e. describing, understanding and explaining; and
- They may aid in getting effective information that cannot otherwise be collected.

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[13] Other types of classifications are *intrinsic, instrumental and collective* case studies (Stake 1995).

At a general level, the whole research can be regarded as a case study of the plastic menace problem in Nairobi City. At specific levels, case studies were used to gather information on country experiences on the issue. Such contextual information is helpful in extracting experiences from actual implementation of policies which could be useful when exploring policy options in Nairobi. Accordingly, the experiences of South Africa, India, Ireland, Australia, Eritrea, Bangladesh and Somaliland were covered.[14]

In addition, small case studies were also performed in two instances, i.e. on a plastic waste recycling company and on a Community Based Organisation (which collects, composts & recycles garbage including plastics). The objective was to get firsthand information on collection, recycling and composting of MSW (including plastics) as these activities are of central importance to the problem.

1.6.2 Data Collection

A number of techniques have been used in this research for the purpose of generating data and relevant information. Regarding origin, both primary and secondary sources have been investigated as indicated below.

a) Literature Review

Literature review was undertaken throughout the various phases of the study, i.e. problem description, formulation of contextual framework, assessment of country experiences, etc. Both electronic and printed materials have been used. In particular, different studies, and workshop reports on the issue of MSW management and the problems of plastic bag waste in Nairobi and in Kenya were studied.

b) Interviews

Primary data was obtained through interviews of experts and knowledgeable people in the area. Through background reading of relevant reports and consultations with the experts of the Kenya Cleaner Production Centre (purposive sampling), relevant organisations and other stakeholders were identified along with respondents.

Structured, open-ended interviews were conducted with key informants from the following organisations:

a) National Environmental Management Authority (NEMA);
b) Nairobi City Council (NCC);
c) Kenya Association of Manufacturers (KAM) and the Plastic Sector Group;
d) Kenya National Cleaner Production Centre (KNCPC);
e) Kenya Institute for Public Policy Research and Analysis (KIPPRA);
f) Kenya Bureau of Standards (KEBS);
g) Ministry of Trade and Industry (MoTI);
h) Plastic Industry & Plastic Bag Manufacturers: Prestige Packaging Limited & Packaging Industries Limited;
i) Plastic (Bag) Waste Recyclers: Green Loop International Limited;
j) Intermediate Technology Development Group- East Africa (ITDG-EA);

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[14] These countries were identified as they have implemented some sort of measure on the plastic bag waste problem and some information on the outcomes is relatively accessible. Another reason was the relevance these measures would have to developing countries and the diversity of measures utilised.

k) United Nations Environmental Programme (UNEP); and
l) Community Based Organisations (CBOs): *Kayole* Environmental Management Association.

In addition, discussions were held with 'waste scavengers'[15] under informal settings.

As regards country experiences (and as mentioned in Section 1.5 above), the views of some knowledgeable people were included in the Indian case study to supplement secondary data.

1.6.3 Data Evaluation

The data gathered through the methods outlined above is evaluated using various techniques.

The key analytical tool used is the waste management hierarchy along with the requirements of sustainable MSW management. Due to its adaptability to the case under investigation, the remedial policy and technical solutions (proposed in Chapter 5) are presented as *reconstructed*[16] waste management hierarchies. Selection and packaging of appropriate policy instruments for Nairobi was based on relevant environmental policy evaluation criteria.

The input-output model of public policy evaluation (based on intervention theory) is used as a *heuristic*[17] tool to guide the analysis. Such models were constructed for certain policy instruments applicable to the case as determined from country experiences. They show the inter-relationship between the problem being addressed, the policy interventions adopted, the intermediate outcomes, and the ultimate outcomes.

1.7 Structure of the Thesis

This thesis is structured in the following manner. At the beginning is the introductory chapter which outlines the essence of the problem being addressed and the key research questions. Chapter 2 deals with the evaluation framework where a number of pertinent issues are discussed, i.e. theoretical arguments on the causes of environmental pollution, available corrective policy instruments, and the process of policy formulation and evaluation. Chapter 3 presents a situational analysis of pertinent issues in Nairobi which, among others, include the status of MSW management in the city; plastic bag waste pollution and its root causes; in-place initiatives in response to the problem; the plastic manufacturing sector; and status of the relevant institutional and infrastructural frameworks. Chapter 4 reviews the intervention measures implemented by other countries in response to the same problem. Chapter 5 outlines policy packages and technical approaches that could resolve the problem (in Nairobi) in the short-to-medium and long term. Chapter 6 is where the main conclusions of the research are presented and where possible areas of future research are highlighted.

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[15] Waste scavenger is a terminology frequently encountered in most literature (on MSW in Africa) to refer to group of people who make their living by salvaging valuable materials from waste. The terminology is also commonly used in Kenya in the spoken language. This research recognizes the valuable service these people render to the environment and society at large and hence the term in this thesis is not intended to be derogatory.

[16] This is to mean that the waste management hierarchy is adapted and drawn for the plastic bag waste management issue in consideration of all relevant and specific findings of the study.

[17] Heuristic: interrogative, investigative.

1.8 Relevance of the Study

This research is essentially meant to contribute to the ongoing endeavours in Africa to bring about a pattern of sustainable consumption and production of plastic products and plastic bags in particular.

Aside from the various initiatives already underway in Nairobi, specific regulations are not yet in place to address the problem in Kenya. In respect of the commitment and concern from the government and other stakeholders on the issue, it is anticipated that some sort of intervention measure could come into play some time in the future.

By trying to address the problem in Nairobi on the basis of universally accepted principles and the practical experiences of other countries, this study aims to compile useful information and recommendations that could be useful to such policy measures in Kenya and other African countries.

2 Framework for Evaluation

The aim of this chapter is to develop an appropriate theoretical framework for evaluation with which to analyse data collected in the case under study.

The task of drawing an appropriate evaluation framework is accomplished through a literature review of a number of relevant issues. Three elements are of particular interest here, namely theoretical arguments, practical experiences of other countries and heuristic tools.

First and foremost the issue of pollution[18] and its underlying causes are addressed. Then, the concept of sustainable consumption and production is briefly discussed as one desirable end. As a means of bridging the gap between the current state, where there is unacceptable pollution and that of the desirable scenario of sustainable consumption and production, remedial policy options and technical approaches are explored. To facilitate a selection of measures from available instruments, the subject of environmental policy evaluation criteria is examined.

The subject of sustainability will be adapted to MSW management which is the focus of this research. A model of MSW management infrastructure will be used as a checklist to facilitate the contextual evaluation study in Nairobi.

The theoretical discourse will be supplemented with practical experiences of a number of countries, which have implemented various measures on the problem. This will help in taking the whole exercise from the theoretical realm into the practical world.

Additionally, intervention theory is used as a heuristic tool to map out the sequence of outcomes as a result of adoption of the identified policy instruments.

2.1 Theoretical Background

2.1.1 Why there is Pollution: Market, Institutional and Policy Failures

A number of authors have discussed the underlying causes of environmental damages due to production and consumption (Panayotou, 1994; Field, 1997; Sawyer EnviroEconomic Consulting, 1996).

Panayotou (1994, p.3) argues that the threefold combination of institutional, market[19] and policy failures results in a cascade of undesirable effects in society. He explains that '*institutional failures such as the absence of secure property rights, market failures such as environmental externalities, and policy failures such as distortionary subsidies, drive a wedge between the private and social costs of production and consumption activities.*" Field (1997, p.190) identifies another [fourth] type of failure which he calls government failure[20], i.e. systematic tendencies within legislatures and regulating agencies

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[18] Implied to mean plastic bag waste pollution

[19] Field (1997, p. 190) elaborates that market failure, which he describes as a situation arising due to externalities in which unregulated markets may not lead to efficient and equitable results leads to pollution. This is due to the public good nature of environmental quality, consequently necessitating for public policy to correct the situation (*Ibid.*).

[20] In connection with government failure, Field (p. 190) further elaborates: "…*the policy process is an ongoing political struggle where ambitious politicians attempting to accumulate power, lobbying groups representing particular interests, administrative agencies with their own agendas, and others, all come together in a process of conflict and strife. What comes out of this process may not resemble anything like informed, rational public policy that advances the welfare of society. What comes out of the process could make the situation worse in some circumstances.*"

that work against the attainment of efficient and equitable public policies. The presence of this type of failure implies that it cannot always be assumed that all public environmental policies will make situations better (*Ibid.*).[21]

A simple definition of social, private and external costs and their inter-relationship is as follows (Coastline Community College, 2005):

Social costs are the full resource costs of an economic activity, including externalities.

Private costs are the costs of an economic activity directly borne by the immediate producer or consumer (excluding externalities).

When social costs differ from private costs, external costs exist. External costs are equal to the difference between the social and private costs, i.e. External costs = Social Costs – Private Costs.

According to Panayotou (1994, p.3), a direct result of such failures is that producers and consumers of products and services do not receive the correct signals about the true scarcity of resources they deplete or the cost of environmental damage they cause. This, he argues, leads to over-production and over-consumption of commodities that are resource-depleting and environment-polluting, and underproduction and under-consumption of commodities that are resource-saving and environmentally friendly. The process results in a pattern of economic growth which undermines its own resource base and which is ultimately unsustainable (*Ibid.*).

In view of the overwhelming plastic bag waste pollution that has become characteristic feature of many parts of the world including Kenya, one may anticipate that at the root of the problem is one or a combination of these failures. This research sets out to identify the failure(s) relevant to the Kenyan context along with possible solutions. However, while it fully recognises the implications of government failure, more so in developing countries, it does not attempt to investigate the causes and remedies of this failure for two reasons. First, in the opinion of the author, government failure is not specific to environmental problems only but to a number of other issues and there is as such no easy solution to it. Second, the Kenyan government has not yet officially enforced a policy (regulation) on the plastic bag waste pollution and hence government failure cannot be considered at the moment.

2.1.2 Sustainable Consumption & Production and Sustainable MSW Management

As briefly discussed above, one desirable societal end is a pattern of sustainable consumption and production. While a number of definitions of this concept are available, mention can be made of the ones provided by the International Institute for Sustainable Development (IISD) and UNEP.

One definition[22] provided by the IISD, adopted from WBCSD (n.d.), is presented below owing to its simplicity:

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[21] The online WIKIPEDIA encyclopedia provides the following definition: Government failure is a term describing a situation in which the government intervenes to correct for externalities and ends up making things worse.

[22] Another definition that UNEP has provided in its website is: "The use of services and related products which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life-cycle so as not to jeopardize the needs of future generations." (UN CSD International Work Programme, adopted in 1995).

"Sustainable production and consumption involves business, government, communities and households contributing to environmental quality through the efficient production and use of natural resources, the minimization of wastes, and the optimization of products and services."

As has been discussed in Chapter 1, a number of institutions have raised the need for sustainable consumption and production of plastic bags. Foremost amongst them is the UNEP-ARSCP project on plastics in Africa (Summarised in Appendix 1).

This concept of sustainability can also be applied to MSW management in general and to plastic bag waste in particular (which is but one component of the former). Accordingly, programs that endeavour to bring about lasting solutions [to these problems] should hinge on the basic requirements of waste management. To this end, the two fundamental requirements of waste management are less waste followed by an effective system for managing the waste that still will arises (McDogall, White, Franke & Hindle, 2001, p. 15). Waste reduction normally forms the top of the waste management hierarchy. However, since there will still be some waste generated even with source reduction, an effective system to manage this waste is also needed (McDogall, et al. 20001, p.16). According to Ren (2002, p.28), sound waste management should follow a hierarchy of Four-Rs, i.e. Reduce, Reuse, Recycle, and Recovery of the energy content if not recyclable before final disposal. Pictorially, this desired approach could be represented by the waste management hierarchy as shown in Figure 2-1 below.[23]

Figure 2-1 The waste management hierarchy (the inverted pyramid model)
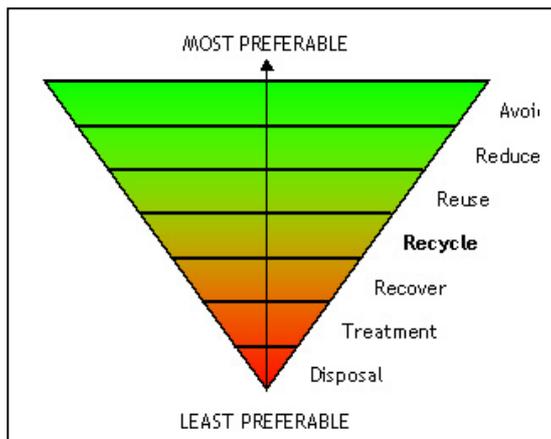
Source: Zero Waste SA (2005)

The International Environmental Technology Centre (1996, p.5) underlines the following points concerning the waste management hierarchy. First, it is a wide spread element of national and regional policy and is often considered a fundamental basis of sound practice. Second, its purpose is to make waste management practices as environmentally sound as possible and it ranks the various operations according to their environmental or energy benefits. Third, its core elements are taken into account in international conventions and

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[23] In the literature, two basic representations o the waste management hierarchy are encountered- which could be referred to as the 'upright' and 'inverted' pyramids. In this writing, the inverted pyramid model is used for the simple reason that it gives a proportional view of the area (volume) that the different approaches should occupy in the pyramid in the order of their preference. In the opinion of the author, the upright pyramid, though it appears mechanically stable, does not impart this important feature.

protocols and also in regional endeavours for the development of coordinated policies on the reuse of various by-products of waste management processes. Fourth, it is a useful policy tool for dealing with landfill shortages and for minimizing water and air pollution. Fifth, some aspects of this hierarchy are already in place in many developing countries due to the fact that existing traditional practices are characterized by prevention, re-use and recycling in that order.

Hence, the policy packages to be proposed for Nairobi in this research will be based on the requirements of sound MSW management and on the waste management hierarchy. This is particularly true in the short-to-medium term. Ultimate solutions however, could only be attained when the rationales of sustainable consumption and production are fully met.

2.1.3 Range of Policy Options and the Rationale of Policy Packaging

A number of authors discuss threefold type of policy instruments (Memelmans-Videc et al., 1998; Field, 1997; Vedung, 1997; Panayotou, 1994).

Memelmans-Videc et al. (1998, p. 9, p.51) describe them as *tripartite/threefold* configuration including regulation (the stick), economic means (the carrot), and information (the sermon). Choice [amongst these options] is a search for the optimal combination of these various alternatives (*Ibid.*). The definitions provided by the other authors are similar and Memelmans-Videc et al. (1998) have adopted theirs from Vedung (1997).

A regulation is "*a measure taken by government authorities so as to influence people by formulating rules and directives which mandate the latter to act according to these orders; the determining feature of regulations is, therefore, that the relationship is authoritative*" (Memelmans-Videc, et al., 1998, p. 10).

Economic policy instruments, on the other hand involve "*the handing out or taking away of material resources while the addressees are not obliged to take the measures stipulated*" (Memelmans-Videc, et al., 1998, p. 11). Panayotou (1994, p.4) provides the following explanation: "*Economic instruments for environmental management such as the removal of distortionary subsidies, secure property rights, pollution taxes, user charges, tradable emission permits, and refundable deposits aim to correct these failures, reinstate full-cost pricing, and bring about a realignment of resource allocation with society's objectives and interests—a necessary condition for sustainable development.*" In connection to this, the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992, acknowledged the importance of internalization of environmental costs in forging sustainable development and the critical role that economic instruments could play in attaining this. [24]

Of special relevance in the economic instruments category is that of environmental taxation for the simple reason that it was the major instrument used in a number of countries which intervened with the menace of plastic bag waste. Patel Tonra (2004, 6-7) makes a good reference to a study on the topic undertaken by the OECD in 2001. The conclusion of the report [as summarized by Patel Tonra] was that economic instruments allow local authorities and governments to "*send direct price signals to consumers and producers of polluting goods.*" It also emphasized that good environmental taxation is possible when the tax impacts on the behaviour to be influenced as directly as possible.[25] Another finding still was the need to put the level of taxation equivalent to the cost of dealing with the pollution caused (*Ibid.*).

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[24] Principle 16 of the Rio Declaration states: 'National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution with due regard to public interest and without distorting international trade and investment (UN 1992).'"

[25] This is to imply that the more direct the taxation/levy, the greater the opportunity for success (Patel Tonra, 2004).

Patel Tonra (2004, p.8) also contends that taxes and charges are increasingly being used in the EU as environmental policy instruments. Product charges, user charges, deposit and refund, resource tax, voluntary approaches, and emission charges are identified as the most important instruments (*Ibid.*).[26]

Of the list above, product charges need to be highlighted here as they are the ones used in practice to manage the problem of plastic bag waste. Concerning this, University College Dublin (2002) explains that there are certain goods for which the costs of measuring, monitoring and charging environmental damages are so high that the second best option of taxing the good itself with its 'embedded' external costs is the alternative. Most notable examples of such taxes are those that are imposed on transport fuels[27] and also on plastic bags. The advantage with such an approach is that one can avoid the problem of measuring and charging for pollutants but still can crudely approximate external costs (*Ibid.*).

Information instruments "*place an emphasis on prevention of wrong or stimulation of the right conduct by offering insights into consequences of behaviour; they are attempts at influencing people through transfer of knowledge, the communication of reasoned argument, and persuasion*" (*Ibid.*).

All three variants, i.e. the communicative (sermons), the economic (carrots) and the juridical control (sticks) have simulative (rewarding) as well as repressive (punishment) modes (p.53). Examples of stimulative modes are information programs, subsidies and covenants in that order, whereas repressive modes include propaganda, levies and directives respectively (Memelmans-Videc, et al., 1998, p. 53).

The tendency of packaging policy instruments is observed in actual practice which is also the case in the intervention measures on the menace of plastic bag waste by different countries. The rationale behind this is discussed by Memelmans-Videc, et al (1998, p.52, 53 & 130), where they argue that governments should combine stimulative and repressive instruments so as to strike a balance between legitimacy as well as effectiveness. They also point out the fact that policy instruments often appear in packages [of which they name two variants], i.e. *vertical packaging* (where one policy instrument is used to strengthen or restrain another one; and *horizontal packaging* in which two or more policy instruments are used for the same purpose.

While these options are available to the policy maker, successful instrument choice and implementation hinge on a detailed contextual study of each case. In support of this argument, Memelmans-Videc, et al. (1998, p. 52) state a number of reasons. First, such an evaluation enables comparisons between what can be learned from other instances and from the present situation. Second, it is the only way through which a particular instrument can be taken out of the theoretical and placed in the practical world. Third, it links policies, problems, targets and implementation into a coherent whole. Fourth, it makes it clear that the selection of the implementing organization to effectuate the initiative is of prime importance to the success of the policy.

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[26] For detailed information on each type of tax/charge and where it has been put to practice, the reader is referred to the study by Patel Tonra (2004).

[27] That is to mean that an excise duty is levied per litre of fuel purchased as a proxy for the external costs they entail when consumed. (Ibid.)

An issue often raised, in connection with developing countries and environmental policies is the case for and against Command-and Control (CAC)[28] and market-based instruments.

Understandably, the category 'developing countries' encompasses various nations which are on different levels of socio-economic development. Concerning this, Field (1997, p. 418) writes: "…*the category 'developing countries' actually includes a wide range of experience. At the one end of the spectrum are countries that are still almost totally agricultural, substantially uniform technologically, and with only the beginning of a modern economic sector. At the other end, of the spectrum are countries that have developed relatively large industrial, financial, and transportation sectors; important economic links to the rest of the world; and, most importantly, comparatively sophisticated political institutions.*" The same challenge is also acknowledged by Panayotou.[29] As this research focuses on Kenya, through out this writing, the term developing countries is intended to imply to the former category in the quoted description.

Field (1997) and Panayotou (1994) have touched upon the challenges of using regulatory and market-based instruments in developing countries.

Writing on this Field (1997, p.417) underscores two issues. First, given their limited resources and their focus on economic development, these countries cannot afford to devote more resources to environmental quality improvements than is necessary. This being an argument ascertaining that policies should be cost-effective, it is clearly in favour of market incentives. The second point is that CAC is the dominant trend in environmental policy issues in most developing countries- partly due to long traditions in this area and partly due to weak policy institutions. Given this background, he emphasises that simple CAC approaches could be beneficial particularly in least developed countries- as is also recommended by the Bruntland Commission.[30]

Panayotou (1994, p.2) gives an interesting account of the use and implications of economic instruments in many developing countries including those in Africa. He ascertains that as economic instruments are well suited for the integration of environmental and economic policy, they can, as a result, be used to advance sustainable development. He, however, admits that despite their many advantages, economic instruments are not widely used and their introduction faces many obstacles in these countries (*Ibid.*).

Even with such hurdles, Panayotou (1994, p.2) makes a very optimistic case for the use of economic instruments in developing countries. First, he believes that such instruments contain useful lessons for both developing countries and transitional economies and should be experimented. Second, he explains that developing countries themselves have used economic instruments for some time.[31] He concludes: "*the fact that a dissimilar group of developing countries have been able to adopt and adapt economic instruments for environmental management bodes well for the introduction of these instruments elsewhere in the developing world.*"

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[28] The CAC instruments relevant to this study are standards, i.e. minimum thickness (weight) standards for plastic bags.

[29] Panayotou (1994, p.3) writes: " It is important to note that developing countries are a very heterogeneous group, both in terms of the stage of economic and political development and in terms of ecological conditions."

[30] "…regulations imposing uniform performance standards are essential to ensure that industry makes the investments necessary to reduce pollution."- World Commission on Environment and Development. (1987). Our Common Future. New York: p. 220

[31] He also raises a very important weakness in developing countries: although these experiences are relevant, they are largely undocumented and anecdotal.

From the above discussions, it follows that enforcement of both CAC and economic instruments holds a number of challenges in developing countries. However the need for their use in these countries is at the same time justified on various grounds.

2.1.4 (Environmental) Policy Evaluation/Selection Criteria

Typology of Criteria

As much as a *causal analysis* is essential in the selection of a policy response, a second critical element is the *context of implementation*[32] (Memelmans-Videc, et al., 1998, p.150). The policy maker's choice, with regards to context of implementation, can be depicted in the format presented in Table 2-1 below.

Table 2-1 The policy maker's choice

Likelihood of Implementation

		High	Low
Robustness of Instrument	**High**		
	Low		

Source : Memelmans-Videc, et al. (1998, p.151).

Understandably, the top left box (High-High) is the most desired option. However, this is not easily attainable in the real world. Where one ought to be only be decided through an understanding of the context of the problem, the array of instruments, the tradeoffs of effectiveness and efficiency, the capabilities of the implementing institution, the political and financial costs of selecting a particular instrument and the different pressures faced by the policymaker (Memelmans-Videc, et al., 1998, p.151). This brings as to another important issue, i.e. environmental policy evaluation criteria.

Various works have dealt with the issue of environmental evaluation criteria (Memelmans-Videc, et al., 1998; Vedung, 1997; Field, 1997; Panayotou, 1994; OECD, 2001). It should be noted here that the first two works are complimentary.

According to Memelmans-Videc, et al. (1998, p. 7), there are four central values that determine the process of instrument choice, i.e. *effectiveness, efficiency, legality and democracy.*[33] Policy

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[32] Does one choose a weaker or less appropriate instrument where there is some confidence that it can be implemented and at least some change can be anticipated? Or does one take the risk of choosing a more robust instrument where the implementation difficulties are considerably greater and the likelihood of success more tenuous, but with a greater possibility of impact on the problem if successfully implemented?

[33] Effectiveness stands for the degree of goal-realization due to the use of certain policy instruments. Efficiency refers to the input-output/outcome ratio of policy instrumentation. Legality refers to the degree of correspondence of administrative action in designing and implementing policies with the relevant formal rules as well as with the principles of proper (administrative) process. It may entail values like equity and motivation. Democracy refers to the degree to which administrative action in designing and implementing policies correspond with accepted norms as to government-citizen relationships in a democratic political order (Ibid.).

instrument choice is based on the preference to these competing and most often conflicting values (*Ibid*). The authors further argue that instruments that perform very well in respect of the democracy criterion oftentimes under-perform in efficiency and as a result the choice of policy instruments has to be viewed as "*a search for optimum solutions, a prioritizing process, a balancing act.*" Field (1997); Panayotou (1994); OECD (2001) identify the criteria by name and do not as such categorise them into central values as the other two works did.

Field (1997, p.181) identifies five of them which he names: *ability to achieve efficient and cost-effective reduction in pollution; fairness; incentives they offer* [to polluters] *to search for solutions; their enforceability; and the degree to which they agree to certain moral precepts.* The OECD 2001 manual identifies six with significant overlap with Field, i.e. *environmental effectiveness; economic efficiency; political acceptability; administrability; innovative advancement; and directness* (Patel Tonra, 2004). Panayotou gives a very long list but in agreement with the previous two. He identifies nine criteria, namely *environmental effectiveness; cost effectiveness; flexibility; dynamic efficiency; equity; ease of introduction; ease of monitoring and enforcement; predictability; and acceptability.*

The author is of the opinion that the criteria identified above [by the various authors] can be re-grouped under the four central values of Memelmans-Videc et al. (Vedung incusive). Table 2-2 below provides definitions as provided by the various authors. It is also an attempt by the author to re-group them according to the four-central values and should, therefore, be scrutinised by the reader.

Table 2-2 Policy Evaluation Criteria: Definitions and Classifications

No.	Criterion	Central Value[34]	Definition/Intent (Author)
1	Environmental effectiveness	Effectiveness	Will the instrument reduce or change environmental impact? (OECD, 2001).
			Will the instrument achieve the environmental objective within the specified time span and what degree of certainty can be expected? (Panayotou, 1994).
2	Efficiency	Efficiency	By "efficiency" we mean the balance between abatement costs and damages. An efficient policy is one that moves up to, or near to the point where marginal abatement costs and marginal damages are equal (Field).
			Will the instrument save resources? (OECD, 2001).
3	Cost effectiveness	Effectiveness	A policy is cost effective if it produces the maximum environmental improvement possible for the resources being expended or, equivalently, it achieves a given amount of environmental improvement at the least possible cost. For a policy to be efficient it must be coat effective, but not necessarily vice versa (Field).
			Will the instrument achieve the environmental objective (or target) at the minimum possible cost to society? (Panayotou, 1994).
4	Fairness (Equity)	Legality	Equity is a matter of morality and the regard that relatively well-off people have for those less fortunate. However, there is no agreement on how much weight should be put on the two objectives, i.e. efficiency and distribution (Field).
			Will the costs and benefits of the instrument be equitably distributed? Who gains and who loses? (Panayotou, 1994).
5	Incentives for long-run improvements	Efficiency	A critically important criteria that determines whether a policy provides a strong incentive for individuals and groups to find new, innovative ways of reducing their impacts on the ambient environment (Field).
			(=Innovative advancement): Will technological and managerial improvements be encouraged? (OECD, 2001)
			(=Dynamic Efficiency): Does the instrument provide incentives for developing and adopting new environmentally cleaner and economically more efficient technologies? Does it promote development of an environmentally sound infrastructure and economic structure in general? (Panayotou, 1994).

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[34] As identified by Memelmans-Videc, et al. (1998)

No.	Criterion	Central Value[34]	Definition/Intent (Author)
6	Enforceability	Democracy (?)	Enforcement requires energy and resources… and there will always be other calls on these resources; further more, there will always be people whose interests lie in not having environmental policies enforced thus enforcement is unlikely to happen automatically. The costs of enforcement, although perhaps not as large as overall compliance costs in most cases, are critical to the success of environmental quality programs and ought to be treated explicitly in evaluating the overall social costs of these programs (Field).
			(=Administrability): Is the programme feasible to carry out? (OECD, 2001).
			(=Ease of Introduction): Is the instrument consistent with the country's legislative framework? (Panayotou, 1994).
			(=Flexibility): Is the instrument flexible enough to adjust to changes in technology, the resource scarcity, and market conditions? (Panayotou, 1994).
			(=Predictability): Does the instrument combine flexibility and predictability? (Panayotou, 1994).
			(=Ease of Monitoring and Enforcement): How difficult or costly will monitoring and enforcement be? (Panayotou, 1994).
7	Moral considerations	Legality (?)	The innate feelings that people have about what is right and wrong undoubtedly affect the way they look at different environmental policies (p. 189). Policies that declare outright that certain types of polluting behaviour are illegal are to be preferred to policies that do not; another argument in morality is that those who cause a problem ought to bear the major burden of alleviating it (Field).
			(=Directness): Is the instrument applied on the polluter and will it therefore change behaviour? (OECD, 2001).
8	Political acceptability	Democracy	Will the instrument be supported politically? (OECD, 2001)
			(=Acceptability): Is the instrument understandable to the public, acceptable to the industry, and politically saleable? (Panayotou, 1994).

The Context of Developing Countries

On the choice of environmental policies in developing countries, Field (1997, p.411) asserts that the foundation of an effective policy is the evaluation of the costs and benefits of different alternatives. Environmental damages in developing countries, more and above those encountered in the developed ones, affect economic productivity through impacts on human health, soil fertility, resource depletion, etc. Therefore, the need in these countries for valuation of environmental damages is of paramount importance- which is not actually the case at the moment (*Ibid.*). Regardless of this being very central in the selection of appropriate policies, Field (1997) acknowledges some challenges in estimating the realistic values of environmental benefits and damages in these countries.[35]

This leads to the observation that one may have to be careful with use of *efficiency* and *effectiveness* when dealing with developing countries. Elaborating on this, Field (1997, p.183 & p.417) points out that [out of criteria he identified] efficiency and cost effectiveness are relatively considered as most important in developing countries as people have fewer resources to put in environmental programs and cannot afford to have policies that are not cost effective and efficient. However, as accurate measurement of environmental damages is very difficult to undertake (especially in developing countries) application of cost-efficiency is difficult. He therefore recommends use of *cost-effectiveness* as a primary criterion (Field, 1997, p.182).

Selected Criteria

The author proposes the following five criteria for selecting the policy and technical instruments that will be proposed in response to the problem in Nairobi: **(1) Environmental effectiveness; (2) Cost-effectiveness; (3) Incentives for long-run improvements; (4) Enforceability; and (5) Political acceptability.**

Environmental effectiveness is chosen because policies naturally aim at achieving some form of betterment in comparison to the status quo [whether they succeed or fail being another thing]. Hence, it is sensible to evaluate all environmental policies in this light. The reason for the selection of cost effectiveness (as against cost-efficiency) is already discussed above. On the importance of incentives for long-run improvement Field et al. (2002, p. 187) argue that it is critical to assess whether a policy places all the initiative and burden on public agencies or provides incentives for private parties to devote their energies and creativities to find new ways of reducing environmental impacts. They further argue that "*it is private parties, firms and consumers whose decisions actually determine the range and extent of environmental impacts and the incentives facing these parties determine how and where these impacts will be reduced*" (*Ibid.*). This argument is even more valid in developing countries where public agencies are technically and financially weak

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[35] Field (1997, p. 412) further asserts that this can be illustrated by the two common tools utilized in environmental valuation, i.e. willingness-to-pay and discounting:

(i) Willingness-To-Pay (WTP): As WTP not only indicates preferences but also the ability to pay, use of this approach in the valuation of environmental damages may yield a distorted estimate in developing countries where poverty is wide spread. Hence, the WTP estimate, in the face of abject poverty, may be quite small although the magnitude of environmental degradation may be quite high.

(ii) Discounting: In developing countries, focus is highly placed on long-term development. It is also often asserted that people in low income countries discount the future very highly- preferring projects that will pay off quickly because of a need for an immediate income. Given the fact that environmental improvement programs often deliver their benefits in long run, they may be given low priorities in comparison to economic development projects that pay off quickly.

to spearhead long-run improvements, justifying the inclusion of this criterion. A similar argument goes for enforceability. Field et al. (2002, p. 189) argue that enforcement is an important segment of environmental quality programs as public agencies face budget constraints. Although these costs are not as large as compliance costs, they are oftentimes substantial and crucial to the success of environmental programs (*Ibid.*), which is even more valid in developing countries. As Table 2-2 shows, political acceptability is an issue of democracy. As environmental policies are intended to change undesirable behaviour of polluters, whether or not the programme faces strong opposition will have a bearing on its success. This justifies the inclusion of this as a criterion.

2.2 Heuristic Tools

2.2.1 Public/Environmental Policy Evaluation Model: Use of Intervention Theory

Vedung (1997) and (Kautto and Similä, n.d) have discussed the essence of intervention theory and the input-output model of public policy evaluation.

According to Kauto and Similä (n.d., 2-4), the aim of intervention theory is to describe how a certain policy is intended to be implemented and function and it includes two kinds of assumptions, i.e. (a) assumptions on the goals and other expected impacts; and (b) assumptions on the causal linkages between the goals and impacts. Vedung (1997, 138-144), refers to the process as reconstruction of an intervention theory.[36]

The system model [depicting such assumptions and linkages] is, accordingly, a heuristic tool, i.e. "an instrument to support thinking" (Kauto & Similä, n.d., 2-4). They also claim that an evaluation of public policy is often based on the input-output model which consists of the essential elements, i.e. inputs, public administration, outputs [of the public administration] and outcomes [of the outputs].

Outputs are defined as matters that come out of government bodies and are faced by the addressees, e.g. taxes, permits. Outcomes are the actions taken by the addressees when confronted by the output but also what occurs after that in the chain of events. Outcomes are classified as immediate, intermediate and ultimate (Vedung, 1997, p. 5) & (Kautto and Similä (n.d., p.2). Such an inter-relationship in government interventions and their evaluation, according to Vedung, is shown in Figure 2-2 below.

As discussed above, intervention theory in this research is used as a helping tool in the reconstruction of the main assumptions and expected causal chains of the policy instruments deemed [by the author] to satisfactorily curb the plastic bag waste menace in Nairobi, Kenya. The reader should appreciate the fact that such reconstructions will be subject to the author's grasp of the whole process as learnt from the experiences of the different countries surveyed. In addition, it should be mentioned that such reconstructions will not be made for each and every policy instrument that can be imagined but to a package of plausible options (identified from country experiences).

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[36] This, according to Vedung means to put together, in sequence, events and changes that should occur in order for the intended outcomes to take place.

Figure 2-2 The System Model to Government Interventions

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┌─────────────────────────────────────┐
│              Input                   │
└─────────────────────────────────────┘
                   │
                   ▼
┌─────────────────────────────────────┐
│      Conversion (Administration)     │
└─────────────────────────────────────┘
                   │
                   ▼
┌─────────────────────────────────────┐
│              Output                  │
└─────────────────────────────────────┘
                   │
                   ▼
┌─────────────────────────────────────┐
│       Outcome 1 (Immediate)          │
└─────────────────────────────────────┘
                   │
                   ▼
┌─────────────────────────────────────┐
│      Outcome 2 (Intermediate)        │
└─────────────────────────────────────┘
                   │
                   ▼
┌─────────────────────────────────────┐
│        Outcome 3 (Ultimate)          │
└─────────────────────────────────────┘
```
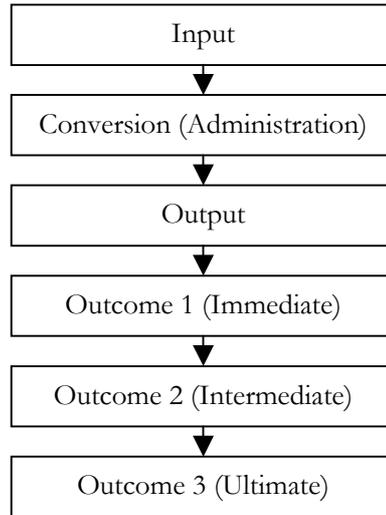
Source: Vedung (1997, p.5)

2.2.2 Municipal Solid Waste Management Systems

Other heuristic tools used to guide this research are widely accepted recommendations and guidelines on MSW management systems. These will be used to guide the evaluation of Nairobi city's MSW management system, which is an important element of this research.[37]

Principally, UNEP's International Environmental Technology Centre (IETC) guidelines on *sound practices*[38] of MSW management will be used. The reason is that the guidelines make sufficient coverage of developing regions in general and the African region in particular in addition to being from a reputed source (UNEP). A brief summary of the relevant elements from these guidelines is presented below.

Sound practice is determined by a number of factors, i.e. environmental, economic, climatic, and social context in which policy decisions are made (IETC, 1996, p xiii). An evaluation of a [sound] practice should examine at least the following six components (IETC, 1996, p. xiii):

a) **Waste reduction:** including source separation[39], material recovery[40], reuse[41] and recycling

b) **Collection and transfer:** including storage prior to collection, door-to-door & communal collection, and use of transfer stations

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[37] Plastic bag waste is one component of the broad category of MSW.

[38] Sound practice in the context of MSW management is defined as: "…a technically and politically feasible, cost-effective, sustainable, environmentally beneficial, and socially sensitive solution to a MSW management problem" (IETC, 1996, p. 12).

[39] Source separation, as defined in IETC (1996, p. 20) and as implied in this writing is: keeping different categories of recyclables and organics separately "at source", i.e., at the point of generation, to facilitate reuse, recycling and composting.

[40] Material recovery, as defined in IETC (1996, p. 20) and as implied in this writing is: obtaining materials/organics (by source separation or sorting out from mixed wastes) that can be reused or recycled.

[41] Reuse as defined in IETC (1996, p. 20) and as implied in these writing is: reusing the product for the same or different purpose.

c) **Composting:** including backyard, decentralised, and centralised composting, and anaerobic digestion

d) **Incineration:** including waste-to-energy technologies

e) **Landfills:** including low-technology approaches and disposal by other means

f) **Special wastes:** techniques for handling medical waste, tires, used oil, wet batteries, construction and demolition debris, and sewage sludge.

The primary focus of the assessment of Nairobi's MSW management practices is to set the context in which the policy interventions will have to be explored for the plastic bag problem. This research, therefore, does not intend to carry out an exhaustive 'sound practice' evaluation of the City's MSW management system. The components (topics) as per IETC (1996) will primarily be used as checklists to guide the evaluation of the city's MSW practices.

Figure 2-3 Infrastructure for municipal solid waste management
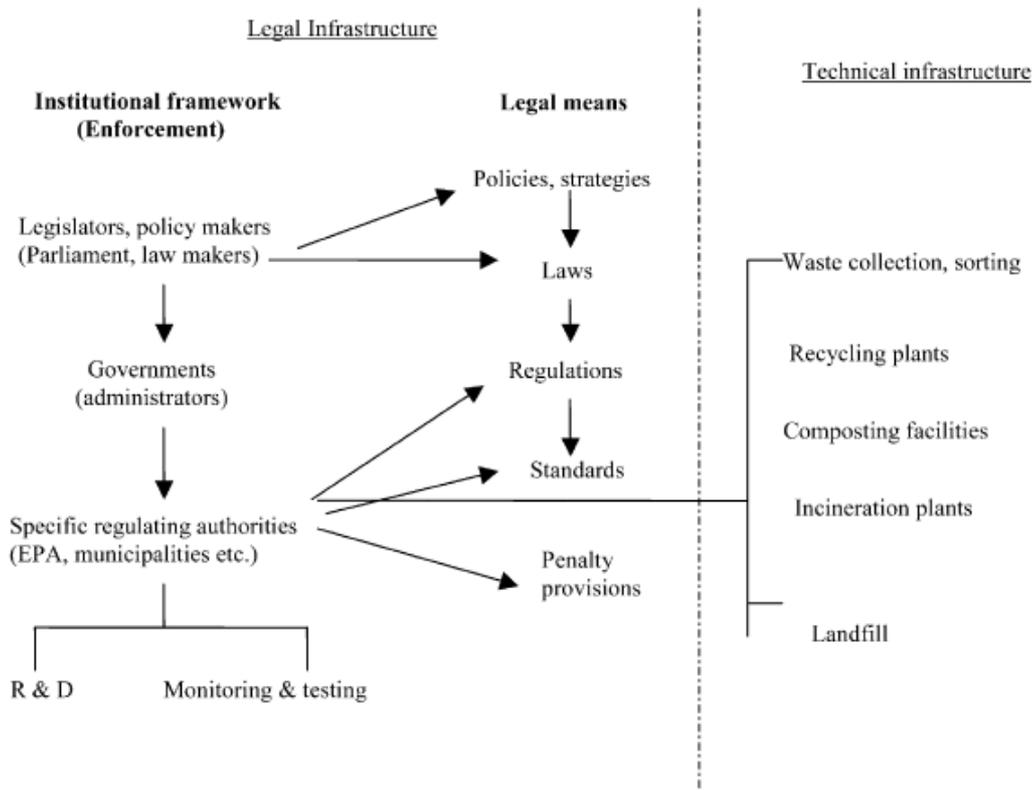
Source: Ren (2003)

An additional checklist that will be used to facilitate the research is the components of MSW infrastructure, namely institutional, legal and technical infrastructures. One such model by Ren (2003, p.28) is shown in Figure 2-3 above. The argument is that in order to carry out a proper MSW management, governments must establish an appropriate infrastructure in which a number of legal, institutional and technical conditions need to be met. To the extent possible, the research endeavours to make an evaluation of the institutional, legal and technical MSW infrastructure in Nairobi, Kenya by using this model as a checklist.

2.2.3 Experience of Other Countries

As also discussed above, this will be the major source of factual information to guide the research. It is particularly important in the final phase of policy instrument identification, evaluation, selection, and packaging.

2.3 Analytical Framework for Evaluation

On the basis of the aforementioned considerations, the analytical framework that will be used in this research is presented in Figure 2-4 below. It shows the various activities that will be covered in the research, their sequential inter-relationship and the type of input data required at each stage. The broadly stated "contextual evaluation" encompasses relevant input information on Nairobi city with regard to MSW management system, status of plastic bag waste pollution, what has already been done in response, emerging alternatives, the plastic manufacturing sector, institutional infrastructure, and the like.

Figure 2-4 Framework for Evaluation of Plastic Bag Waste Management in Nairobi
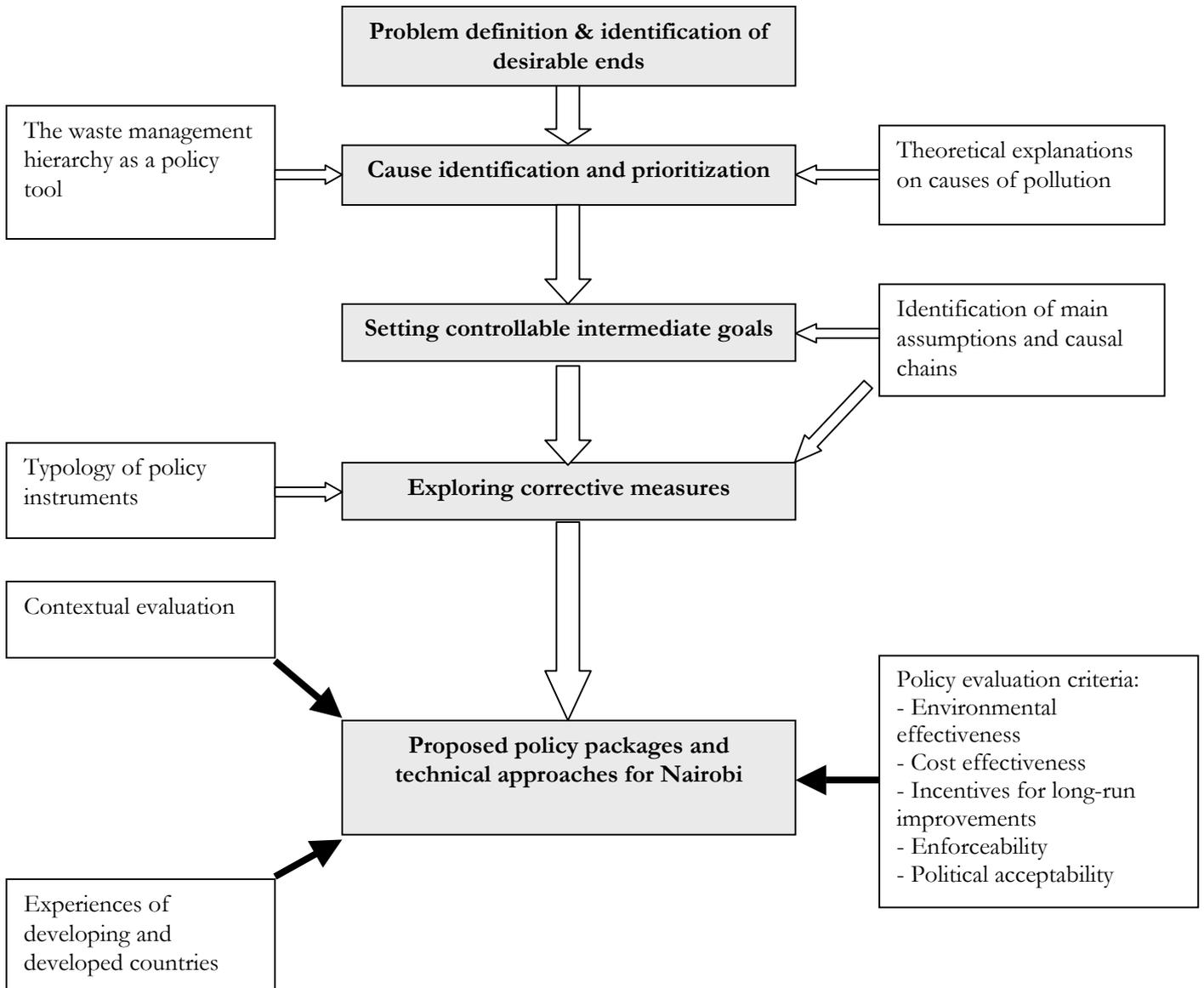
3 Contextual Assessment

This chapter is intended as a broad situational analysis of the various aspects surrounding the case under study. The objective is to establish the context in which appropriate policies have to be explored at a latter stage.

As much as possible, UNEP's IETC guidelines and the MSW infrastructure model discussed in Section 2.2.2 are used to direct the assessment. An attempt is made to encompass the pertinent institutional, legal and technical infrastructure.

The following broad topics will be covered in the contextual evaluation. They are identified through a focused literature survey on the problem area and consultation with relevant institutions, i.e. IIIEE, KNCPC and UNEP:

a)   Institutional Infrastructure;

b)   Status of MSW Management System in Nairobi City;

c)   Status of Plastic Bag Waste in Nairobi City and Root Causes;

d)   What Has Been Done in Response;

e)   Status of Private and Community Based Organisations;

f)   The plastic Manufacturing Sector in Kenya; and

g)   Emerging Alternatives

3.1 Institutional Infrastructure

This section briefly introduces the main actors concerning MSW and plastic bag waste management issues in Nairobi [and Kenya]. It should not be considered as an exhaustive description and evaluation of all stakeholders.

3.1.1 Nairobi City Council (NCC)

NCC is responsible to ensure proper storage, collection, transportation, safe treatment and disposal of solid waste in Nairobi. Its main responsibilities as regards solid waste management are: (a) provision of services for collection, transportation, treatment and disposal; (b) regulating and monitoring the activities of solid waste generators; (c) regulation and monitoring of private companies engaged in solid waste management activities; (d) formulation and enforcement of relevant laws and regulations; and (e) formulation and implementation of MSW policies (Nairobi City, 2005).

Due to failure of the NCC to carry out its responsibilities, residential associations (RAs) have evolved in many middle and high-income areas to supplement NCC services. Currently, an estimated 200 registered RAs are operating in the city, concerned, among others, in improving city cleanliness. They contract, organize, and monitor private MSW collection services (UNEP, 2005, p. 30).

NCC officials claim that a policy on public private partnership has already been passed by the Council (Maranga, Crispus. 2005, July 14. Personal interview). This policy is expected to

encourage CBOs to join hands with NCC in the management of MSW; in due course, their roles would also be recognised (*Ibid.*).

Overall, although the NCC continues to hold the duty of formulating and implementing policies and by-laws, its role in garbage collection, recycling, composting and disposal has diminished dramatically. As a result, private companies and CBOs have assumed more of these responsibilities. This also continues to be the case in the future. Hence, the envisioning of such systems as recycling and composting is deemed necessary, which could be essential in source-reduction of waste and could also generate revenues to cover their operation costs.

3.1.2 The National Environment Management Authority (NEMA)

NEMA was established under EMCA (1999) [see Section 3.2 below] and became operational in July 2002. Its duties are supervising and co-coordinating all matters related to the environment and serving as the principal instrument in the implementation of all policies relating to the environment in Kenya (NEMA, 2005).

NEMA is growing stronger by the day as more resources are being set-aside by the government for its activities. One critical area of improvement is securing sufficient trained manpower; this aside, it is capable of implementing environmental policy interventions (Ikiara, Moses. 2005, July 8. Personal interview). These views are also supported by MoTI (Munyao, Gregory. 2005, July 7. Personal interview).

3.1.3 Kenya Revenue Authority (KRA)

KRA was established by an Act of Parliament in July 1995. Its purpose is to enhance the mobilisation of government revenue, and providing effective tax administration in revenue collection. In particular, the functions of the Authority are to assess, collect and account for all revenues; and to advise on matters relating to the administration of and collection of revenues (KRA, 2005).

KRA often surpasses targets set by the government for revenue collection. Hence, if assigned, it can collect eco-taxes [such as levies on plastic bags] satisfactorily. One arrangement is that KRA can be assigned to collect eco-taxes on commission basis (Ikiara, Moses. 2005, July 8. Personal interview).

3.1.4 Kenya Bureau of Standards (KEBS)

KEBS was established by an Act of parliament and started operation in July 1974. The objectives of KEBS relevant to the case under investigation are preparation of standards relating to products, materials, processes, etc.; quality inspection of imports at ports of entry; and dissemination of information relating to standards (KEBS, 2005). Standards are formulated by Technical Committees which consist of experts from various interest groups such as producers, consumers, technologists, research organizations and testing organizations in both the private and public sectors (*Ibid.*).

Samson Ombok (2005, July 5. Personal interview) revealed that KEBS has Quality Assurance Officers who collect samples of products from manufacturers, importers, supermarkets, etc. to check compliance with respective standards. It also has Import Inspection Officers which carry out the same duty at all entry points. He also disclosed the fact that while KEBS carries out mandatory review of standards every five years, an interim review is also possible before the end of the five-year period if the need arises. He argues that KEBS sets standards with

caution not to create trade barriers and restrict export activities. He is also the opinion that the Country's penal codes are sufficient to deal with any fraudulent activities in relation to KEBS standards.

3.1.5 Kenya Institute for Public Policy Research and Analysis (KIPPRA)

KIPPRA is an autonomous public institute formed under the provisions of the country's State Corporations Act. Its primary mission is to conduct research and analysis leading to policy advice to government and the private sector. Its main objectives are: (a) to develop capacities in public policy research and analysis and assist the government in the process of policy formulation, implementation and evaluation; and (b) to conduct policy research in areas such as human resource development, social welfare, environment and natural resources, agriculture and rural development, trade and industry, etc. (KIPPRA, 2005).

KIPPRA has carried out a number of studies in the above named areas. Of special relevance to this research is the one on the use of economic instruments for MSW management in Kenya (see Section 3.4.1).

3.1.6 Kenya National Cleaner Production Centre (KNCPC)

KNCPC is an autonomous non-profit institution established in July 2000 as a project of the United Nations Industrial Development Organisation (UNIDO) and the Kenya Industrial Research and Development Institute (KIRDI) (KNCPC, 2004, p.1).

The Centre is mandated to build national capacity in preventive environmental management tools through a number approaches comprising, among others, technical support, policy advice and cleaner technology transfer (KNCPC, 2004, p.4).

One of the 'priority sub-sectors' ear-marked by the Centre for cleaner production strategy and implementation is the plastic industry. To this end, KNCPC is working with concerned stakeholders, especially with the plastic manufacturers to come up with a lasting solution to the plastic waste management problem in Kenya (Nyakang'o, Jane. 2005, June 24 Personal interview & KNCPC, 2004, p.9, 10).

3.2 Legal and Policy Frameworks

3.2.1 Environmental Management and Coordination Act (EMCA, 1999)

In 1999, the Kenyan parliament passed the Environmental Management and Co-ordination Act (EMCA) which came into force in January 2000. The National Management Authority (NEMA) established by the Act is the main body that coordinates environmental management activities in the country (ELCI, 2005, p.6).

The following are the relevant sections of the Act (ELCI, 2005, p.41 & UNEP, 2005, p 15). Section 3 provides every Kenyan with the right to a clean and healthy environment; grants citizens the duty to safeguard the environment. Section 87 demands that every person[42] whose activities generate waste must ensure that the waste is minimised through treatment, reclamation, and recycling. Section 142 (1) stipulates that any person who pollutes the environment by discharging dangerous materials into land, water, air or the aquatic

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[42] Legally, a "person" means an individual, association or corporate body that is legally constituted

environment is guilty of an offence; it also lays down penalty provisions, i.e. if justified, the court may demand the person in question to pay 'the full cost of cleaning up the polluted environment'; in addition, the court may order the polluter to pay any third party who has incurred damages due to the pollution. Part V, Section 57, sub-section I makes provisions for the use of, taxes and other fiscal incentives, disincentives or fees "to induce or promote the proper management of the environment and natural resources or the prevention or abatement of environmental degradation".

UNEP (2005, p x & 14) asserts that the enactment of EMCA and the creation of NEMA for its implementation provide strong institutional base for the use of economic instruments to manage environmental problems from plastic shopping bag waste. Furthermore, it underscores the fact that although the private sector has been participating in collection, transportation and disposal of MSW in the absence of any policy or legal supports, EMCA and policy development efforts by the NCC consider privatization as one useful instrument for the management of solid wastes in the country.

Ikiara, Moses (2005, July 8. Personal interview) also describes EMCA as the most comprehensive attempt on environmental legislation in Kenya for various reasons. Primarily, it allocates property rights to citizens on various aspects of the environment, the most important being the right to clean environment. Second, it empowers citizens to prosecute polluters, including indiscriminate solid waste dumpers, to pay for the damage or nuisance caused. Last, it has empowered NEMA to implement all environmental policies and laws of the country. However, he points out that NEMA has not yet managed to establish regional offices, set standards, acquire the required trained staff and facilities so as to function effectively. He also asserts that although EMCA has provisions for the use of economic instruments in environmental management, NEMA has not yet developed the required operational guidelines.

NEMA, however, states that it is in the process of gazettment of a regulation on waste management. Suitable economic instruments to promote activities that benefit the environment (including duty waivers, tax exemptions, sanctions) are also being developed in close consultation with relevant ministries (Mbegera, M.O. 2005, June 29 & July 5. Personal interview).

3.2.2 Local Government By-laws

According to Crispus Maranga (2005, July 14. Personal interview), these are 'general nuisance by-laws' and have provisions for garbage disposal of which one example is the NCC by-laws.

For a long period, by-laws in Nairobi on solid waste management have not been comprehensive and had no provisions for the categorisation of different types of waste; they did not also specify on how best categorisation can be done (NCC brochure, n.d.). In the face of growing MSW generation in Nairobi city, due partly to rapid urbanisation, the NCC by-laws have been rendered out-dated and too weak in their penalty to deter offenders (NemaNews, 2005, p.22). Although NCC by-laws prohibit illegal disposal of waste, specify storage and collection responsibilities for solid waste generators, and indicate the Council's right to collect MSW management charges, all of these are not adequately implemented (UNEP, 2005,p.33).

Industry associations such as KAM also stress that failure of the NCC by-laws is one of the most essential cause of growing problems in respect of illegal dumping and littering (including post-consumer plastics)(Kimilu, Damaris. 2005, June 30. Personal interview).

3.2.3 The Public Health Act

Section 116 and 117 of this Act stipulate that local Authorities (such as the NCC) are responsible to maintain cleanliness and prevent danger to health from 'unsustainable dwellings'. Another relevant section (126A) requires every Council to make by-laws that regulate, among others, the construction of buildings and sanitary conveniences for drainage and sewer. Still another section (129) acknowledges NCC's responsibility in the prevention of pollution of drinking water sources and the prosecution of polluters (ELCI, 2005, p.15).

3.2.4 Others

Of special importance to the case under study is the Counterfeits Goods Bill (2005) drafted by MoTI. It is currently being evaluated by the Cabinet and if it passes through will help in the control of sub-standard and counterfeit products including plastic bags (Munyao, Gregory. 2005, July 7. Personal interview).

Still of some relevance to MSW management is the Land Act which, among others, requires the setting aside of suitable areas for garbage disposal and hazardous industries. Another one, the Building Code, demands the provision of refuse receptacles/cubicles in residential areas (Maranga, Crispus. 2005, July 14. Personal interview).

Overall, the author is of the opinion that the in-place legal and policy frameworks in Nairobi are sufficient for the functioning of well-formulated government interventions to address the plastic bag waste menace. However, the NCC by-laws appear to be out-dated and not stringent enough to deter such offences as littering and illegal dumping. They have to be revised for the success of any future endeavours.

3.3 Status of MSW Management in Nairobi City

3.3.1 Overview

There were times when Nairobi was considered as one of Africa's best kept cities. The current state, however, is one where it is 'fighting under the weight of poor sanitation mainly due to poor waste management' (ITDG-EA. 2005, p. 4). Currently, the city has about two million inhabitants and in addition hosts an estimated of three million visitors every day. This results in solid waste generation of about 2 400 tons per day, which is increasing by the day as a result of growing population pressure (*Ibid.*).

Most cities in Kenya do not have up-to-date human settlement and physical development plans (NEMANews, 2005, p. 22). Nairobi's master plan dates from 1948 and although a revision was made in 1973, it was not approved (*Ibid.*). This has resulted in uncontrolled urban development, overcrowding, and lack of safe drinking water, proper drainage and access roads. Improper disposal of MSW and littering in [Kenya and Nairobi] also continue to rise as a result of unplanned dumping sites and lack of co-ordination of key players (*Ibid.*).

A sizable proportion of Nairobi's inhabitants (about 50-60%) live in informal settlements which lack basic sanitary and MSW infrastructure. In these settlements, the adverse impacts of MSW are highly pronounced as there is a practice of open dumping of garbage and as the areas serve as dumping ground for garbage from high income areas (ITDG-EA. 2005, p. 4). In general, priority in garbage collection is given to the Central Business District, high-income residential areas and industries. On the contrary, low-income areas are grossly neglected (NEMANews, 2005, p. 22).

In addition to open dumping, open-air burning is also common. The main reasons are lack of a well functioning MSW management system and legal guidelines on the disposal of waste (IPEP, n.d.).

3.3.2 Waste Characterisation

To facilitate comparison, a regional overview of MSW characteristics in Africa as compiled by IETC (1996, 129-130) is discussed first. It highlights the following points:

> *Although waste characterisation is a key component in MSW management, such data are not usually reliably compiled in many African urban centres. On wet-basis, MSW per-capita generation rate from Accra, Ibadan, Dakar, Abidjan and Lusaka fall in the range of 0.5-0.8kg/day; the corresponding average OECD figure is 1-2kg/day. Organic content of MSW usually falls in the range 35-80% and is closer to the higher end. MSW from many African urban centres is low in percentage of commercially recyclable materials and has too low calorific value, making it less attractive for energy recovery by incineration. Composition of plastics, glass and metals (independently) is usually less than 10%; paper is in the low teens.*

Eisa and Visvanathan (2002, p.10), however, argue that urbanisation and industrialisation in Africa and Asia are leading to dependence on disposable items like plastic bags, paper wraps, metal cans, cardboard boxes, etc. This, they argue, is resulting in changing characteristics of MSW composition in these places.

Coming back to Nairobi city, we find that some studies have been conducted on MSW management (JICA, 1998; ITDG, 2004). The JICA study (Interim report, 1997, p.1) estimated that about 1 450 tons of MSW/day were generated in Nairobi in the late 1990s. The study puts the MSW per capita generation at the time at 0.67 kg/day which translates to about 245 kg per person per year. A recent study by ITDG (2004) puts the daily solid MSW generation at a relatively higher value of 2 400t. Equivalently, the study estimates per capita solid waste generation at about 253 kg per person per year.[43] This figure falls within the range specified by IETC for African urban centres. No explanations were obtained [by the author] as to why this change is taking place. However, it could be speculated that the increase in daily MSW generation over the period could be attributed to a number of reasons, e.g. population growth (for daily generation), increase in volume of goods consumed (for per capita figures).

The NCC estimate for daily waste generation is between 1 600 to 2 400 tons which appears to be a projection based on the JICA study[44] (Maranga, C. 2005, July 14. Personal interview).

On MSW composition in the city, the JICA study (1997, p.1) documented the following results: organics (51%), paper (18%), plastics (15%), glass & metal (7%), textile (3%) and others (6%). ITDG (2004) gives a slightly different figure, i.e. organics (61%), plastics (21%), paper (12%). Figure 3-1 below shows a pictorial representation of the ITDG study from 2004.

From these data, it appears that the percentage of plastics is growing. It is also unduly high when compared with the IETC prediction of less than 10% and the EU average of 9% as indicated in Figure 3-2. However, other estimates also indicate the overly high proportion of

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[43] A comparison can be made with the per capita MSW generation for Sweden in 2002, i.e. 476kg/person.year (RVF, 2003).

[44] The JICA study is the main source document on MSW available to the NCC.

plastics in the MSW stream [e.g. KEMA, case study, Section 3.6]. The author has however not carried out detailed investigations as to why this is the case.[45]

Figure 3-1 Composition of MSW in Nairobi
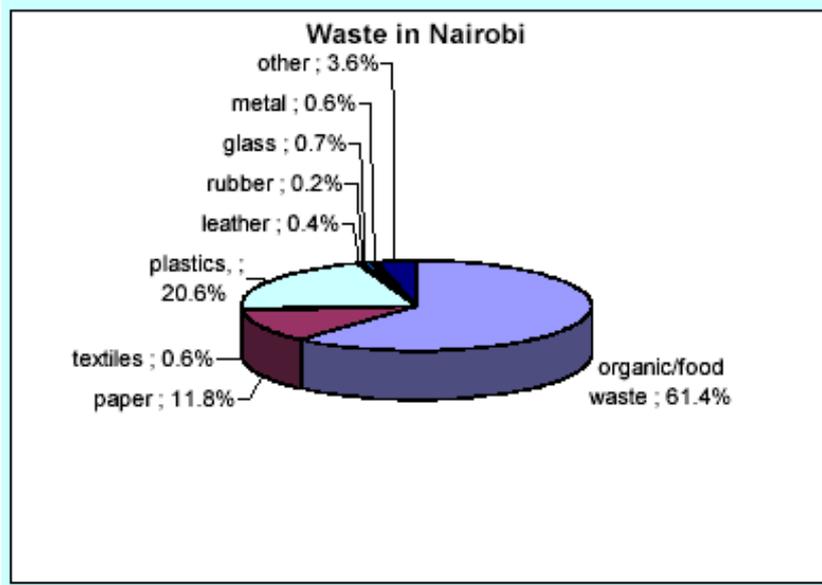
Source: ITDG (2004)

Figure 3-2 Average Composition of MSW in the EU
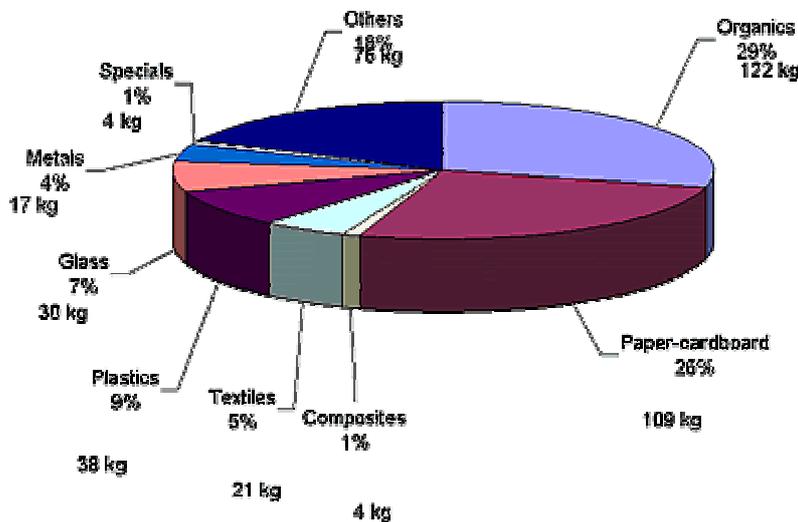
Source: Association of Cities and Regions for Recycling and Sustainable Resource Management (2005)

A separate solid waste management survey[46] was also carried out by ITDG on the informal settlements of Nairobi. This study documented that about 90% of the organic fraction of solid

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[45] From the figures it can be observed that except for paper, other materials like glass, metal, textiles, composites, etc are present in relatively lower proportion compared to the EU.

[46] The survey covered 340 households, 54 business enterprises and 24 institutions using various techniques including GIS mapping (ITDG. 2005, p. 6).

waste originates from food materials while 70% of the inorganic waste is from plastics. The majority of the households were also found to store their waste in plastic bags (75%). Open dumping of waste is highly practiced in these areas as 70% of the households do not get collection services at all. Of the 30% that are serviced, 85% is by youth groups, 11% by private companies and 4% by scavengers (ITDG. 2005, p. 5).

3.3.3 Waste reduction[47]

Again a regional overview on waste reduction practices in Africa is presented first to facilitate comparison. Although recycling and composting are mechanisms for waste reduction, they are separately discussed here in sufficient detail due to the relevance they have to the case under study.

IETC (1996, 121-122) has documented the following points which are also supported by Achankeng (2003, p.16):

> *There is little formalized system of material recovery in Africa. Rather, material recovery including source separation and recycling is the duty of the informal sector. Waste pickers [known also as scavengers] render informal collection services whereby they salvage additional valuable materials at curb sides, dumps and landfills. At landfill sites, waste pickers may be organized into groups with permits to operate. In low income urban areas, recovery takes place at the household level in the form of reuse of plastic bags, bottles, paper, cardboards and cans. Rate of reuse is relatively high in Africa and these materials enter the waste stream only when they are no longer required for household use. In the presence of adequate market, plastics are recycled by waste pickers some of which also process the material prior to sale which are sold to local plastic products manufacturers. There is few official statistics on MSW generation and recycling in Africa. Hence it is very difficult to generalize on reduction and recovery rates. The degree of commercial recycling of paper, plastics, glass, and metals depends on the presence of industries or other end-use. Even in the event where such industries are present, they do not consistently encourage recycling.*

As regards Nairobi, a discussion with NCC experts indicated that households do not segregate waste at source. This implies that source reduction does not take place to a significant level. Scavenging is the major activity which contributes to this effect as some valuable materials are recovered in the process. Major items segregated by scavengers are food scraps (for animal feed), paper, hard plastics, glass and tins. Given the very high proportion of the organic fraction, NCC believes that segregating the organic fraction alone could lead to a sizable reduction in MSW quantity that goes to *Dandora[48]* or illegal dumping (Maranga, C. 2005, July 14. Personal interview).

From the above discussion (with NCC experts) it should be noted that hard plastics are relatively well collected by the informal sector in comparison to the flimsy ones. The role played by Community Based Organisations (CBOs) and other organisations in recycling post-consumer plastics is discussed in the following sections.

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[47] Waste reduction, as defined by IETC (1996, p. 20) is: all means of reducing the amounts of waste that must be collected and disposed of; this range from legislation and agreements at the national level for packaging and product redesign to local programs to prevent recyclables and compostable organics from entering the final waste stream.

[48] Dandora is the only open dumpsite in Nairobi city where MSW is disposed.

3.3.4 Recycling[49]

Challenges and Prospects of Recycling Plastics

Hogland, Nyström, Schelin & Tamaddon (1991, 13 & 53) discuss the challenges of recycling plastics, especially the ones reclaimed from municipal solid waste streams. They contend that technological developments in plastic recycling failed to make an impact because of the unsatisfactory market for secondary products made from recycled plastics and the cost of these products. They also assert that plastic waste is usually not homogenous and is contaminated with other plastics or materials which affect recyclables and end-use applications. The factors that determine the value of a recyclable material do not depend on the value of the material as such but rather on the cost of collection, separation, decontamination and potential market for the material (*Ibid.*).

While the focus should be on finding ways for the provision of clean post-consumer recyclable plastics, e.g. through developing a source separation culture, it is also clear that methods to manage unsorted and contaminated plastics should also be explored.

Hogland et al. (1991, 62-63) discuss that waste High Density Poly Ethylene (HDPE) is finding increasing applications, among others, in the production of bottles for non-food applications, flower pots, drainage pipes, etc. Similarly the authors describe processing of mixed plastic waste as a promising area that allows the production of high volume products; most notable amongst them are plastic lumber, fencing posts, roadside posts, pallets and park benches.

McDogall, White, Franke & Hindle (2001, p. 450) assert that one of the assumptions made in evaluating the savings gained due to material recycling is that products from the recycled feedstock would have the same functionality as the ones from virgin raw materials; when it comes to plastics, however, this is not the case. An example given in this work is that bags made of recycled HDPE need to be 30µm thick to have the same strength as 20µm bags from virgin HDPE. In addition, the authors documented studies which show a 3.5 % increase in wastage rate in the production of bags using recycled HDPE. They highlight the clear advantages that would be obtained by using recycled HDPE in the production of other materials like detergent bottles where up to 25% of such material can be used without loss of function.

Due to the sub-standard safety, health and environmental conditions of the Indian plastic bag recycling sector, Narayan also asserts that more environmental and health advantages will be gained in India by banning the recycling of plastics into plastic bags (2005, May 5, E-mail communication).

Regional Overview

As discussed above, the IETC guidelines include recycling as one method of waste reduction. Hence, most of what is discussed under section 3.3.3 holds true here as well. Recycling is separately discussed here because of its relevance to plastic waste minimisation.

Eisa and Visvanathan (2002, p.6) argue that waste utilization and recycling seem to particularly suit the African and Asian context as indicated by a number of such projects in these regions which are based on economic advantages. Currently, therefore, more emphasis is placed on

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[49] Recycling as defined by IETC (1996, p. 20) is: *the process of transforming materials into secondary resources for manufacture of new products.*

the ways and extent of recycling that could help in reducing waste quantity that has to be managed- more so in the light of scarce resources. As a result, MSW management goals also focus on source segregation[50], waste reduction, recycling, community participation and employment generation in the sector (*Ibid.*). Achankeng (2003, p.16) singles out lack of local or national markets for products as the principal problem of recycling in Africa.

Current Status in Kenya

The UNEP study (2005, xii & 36-37) provides background information on recycling practices in Nairobi. First, it makes the observation that recycling of items like paper, metals, plastics, tyres, and used clothes is becoming increasingly popular. At the Dandora dumpsite, the study notes, scavengers salvage more than 30 different types of materials, the major ones being metals, especially aluminium and copper. Recycling of post-consumer plastic bags is very low. It further indicates that it is only an estimated 8% of the recyclable materials that are recovered from the MSW stream in the country. Lack of adequate market and land for such activities is singled out as major challenges faced by recycling groups (*Ibid.).* While the study acknowledges the potential for recycling, the major problem is noted to be contamination of recyclables; absence of policies on recycling is also pointed out. It, in addition, observes that industry operators support the setting up of recycling schemes (importantly for aluminium cans, bottles, and polyethylene plastics) for environmental, social and economic reasons.

On the recycling of plastic waste including bags, the following observations were made by the plastic sector group of KAM (Kantaria, Bimal. 2005, July 22. Personal interview). First, out of the 45 plastic bag manufacturers operating in the country, about 17 conduct recycling of post-consumer plastic waste. Second, in order for the recycling of plastic waste to succeed, the NCC should assume a pivotal role by facilitating source-separation and collection of recyclables. It should also set-aside appropriate locations where people could bring their post-consumer plastic wastes. Third, there is a potential market for recycling of post-consumer plastic waste though it has to be yet developed. An indication is that while the average selling price of plastic products is Ksh 60/kg, post consumer plastic waste sells for only Ksh 3-4/kg.[51] Fourth, a very lucrative business from post-consumer plastic waste is that of black plastic sheeting for use in building construction. The demand for this item is growing so fast that, at times, even scavengers from the Dandora dump site cannot cope with demand for post-consumer plastic waste. A reasonably clean polyethylene and polypropylene waste could be combined to manufacture the item. While sheeting from virgin plastics costs Ksh 160/kg, one produced from post-consumer waste costs only Ksh 95/kg.

With a view to obtain first-hand information on the challenges and prospects of plastics recycling, a small case study of Green Loop International Limited (GLIL), a company based in Nairobi and which recycles plastic waste, was undertaken. The findings are presented in Box 2 (Shah, Jai. 2005, July 28. Site Visit & Personal interview).

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[50] In this writing, we use source separation and source segregation to mean the same thing.

[51] KSh is a short notation for Kenyan Shillings. 1 Euro= 91.00 Kenyan Shillings; 1 USD= 75.00 Kenyan Shillings (July 2005 exchange rates)

Box 2 Plastic Waste Recycling: The Case of Green Loop International Limited

Currently GLIL recycles HDPE and LDPE waste into injection and blow-moulding grade raw material. They recycle waste plastic sheeting, jerry cans, buckets, bags, etc which they currently collect from all over the country. The major item they collect is plastic sheeting from green houses, which farms used to burn or bury before GLIL [and other recyclers] ventured into the business. At the moment, they buy waste plastics for a price of about Ksh 3 to 8 per kg. The selling price of their finished products is 40 to 60% of the imported virgin raw materials.

GLIL has a capacity of 150t/month of finished product, which can easily be expanded to 300t/month. In addition, there is a capacity for the manufacture of 150t/month of plastic lumber. When there is full-scale washing and production, it offers temporary job opportunities for about 70 to 75 persons. The company sees growing market opportunities for recycled plastic lumber [including posts] and black sheeting for building construction though these might have sizable development costs.

The major technical problem being collection, GLIL is planning to strengthen its relations with CBOs [which also involve scavengers] which are engaged in the collection of recyclable waste. Other challenges at the moment are very high costs for electricity, land and advertisement. GLIL suggests preferential tariffs on electricity and land to help strengthen the recycling sector. Other incentives suggested are waivers on income taxes and duties on purchase of supplies. Advertisement is proving a major cost item for GLIL on which some support [from the government] is desired.

The challenge of collecting flimsy plastic bags is also well noted by GLIL. To this end, the company believes that well established take back mechanisms by supermarket chains could be one way to facilitate recycling of waste plastic bags. Another one suggested is standards for higher gauges.

3.3.5 Composting

An assessment of such practices in Africa as carried out by IETC (1996, p.123) indicates the following:

> *Although the organic content of MSW in urban centres of Africa may exceed 70% (wet basis), centralized composting, anaerobic digestion, and gas recovery are not commonly practiced. Backyard composting is also very limited. Composting is hence an overlooked opportunity and hence, further work has to be done to capture the potential market.*

Achankeng (2003, p.17) argues that although the organic content is high and as a result makes composting appear as a viable activity, trials in many African countries ended with disappointing results. To support his claim, he cites industrial-scale composting projects in Dakar (Senegal) and Abidjan (Cote d' Ivoire) which proved unsuccessful. He also mentions small scale composting projects in Benin, Cameroon, Egypt, Kenya, Nigeria, South Africa, and Zambia, which failed to bring about a significant impact on the MSW reduction of the respective cities. The principal reason for these failed initiatives, according to Achankeng, is low demand for the product due to its poor quality resulting from inadequate source segregation. To support this claim, he cites a study of composting in Mali and Cameroon [by Keita (2001 & 2003] which indicated that increasing quantities of foreign materials such as plastics and packaging contaminated compost manure making it unacceptable to farmers. He additionally refers to a case of composting initiative in Yaounde (Cameroon) which turned a

fiasco due to poor quality of the product as a consequence of plastic contamination and competition from imported artificial fertilizers.

As regards Nairobi city, the NCC claims that the it does not carryout composting activities at the moment. Rather such activities are mainly carried out by CBOs and the products are sold to consumers such as flower gardens. Rural farmers, which were supposed to be the biggest consumers of compost, rely heavily on chemical fertilizers and to some extent on animal manure; this implies the market for compost is limited (Maranga, C. 2005, July 14. Personal interview).

The UNEP study (2005, 36-37), indicates that although the percentage of MSW recovered as compost is only 5 per cent of the compostables at the moment, the practice is growing. The study also notes that major problems composting groups face are the need to procure land to conduct the business [often beyond their means] and the absence of a stable market.

3.3.6 Incineration

In a similar assessment, the IETC guidelines (1996, p.125) note the following features concerning incineration practices in Africa:

> *Incineration and Waste-to-Energy (WTE) systems do not play significant roles in MSW management. Due to the composition of waste [high food residues and moisture[52]], lack of trained manpower and technical infrastructure, and associated high capital costs, incineration is generally regarded as an inappropriate technology in most African cities. Achankeng (2003, p. 17) also supports this observation and claims that the high organic and water content of the waste stream in many urban centres of the continent makes the operation a net energy consumer than a net generator. The high costs of pre-processing involved in the production of Refuse-Derived-Fuel (RDF) pose a challenge to the development of this alternative.*

Achankeng (2003, p. 17) additionally recounts the failed cases of incinerators in Tanzania and Nigeria for the reasons mentioned above.

A discussion with NCC officials revealed that there are no MSW incinerators owned by the Council. However, some hospitals (e.g. Nairobi & Arakai Hospitals) have their own incinerators for burning medical waste. In addition, some pharmaceutical plants (e.g. Twiga Chemicals and RID Pharmaceutical Laboratories) also operate their own incinerators to burn expired drugs (Maranga, C. 2005, July 14. Personal interview).

From the discussion above and taking the contribution such facilities have in Africa, incineration is not expected to assume a substantial role for MSW mangement in Nairobi in the foreseeable future.

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[52] Given an organic content of about 70%, incineration will be an energy-consuming rather than an energy-producing process (IETC, 1996, p. 125).

3.3.7 Collection and transfer

The IETC regional overview on Africa states the following points (1996, p.123).

> *Transfer stations[53] are not common in MSW management practices in Africa. Quite often, disposal sites are located within easy reach, on the perimeter of the city. Collection vehicles go from their point of pick-up directly to the disposal site; generally, they have 6-7m³ capacity. Since collection is a major link in any MSW management, there is a need for the development of contextually appropriate collection schemes in African urban centres.*

Eisa and Vivanathan (2002, 4-5) make additional observations about collection and transfer in African and Asian urban centres. Traditionally MSW management in these regions is the responsibility of municipalities. These bodies finance their operations by the revenues collected in the form of municipal taxes or subsidies from government. Collection rates are poor and irregular resulting in the decomposition of the organic part of the waste. House-to-house collection of garbage exists only in specific neighbourhoods- usually high income areas. This is usually lacking in medium- and low income areas and the problem is even more serious in and around slums. As around 90% of the MSW budget in these two regions is spent in the collection and hauling of garbage to dumpsites, more focus has been placed recently on ways for waste recycling and utilisation.

Coming to Nairobi, we encounter a situation where about 70% of the MSW generated remains uncollected as a result of which residents often times have aired complaints (ELCI, 2005, p. 13). According to the 1998 JICA study, 26% of high income, 16% of middle income, and 75% of low income areas do not get collection services (*Ibid.*). The same source has documented that until the mid 1970s, the NCC collected about 90% of the MSW generated in the city; whereas private sector participation started in the mid 1980s and today there is an estimated of 60 private companies engaged in garbage collection.

A discussion with NCC experts also revealed the following interesting points (Maranga, C. 2005, July 14. Personal interview). At the moment, the NCC has no garbage trucks of its own and all vehicles are hired. Collection by NCC is not regular and the current collection practice is once a week or two weeks which leads to garbage accumulation. This, in turn, results in the scattering of the garbage heap, most importantly of plastic bags which can easily be blown away. In the past, the NCC used to carryout curb-side collection for which it provided garbage bins at each home estate. With the termination of curb-side collection by NCC, CBOs ventured into the collection activity by using big polyethylene bags as a storing medium, which they leave by the road side for pick up by the NCC. These CBOs are better in reaching areas that were not serviced by the NCC. They also recover their costs from charges they collect from households. To a large extent, the CBOs are formed by the unemployed youth.

Maranga (2005, July 14. Personal interview) also claims that the NCC covers its cost of garbage collection and disposal from a 'dust bin charge' of KSh 20/month collected together with water bills from each household having a water meter. The Nairobi Water and Sewerage Company collects the charge on behalf of the NCC. For many years, the charge remained at the same level and as a result a process of revision is in progress. An additional observation that Maranga makes is that there are no transfer stations at the moment. However, the need for one is well understood if the idea of a new landfill materializes. He also claims that in its

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[53] A transfer station is a major facility at which MSW from collection vehicles is consolidated into loads that are transported by larger trucks or other means to more distant final disposal facilities, typically landfills (Global Development Research Centre, 2005).

public private partnership policy, NCC encourages CBOs to establish their own collection centres which could serve as transfer stations from where the NCC could pick up.

3.3.8 Landfilling

IETC (1996, 126-127) has compiled the following assessment about landfilling practices in Africa.

> *Open dumps constitute an overwhelming majority of landfills in Africa. These have no leachate treatment and gas recovery systems. The result is unsafe facilities which result in public health risks and poor aesthetics. Such facilities are often located at the perimeter of major urban centres, open areas, wetlands or next to surface water sources. Lack of financial resources, trained manpower and appropriate policies limit the degree of success to which landfills can be built, operated and maintained. Site selection for landfills often considers accessibility to vehicles as a major criterion; hydrological and public health considerations are often neglected. Most of such facilities are unlined and unfenced. Compaction and application of daily cover are not often done. Large numbers of waste pickers usually make their living by recovering some valuable materials. Operation and maintenance costs are covered from municipal budgets and often fall short of actual expenditures.*

The situation in Nairobi corresponds well with the above observations. The city has only one official landfill at *Dandora* located at about 7.5 km south east of the Central Business District (CBD) which is 'owned' and operated by the NCC (UNEP, 2005 p.27). It is located in a densely populated area (*Ibid.*). The facility is technically an open dump. It has an area of about 27 hectares and contains an estimated of about 1.3 million m^3 of garbage disposed of over a period of 14 years. Gate fees are charged by NCC on the basis of vehicle capacity which range from KSh 30-100 (USD 0.40-1.30) (CWG, 2003, p. 6). The site receives all types of solid waste, i.e. domestic, industrial, commercial, institutional, and hospital waste (JICA Interim report, 1997, p.2-6). In addition to the evident adverse impacts on groundwater and local air qualities, leachate from the dumpsite has severely affected the nearby Nairobi River (*Ibid.*). A *Hotspot* report for Nairobi based on a study by the International Persistent Organic Pollutants (POPs) Elimination Project additionally established that the area around the dumpsite is highly contaminated with POPs as a result of open air burning of garbage (IELP, n.d.).

The costs of disposal at Dandora are relatively high due to a number of reasons. First, the place is located at the periphery of the city. Second, there are no transfer facilities in Nairobi. Third, there are additional expenses related to insecurity (CWG, 2003, p. 6). Concerning security, a gang of waste pickers and dealers have control over the site. Each gang controls *its territory* and claims property right not only on *its* plot but also on the garbage that is dumped there and on garbage trucks [that are forced to tip only in specific areas]. In addition, all garbage truck divers (NCC inclusive) are expected to abide by the rules of the gangsters, lest the trucks will be vandalized. As a result drivers usually pay for a police escort which has repeatedly proved useless as some of the gangs are armed criminals disguised as waste dealers (*Ibid.*).

According to the NCC (Maranga, C. 2005, July 14. Personal interview), the Dandora site has been operated originally, as a 'controlled dumping site' where disposed garbage used to be covered by soil on a daily basis. With time, however, the site degraded into an open dump as machinery depreciated and financial resources dwindled. There is an intention from NCC to close down the Dandora dumpsite and open a new sanitary landfill at Ruai which is about 30km from the centre of the city. Given this distance, there is a need to set up a transfer

station at *Umoja* Estate which is about 6km from the centre. Given the two tasks, i.e. closure of Dandora and opening of Ruai, project costs are expected to be very high.

However, there are a number of problems surrounding Ruai as a future landfill site. First, although the land is property of the NCC, there are some people who claim ownership which has led to a dispute. Second, the civil aviation authorities have filed objections claiming the landfill will interfere with the operations of the Jomo Kenyatta International Airport (i.e. birds from the site) as the site is along the flight path of aircrafts. Third, the local residents are also against the opening of the landfill site [NIMBY attitude] (Maranga, C. 2005, July 14. Personal interview). NEMA officials also pointed out the same obstacles around Ruai and further remarked that there is encroachment on the land by illegal settlers and it is as a result getting smaller by the day. In addition, NEMA argues that lack of any other suitable location with no settlements around will pose serious challenges in Nairobi's search for a sanitary landfill (Mbegera, M. 2005, July 5. Personal interview).

In view of the technical and financial constraints surrounding Ruai and the absence of another near-by site, sanitary landfilling as the main option for Nairobi's MSW disposal will entail quite a lot of challenges. This would mean MSW management will have to rely more and more on source reduction and the accompanying technical solutions, i.e. recycling and composting. However, since some waste will, always, have to be disposed of at the end, a sanitary landfill should form an essential component of Nairobi's MSW infrastructure.

3.3.9 Special Wastes

IETC (1996, 127-128) gives the following observations on the status of special wastes in African urban centres:

> *In most instances, facilities and services are not available for the handling of special wastes, e.g. Hazardous Household Waste (HHW), construction waste, Medical & Infectious Waste (MIW), tires, sewage sludge and chemical & pharmaceutical waste. These wastes are often collected together with other MSW streams and co-disposed of at a common dumpsite. Some institutions have incinerators to burn MIW. Materials of economic value are recovered; e.g. tires and lead-acid-batteries are recycled to a certain extent.*

Eisa and Visvanathan (2002, p.7) also describe a situation similar to the above in most urban centres of Africa and Asia, i.e. regulatory and enforcement systems to control hazardous and toxic waste are usually non-existent or not operating.

In Nairobi, source segregation of waste does not take place. The NCC, for instance, collects all domestic, commercial, industrial, hospital and market waste together. No care is taken to collect hazardous waste separately (Maranga, C. 2005, July 14. Personal interview).

The fact that hazardous waste including HHW is not separately collected will have a bearing on a number of treatment operations. Most important in this respect is composting whose quality would be severely affected with small quantities of hazardous waste mixed with the raw material. Hence separate collection of hazardous waste deserves attention.

3.4 Status of Plastic Bag Pollution in Nairobi and Root Cause Analysis

A plague of plastic, an article by Billy Kahora (Ecoforum, 2005, p. 23) describes massive volumes of plastic bag waste characterizing Nairobi. According to this article, the problem in this city is only an indication of what has become a challenging national problem. It portrays a situation in which all the major roads out of Nairobi as being "*lined with more plastic than grass*" and all major urban areas in the country covered "knee-deep in plastic" *(Ibid)*.

Exaggerated the above description might seem, environmentalists, top politicians, members of parliament, and ordinary people have repeatedly complained about the problem (UNEP, 2005, p. 37). The 2004 Kenyan Nobel Peace Prize Laureate professor Wangari Mathaai, is at one time reported as saying, "*If they wrap your fish and chips in plastic bags, please refuse the food*" (Ecoforum, 2005, p. 23). In a similar tune, the president of the country, Mr. Mwai Kibaki, in the opening speech he gave to the UNEP Governing Council Forum of February 21, 2005, said, "*In our major cities, plastic bags are used in large quantities at the household level. However, these bags are not disposed of in ways that ensure a clean environment; my country welcomes initiatives to address the problem*" (NEMANews, 2005, p. 6). One other incidence of public concern is that of the Wildlife Club of Kenya which organized a march to urge the government to regulate plastic bag manufacturers (Wikinews, March 9, 2005).

Littering of plastic bags is associated with a number of environmental problems in Kenya [most of which are also common to other countries]. These problems among others comprise: (a) visual pollution (blight) that affects sectors such as tourism, (b) blockage of gutters and drains; and (c) threat to aquatic wildlife and livestock in the event the bags are mistaken for food and ingested (UNEP, 2005, p.37). Nobel laureate Wangari Mathaai has remarked that unduly disposed of plastic bags usually fill up with rainwater and serve as ideal breeding grounds for mosquitoes which cause malaria (Wikinews, 2005, March 9). Although no independent studies are available indicating the contribution of discarded plastic bags to malaria incidences, the disease undoubtedly remains one of the major health problems in Africa.[54] Hence, the need for further studies to substantiate these claims is justified.

In one of the slums of Nairobi, *Kibera* (also one of Africa's biggest slums with an estimated population of 500 000 people) and other similar settlements, plastic bags are identified with '*flying toilets'*. This is a practice in which, due to lack of adequate toilet facilities, residents of these areas are forced to relieve themselves in plastic bags which they then throw away (ELCI, 2005, p. 18). Concerned with the health hazards of such practices, the African Medical and Research Foundation (AMREF) launched a project to reduce such practices by constructing communal toilets and showers (*Ibid.*).

A discussion with manufacturers indicated that the bags most responsible for littering are carrier bags of 6 microns (known locally as *juala*) for which there is a very high demand due to their affordability. Although a shift has been made to 10 microns as per the Kenyan standard, littering still continues owing to lack of effective collection and recycling infrastructure (Haria, Nishit & Srivathsan, P.S., 2005, July 21, Personal Interview).

Once disposed of in the open environment, plastic bags tend to scatter with the help of wind due to their light weight, which also makes them difficult to collect. As a result, they have now

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[54] The World Health Organisation (WHO) estimates that every year about one million people die from this disease alone of which 90% is in Africa (Fighting Malaria, 2005).

littered road sides, open spaces and rivers in Kenya. In the Nairobi River, they are the major causes of blockage and stagnation. In open dumpsites such as Dandora, the accumulation of plastic bag waste increases year after year due to their poor degradability (Maranga, Crispus. 2005, July 14. Personal interview).

At this juncture, it should be noted that the challenge in Nairobi and in Kenya is only one part of a growing problem due to unsustainable production and consumption of these materials in the whole of Africa. The challenge is common to all urban centres of the continent.[55] For instance, UNEP's Regional Office for Africa often receives a number of requests from many African countries on how to deal with the problem of plastic waste (UNEP, 2004, p.28). Hence, the issue has become one of the priority areas identified by the First African Expert Meeting on the Ten Year Framework Programme on Sustainable Consumption and Production (ARSCP) (UNEP, 2004, p. 29).

3.5 What Has Been Done in Response

3.5.1 NEMA-UNEP-KIPPRA Study[56]

In February 2005, NEMA and UNEP commissioned KIPPRA to develop an environmental policy to address the country's solid waste management problem.

The study examines and discusses the use of economic instruments for environmental management in Kenya. It singles out plastic bag waste for intervention measures because of their "importance, high political & public attention and availability of international experience to learn from" and as doing so offers "great opportunity for Nairobi to reduce the use of these bags and all forms of nuisance associated with their use".

The general findings of study, referred to as UNEP (2005) throughout this thesis, are briefly summarised here below:

a) Nairobi was the focus of the study as the MSW sector in this city is characterized by low coverage of MSW services, uncontrolled dumping, inefficient public services, unregulated private sector participation, and lack of key solid waste management infrastructure.

b) The MSW sector in Nairobi lacks policy and strong reuse and recovery industry; to this end, the percentage of solid waste that is recovered is only about eight per cent of the recyclables and five per cent of the compostables.

c) NCC and private companies combined are collecting around three quarter of the waste from high-income areas while collection services in slums and unplanned settlements are non-existent notwithstanding that up to 60 per cent of Nairobi's residents live in these low income areas. Private sector participation in MSW management is un-regulated where currently an estimated of at least 60 private companies are engaged in MSW collection services in the city. There is also widespread indiscriminate dumping in illegal dumpsites.

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[55] For instance, plastic bag waste is also an emergent MSW problem in the author's hometown of Addis Ababa, Ethiopia. Although this research did not look into its magnitude and current status in this city, discussion with some experts of the Ethiopian Environmental Protection Authority revealed that the problem is real and growing.

[56] Summarized from (UNEP, 2005, ix-xiii).

Its specific findings concerning plastic bags are the following:

a) Industry estimates that about 4 000t of plastic bags are produced monthly in the country, with an estimated 2 000t going into the waste stream.

b) About half of the plastic bags produced in the country are less than 15 microns in thickness (e.g. bread bags are between 6 and 7 microns); it is these thin plastic bags that are prone to inadvertent littering.

c) Recycling and reuse of post-consumer plastic bags is very low.

d) Except paper bags, there are no alternatives to plastic shopping bags in the country; while shopping bags made from natural products are available they are less used because of the availability of plastic shopping bags.

The study recommended the following policy package of seven instruments to manage plastic bag waste in Nairobi which are to be introduced gradually over a period of two to three years:

1. *A ban on plastic shopping bags that are less than 30 microns in thickness*
2. *Consumer awareness and anti-littering campaign*
3. *Promotion of voluntary schemes such as a national code of practice for retailers*
4. *A plastic bag levy collected from suppliers*
5. *Support for development of environmentally-friendly alternative bags*
6. *Support for development of an effective plastic bags recycling system*
7. *Support for development of a managed disposal system to cater for the plastic bags that will enter the waste stream irrespective of the measures taken.*

The plastic bag levy is the key economic instrument proposed in the package. Accordingly, the fund to be raised from it is to be earmarked to support development of environmentally-friendly alternative bags; an effective plastic bags recycling system; and a well-managed disposal system. The study proposed a pilot project to implement the policy package to be managed by a committee legally constituted and accountable to NEMA. Lessons learned from the pilot project are expected to be useful to the design and implementation of similar environmental policy packages for other MSW areas in Kenya and other developing countries.

KIPPRA claims that although the government is interested in the implementation of the policy packages, not much is happening in practice (Ikiara, Moses. 2005, July 8. Personal interview). Also, no independent reports were available to the author, at the time of this writing, as regards status of this initiative.

3.5.2 Private Sector Initiatives: KAM-NEMA

In May 2003, plastic industries under KAM together with NEMA came up with what is known as the Ten-Point Action Plan on Plastic Waste Management (Kimilu, Damaris, 2004, p. 5). It has the following provisions (*Ibid.*):

1. *By 2006, plastic manufacturers to recycle 15% of their industrial output*
2. *NEMA to instruct local authorities, retail chains, hotels and restaurants on their obligation to recover 75% of plastics in the environment by 2006*
3. *Production and purchase of flimsy plastics to be phased out immediately*

4. *NEMA to issue advisory to all stakeholders on the agreements and actions on plastic waste management*
5. *Government to issue differential power tariffs for recycling*
6. *KAM to lobby for investment tax allowance of 140% on recycling machinery for incorporation in year 2005 finance bill*
7. *Develop new standard to increase plastic bag thickness by July 2004*
8. *All manufacturers to apply new plastic thickness standard by July 2005*
9. *Develop plastic disposal guidelines by July 2004*
10. *Formulate by-laws on littering for cities and towns by July 2005*

Consequently, the private sector held consultative meetings with the KNCPC to explore possibilities of technical support by the centre. In September 2004, both parties held a workshop where the status of the Plan was evaluated. The following were the main recommendations (KNCPC, 2004): (a) there is need to monitor progress on agreed targets in recycling; (b) KEBS should spearhead creation of national awareness regarding the new thickness standard; (c) the development of incentives to the plastic sector should be expedited; (d) NEMA should liaise with local authorities to ensure enhanced collection of plastic waste that is already in the environment as well as developing legal measures on littering; (e) there is a need for research and development on the use of waste plastics to make useful and marketable plastic products; (f) KNCPC is mandated to secure, package and champion best practices in plastic management; and (g) the need for technical guidelines on incineration of plastic waste and energy recovery is recognised.

However, there are no independent reports from other organisations, e.g. NEMA and KEBS indicating status of compliance. The one carried out by KAM is presented in Table 3-1 below.

Table 3-1 Ten-point Action Plan: Mid-2005 Status as Reported by KAM

Agreement	Implementer	Implementation Status
Recycle 15% of industrial output by 2006	KAM (Manufacturers)	In progress
Develop new standard to increase plastic bag thickness by July 2004	KAM & Kenya Bureau of Standards (KEBS)	KS 1794 developed Nov 2003; gazetted October 2004
Apply new plastic bag standard by July 2005	Industry to apply standard; KEBS to enforce standard	Manufacturers have applied KS 1794 since October 22, 2004
Phase out production of flimsy plastics	Industry to stop manufacture of less than prescribed microns	Bag thickness has been increased via new standard
Recover 75% of plastics in the environment by 2006	NEMA to direct Local Authorities, retail chains, hotels and restaurants	NEMA / Local Authorities
Government to offer differential power tariffs for recycling	KAM to Propose to Ministry of Finance / KPLC	Manufacturers made proposal in 2005 Finance Bill
Government to offer investment tax allowance of 140% on recycling machinery	KAM to propose to Ministry of Finance	Manufacturers made proposal in 2005 Finance Bill

Agreement	Implementer	Implementation Status
Develop plastics disposal guidelines by July 2004	Local Authorities	Not done
Formulate by-laws on littering for cities and towns by July 2005	Local Authorities	Not done
Issue directive to all stakeholders on agreements and actions on plastic waste management	NEMA	Done as a one off thing.

Source: Kimilu, Damaris (2005).

Bimal Kantaria (2005, July 22. Personal interview) claims that KAM has set up a committee representing the plastic sub-sector to oversee the implementation of the Plan. Relevant list of activities, e.g. public awareness and clean-up campaigns were also agreed up on. During the period May 2003- September 2004[57], KAM had been engaged in fund raising activities for the plan (KNCPC, 2004, p.14). KEBS claims that implementation of the standards has started but has no status reports to substantiate the claims (Ombok, Samson. 2005, July 5. Personal interview). MoTI acknowledges that the ten-point plan is progressing slowly (Munyao, Gregory. 2005, July 7, Personal interview).

3.5.3 The Pilot Project on Plastic Waste Management in Nairobi

Desta Mebratu of UNEP's Regional Office for Africa (in Nairobi) gave the following descriptions of the pilot project in the launching meeting which was officially launched on the 19th of July 2005.[58]

This is an ongoing pilot project developed by UNEP in collaboration with NEMA and KAM and other partners like NCC, KNCPC, etc. It is aimed at strengthening the on-going efforts on the issue in Kenya and developing region-specific experiences on plastic waste management in African urban centres. In particular, it endeavours to build on the experiences of the Ten Point Action Plan.

The project has the following four components to be managed by the implementation team shown in parenthesis:

a) **Comprehensive strategy**: development of a comprehensive plastic waste management strategy framework for Nairobi (KNCPC);

b) **Policy measure**: providing input for the design and implementation of economic instruments and related policy measures through stake-holder consultations (KIPPRA);

c) **Recycling**: Increasing recycling of plastic waste through the provision of support to CBOs engaged in such activities (ITDG); and

d) **Awareness and education**: conduct awareness and education programs for the general public on the rational utilisation and disposal of plastic products (MCL SAATCHI and SAATCHI- a media group).

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[57] Date of KNCPC Workshop on Plastic Waste Management; an evaluation of the plan was presented by Bimal Kantaria.

[58] The author participated in the launching meeting by presenting the experiences of the Indian and South African policy interventions on plastic bag waste based on his research paper from IIIEE's 2005 ARPEA II course. This was kindly facilitated by UNEP.

The first meeting of this committee took place on August 5, 2005 in which the author was privileged to participate.

3.5.4 Plastic Bag Standard by KEBS (KS 1794:2003)

As indicated in Table 3-2 above, KS 1794 was a response to the growing plastic waste menace. It was developed in November 2003 and gazetted in October 2004. According to the standard document, the corresponding Indian and South African standards were used to develop this Kenyan equivalent.

Entitled, *Polyethylene and polypropylene bags for general purposes-specification*, KS 1794 has the following major provisions (KEBS, 2003, 2-6):

a) In order to encourage re-use and hence to reduce the impact on the environment, a minimum thickness is set for the various types of plastic bags, i.e. LDPE & LLDPE (15μm), HDPE (10μm) and PP (20μm);

b) Bags manufactured for food products like bread and milk should be printed with food-grade pigments;

c) It applies for monolayer PE and PP film bags for commercial and household packaging of products; it does not cover multi-layer bags; and

d) The allowable printing ink types are specified along with the permissible weight of printing ink (dry-basis) compared to the un-printed bag.

Both KAM and the plastic sector group claim that member industries have already complied with the minimum thickness requirement (Kimilu, Damaris. 2005, June 30 & Kantaria, Bimal. 2005, July 22. Personal interviews). However, no independent evaluations are available (to the author, at the time of this writing) to justify the claims by industry.

3.5.5 ITDG

David Kuria of the Intermediate Technology Development Group- East Africa (ITDG-EA) described the role of the organization in MSW and plastic waste management in Kenya as follows (Personal interview, 2005, June 24).

ITDG is a global NGO engaged in the development of appropriate technologies with focus on supporting the livelihood of the poor. However, MSW is a relatively new area. Although some studies have been conducted on MSW in Nairobi city, specific studies on plastic waste have not yet been undertaken.

ITDG's waste management sectors comprise paper (which is well developed), plastics, organic composting (well developed), metals and bones. The plastics waste management projects have been conceived for three Kenyan cities, i.e. Nairobi, Nakuru and Kisumu. The group signed Memorandum of Agreements in 2004 with two local universities, i.e. University of Nairobi and Egerton University for the development of appropriate technologies for MSW management in Kenya.

ITDG believes that before any technologies are developed that address the plastic waste sector [in Kenya and Nairobi], a techno-economic feasibility study has to be carried out. ITDG does not regard the hard plastic waste stream as problem area. The challenge comes from flimsy plastic bags. The Group is aware of some local endeavours on collection and

utilization of plastic bag waste in Kenya. An example is the manufacture of plastic poles from such waste at Naivasha town which has been underway for about two years. It also claims that relatively high volume and clean plastic sheeting waste from the many green house farms in Kenya seem relatively well suited for the manufacture of plastic poles and similar products.

3.5.6 Chain Stores: The Case of Nakumatt and UCHUMI

Nakumatt and UCHUMI are the two biggest supermarket chains operating in Kenya. They provide customers with free, branded and plain plastic shopping bags.

A discussion with one of the stores of UCHUMI in Nairobi revealed that the chain store encourages customers to return used plastic shopping bags. To facilitate this, collection bins have been provided by most of its outlets. Although alternative carton packaging is available, re-usable bags (e.g. cloth bags) are not made available. The cost of plastic bags is part of the overhead expenses of the stores and there is no direct charge to customers (Kimathi, Loise. 2 July, 2005. Personal interview). Further discussion with the management revealed UCHUMI's strategy on the plastic bag waste issue. Its approach to deal with the problem is a "4R Strategy", namely Reduce, Re-use, Recycle and Recover[59] (Karanja, Sam. 2005, July 18. E-mail communication)

Regarding the 30μm minimum thickness recommended by KIPPRA, the company believes that this will have considerable cost implications to consumers. Hence, it supports the current 10 and 15μm KEBS standard although it doubts the impact of this on environmental improvements.

UCHUMI acknowledges the success achieved in South Africa in reducing plastic bag use at retail outlets as a result of the South African government intervention, which demanded consumers to pay full costs of bags issued. The only concern to UCHUMI is loss of promotion as people resort to re-usable bags or other alternatives and the use of 'mixed' bags bearing the marks of different retailers in one shop. The company also believes that there should be a clear mechanism by which plastic litter in the environment could be collected. It encourages its customers to return the bags they have checked out to collection points at the outlets. Currently, the feasibility of resorting to biodegradable and degradable materials is being evaluated by the chain store.

Discussions with Nakumatt personnel indicated similar results. Nakumatt stores have also provided bins to facilitate return of packaging by consumers, e.g. tins, plastics, etc; but plastic bags are not returned. Nakumatt also claims that it provides brown paper bags and cartons as alternatives but not cloth bags. The cost of plastic bags is absorbed by the company itself (Muigei, Sammy. 2005, July 8 Personal interview).

3.6 Status of Private and Community Based Organizations

Crispus Maranga from NCC (describes the role of Community Based Organisations (CBOs) and private companies as follows. CBOs are assuming increasing responsibility in the collection of garbage from home estates and depositing them at central points. They also organize cleansing campaigns within their own locality in close collaboration with the NCC. They have a growing role to play in scavenging, composting, and recycling. However, most

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[59] *Recovery (energy): use of combustible packaging waste as a means to generate energy through direct incineration with or without other waste.* [UCHUMI intend to liaise with concerned stakeholders to realise this]

CBOs at the moment work independently without due recognition of the valuable service they provide. To change the situation, the NCC has formulated and endorsed a Public Private Partnership policy through which they are expected to collaborate with the NCC. This is believed to change their status for the better. On the other hand, private companies are increasingly being hired by affluent residents to collect and dispose of garbage. They are also hired by the NCC for collection and disposal of same. All in all they collect about 30% of the total waste generated by Nairobi (2005, July 14. Personal interview).

The role that CBOs are playing in the collection, recycling and composting of MSW in Nairobi can be understood from a closer look at one of them, namely the *Kayole* Environmental Management Association (KEMA). It is presented below (Box 3) as a small case study (Munywe, Simon. 2005, June 27. Site visit & Personal interview) & (KEMA brochure. n.d).

Box 3 MSW Collection, Recycling and Composting: the case of KEMA

KEMA was founded in January 1999 by 23 residents of the *Kayole* estate of the city of Nairobi. It is registered as a CBO with the Ministry of Social Services [of Kenya] in 2000.

The residents of Kayole made a thorough investigation of the causes of blockage of sewage and water drains in their locality and found it to be due to plastic bags which they also identified as the major polluters of the city. According to the chairman of KEMA, Simon Munywe, the residents found it necessary to establish the association as garbage dumping and accumulation in the Kayole estate increased at an alarming rate as the NCC failed to discharge its MSW management responsibilities. As a result, recurrent breakouts of waterborne diseases such as malaria, typhoid and cholera became common. Hence, setting up a CBO (KEMA) was found necessary.

The chairman describes the objectives of the association as complimenting NCC's activities in MSW management; mobilizing the residents of Kayole estate to work on improving their living environment; creating employment for the youth; creating public awareness in waste management; and 'turning garbage into wealth' by producing products from waste.

KEMA, also according to the chairman, offers garbage collection services twice a week for about 120 000 residents of the estate for a monthly payment of Ksh 100/household.

Treatment of collected garbage involves the following operations. First, the organic fraction is composted and sold to urban and peri-urban farmers at a price of Ksh 10/kg. The compost is available in 5, 10, 20, and 50 kg bags. The non-biodegradable component is segregated into four fractions, i.e. metals, glass, paper and plastics. The metals are used for the in-house manufacturing of useful implements like maize shellers. The glass is sold to glass recyclers. The paper is mixed with other combustible materials like dry leaves to produce fuel briquettes using an in-house manufactured briquetting machine. The plastics are used to produce a number of products. The bags are used to make mattresses, pillows, handbags, cushions, hats,

carpets, waste paper baskets, etc. In addition, other thermoplastics, including HDPE & LDPE, are re-melted and moulded to make a number of products like fencing posts and roofing tiles. What remains after composting and recycling is burnt on-site to minimize garbage pile-up.

The composition of the waste collected in the Kayole estate (according to the chairman) is about 70% organic and 30% non-biodegradable. Out of this, the plastic content is reported to be 28% which seems relatively high in light of other studies (ITDG, 2005; JICA, 1997). The chairman estimates that NEMA can currently produce 50 fencing posts/day (15kg each; 6 ft by 4 in. diameter) and 400 tiles/day (2kg; 40cm by 27cm). Selling prices at the time are Ksh 350/post and Ksh 25/tile. In addition to the plastic material that is obtained from the garbage collected, KEMA buys additional material from waste scavengers at a price of 10Ksh/kg.

Major achievements of the association after its inception are claimed by the chairman to be: reduction of uncontrolled MSW dumping in the locality and a corresponding decrease in incidence of diseases resulting from unsanitary conditions; and employment generation for about 400 persons, of which 40 used to be 'street children'. The following are the major problems of KEMA as described by the chairman: equipment used are sub-standard (unsafe); people do not recognize the value of the services rendered by KEMA, i.e. very limited market for products; space limitations, i.e. KEMA was not able to secure separate area to carry out its waste classification and recycling activities; and lack of appropriate vehicles to haul garbage (hand carts used to a greater extent at the moment).

Based on the discussions held with the chairman and visual assessment of the premises of KEMA, the following observations are made by the author. There is a need to create additional demand for the products of environmental CBOs such as recycled plastic fencing posts. In addition, appropriate technology for the manufacture of products from recycled post-consumer plastic waste should be sourced and provided to such CBOs. Such possibilities, for example, can be explored by the government in close consultation with the Intermediate Technology Development Group (ITDG)- Eastern Africa.

3.7 The Plastic Manufacturing Sector in Kenya

3.7.1 Manufacturing Sector in Kenya: Current Performance

A recent economic survey published the following results about the Kenyan manufacturing sector. In 2004, real output in the manufacturing sector grew by 2.7% compared to 1.4% the previous year. Total employment rose from about 240 000 persons in 2003 to about 242 000 persons in 2004. Total value of manufacturing sales, which was KSh 317 291 million in 2003 rose to KSh 332 904 million in 2004, an increase of about 5%. The estimated value of manufacturing output increased by about 17% in 2004 over the previous period; the value of output for the year 2004 was about KSh 450 billion (CBS, 2005, 176-182).

3.7.2 The Plastic Manufacturing Sub-sector

The first plastic factory in Kenya was inaugurated on November 16, 1968. At the time, the then minister of Commerce and Industry (currently the president of the country), Mr. Mwai Kibaki, is reported as having hailed the use of plastics as "a new boon to young developing nations" (Kimilu, 2004, p.1).

In 2004, the plastic manufacturing sub-sector grew by 2.9%. To this end, manufacture of plastic crates, bottles and plates increased by about 20%, 6.8% and 12.7% respectively (CBS, 2005, 176-182).

According to Damaris Kimilu of KAM, the Kenyan plastic manufacturing sector has the following salient features. There are an estimated of about 110 to 115 plastic industries

employing about 11 000 people. The industries have a combined production capacity of about 7 000t/month (84 000t/year). In addition to local production, there is also import of various plastic products which has been on the increase. To this end, about 170 240t and 302 672t of bags and sacks of various plastic materials were reported to have been imported for the period covering 1989-97 and 2002-03. The industry is growing at a rate of about 8 to 10% per annum providing its products both to the local and regional markets of the neighbouring countries (2005, June 30. Personal interview & Kimilu, 2005).

Bimal Kantaria (2005, July 22, Personal interview) estimates the total plastic products consumption in the country a bit higher, i.e. around 10 000t/month (120 000t/year). For the current Kenyan population of about 32 million, per capita consumption would be about 3.75kg/person.year. This looks justified taking the figures for India (4), China (18) and industrialised countries (80-100) as discussed in Chapter 4.

3.7.3 The Plastic Bag Manufacturing Industry

Manufacture of plastic bags in Kenya took off around the early 1990s strongly driven by consumer demand (ELCI, 2005, p.26). To this end, major growing Kenyan supermarkets like UCHUMI resorted to using them as paper bags were proving scarce and expensive. Another reason was that plastic bags turned out to possess better features in many respects (*Ibid.*).

Of the 7 000t/month output, a sizable 4 000t/month is plastic bags of mainly 6-7µm thickness and primarily used for carrying consumer products (UNEP, 2005, p. xii). This translates to 48 000t/year of plastic bags (Kimilu, D. 2005, June 30. Personal interview) & (Kimilu, 2005). Bimal Kantaria (2005, July 22. Personal interview) gives a relatively lower estimate of plastic bag consumption in the country, i.e. 2 000t/month (24 000t/year). He also states that there are 45 plastic bag manufacturers registered with the Kenya Association of Manufacturers.

Of the estimated 4 000t/month plastic bags produced, about half are less than 15 microns thickness (UNEP, 2005, p. xii). In this category fall plastic bread bags with an average thickness of only 6-7 microns- which are the major causes of inadvertent littering (*Ibid.*).

3.8 Emerging Alternatives: Environmentally Degradable Bags

3.8.1 Types, Challenges and Prospects

An ASTM definition of degradable, bio-degradable and compostable plastics follows below (Biocycle, 2002):

Degradable plastics: *A plastic designed to undergo a significant change in its chemical structure under specific environmental conditions, resulting in a loss of some properties that may be measured by standard methods appropriate to the plastic and the application in a period of time that determines its classification.*

Biodegradable plastic: *A degradable plastic in which the degradation must result from the action of naturally occurring micro-organisms.*

Compostable plastic: *A plastic that undergoes biological degradation during composting to yield carbon dioxide, water, inorganic compounds and biomass at a rate consistent with other known compostable materials and leaves no visually distinguishable or toxic residues.*

Degradable plastics, unlike conventional ones, are manufactured to accelerate their decomposition through two common methods, photo-degradation and biodegradation (PENNSTATE, n.d.). In photodegradable polymers: (a) breakdown depends on irregularities

in the polymers which cause the material to slowly degrade when exposed to UV light, typically sunlight; and (b) the rate of degradation is increased by adding photosensitive substances called promoters (*Ibid.*)

Whereas, in biodegradable polymers: (a) micro-organisms like bacteria, fungi and algae break down the polymer chains and consume the resulting materials; and (b) degradation mechanisms usually take two forms, i.e. hydrolysis in which the polymers chemically react with water, and water dissolution, in which the materials physically dissolve in water (*Ibid.*). Common biodegradable plastics are polyesters, polyhydroxybutyrates and vinyl polymers (*Ibid.*). The three well known standards, i.e. the American ASTM D6400-99, the Japanese GreenPla, the European Committee for Standardisation of the EU all have three basic criteria on compostable plastics, i.e. biodegradability or mineralization measured by evolution of carbon dioxide after microbial assimilation; and ability to disintegrate and become not visible and not recognizable after composting; and (c) no impact on the ability of the compost to support plant growth (Biocycle, 2002).

While the idea of (bio-) degradables is appealing from environmental protection point of view, these plastics remain a matter of contention regarding their effects on litter abatement and recycling. For instance, Food Production Daily (2004) contends that bio-degradable plastics should not be considered as a remedy for wasteful consumption and littering as these bags do not address the fundamental issue of waste. Studies also indicate that while degradable plastics could reduce the visual impacts of plastic bags in the litter stream, there is, however, insufficient evidence to conclude that whether these bags will have a positive impact on littering behaviour. One fear is that consumers will tend to believe it is safe to litter as the bags will eventually breakdown leading to an increase in littering behaviour (PNSW, 2004, p.7). Without change in behaviour of people towards littering, they will still continue to throw away these items even more carelessly with the perception that they would degrade any way. Therefore, biodegradable packaging alone cannot give a solution to littering but rather a mix of alternatives have to be considered, namely campaigns to change littering behaviour; provision of facilities such as collection bins and labelling; and use of economic instruments (Ren, 2002, p.35).

The most important factor driving the development of the biodegradable plastics sector is the challenge surrounding the recycling of conventional plastics; hence, biodegradable plastics are developed to find ways around this problem and are not as such inherently designed for material recycling (Ren, 2002, p.28). Mixing of biodegradables with recyclables will adversely affect the quality of the recycled product because in a standard recycling operation, biodegradables will simply decompose and hinder further processing. To avoid this, products made of biodegradables should be labelled as such and should be kept apart from recyclables (Ibid.) The same arguments are supported by PNSW (2004, p.7).

3.8.2 The Status in Nairobi

There are no satisfactory alternatives to plastic shopping bags in Kenya except for some paper bags (UNEP, 2005, 36-37). Although shopping bags made of natural fibers are present in the market, their use is limited because of the availability of plastic shopping bags and their low cost to the consumer (*Ibid.*).

One of the biggest supermarket chains in Kenya, Nakumatt, officially introduced 'degradable shopping bags' in one of its shops on the 6th of July 2005 in the presence of the country's minister of Environment and Natural Resources. The Minister, at the time, urged consumers

to use the new bags "not only to reduce environmental pollution but also to stop the ugly scenes of bags hanging on trees" (Daily Nation, 2005, July 7).[60] He also reportedly urged the baking industry to consider changing the packaging of their products which is amongst the major contributors towards the problem (The Standard, 2005 July 13). The launch placed Kenya in the World Environmental Protection Programme in the fight against global pollution (Daily Nation, 2005, July 7 & The Standard, 2005 July 13). The bags were developed for Nakumatt by Packaging Industries Limited (PIL) (The Standard, 2005 July 13).

A discussion with PIL management concerning these bags revealed that they are of the photo-degradable type and not bio-degradables. Due to market limitations, PIL's current production capacity is limited to about 150t/month; however, there is a capacity for up to 1 100t/month. It was also learnt that the bags have been tested for 'accelerated ageing' in Switzerland, Italy and India and the results indicate that they become brittle and start to photo-degrade in 12 to 14 months.[61] The additives used in the bags are compatible with recycling operations of conventional plastics. On film thickness, PIL claims that the ones launched by Nakumatt are 20-25 microns. Overall, they incur a 15 to 20% cost increment over the conventional ones used previously (Haria, Nishit &. Srivathsan, P.S., 2005, July 21, Personal Interview).

In addition, PIL management is of the opinion that degradable plastics are not the long-term solution to the menace. It is rather a relief measure. An effective recycling system is PIL's policy for a lasting solution. To this end, manufacturing facilities in Italy have been visited by the management which operate effective post-consumer waste recycling machinery, even highly contaminated ones. PIL believes this to be applicable also in Kenya. On the contrary, the company has not considered the implications of compostable plastic bags (Haria, Nishit &. Srivathsan, P.S., 2005, July 21, Personal Interview).

Similar discussions with the management of Prestige Packaging Ltd. revealed that the company is in preparation to launch degradable bags for the other big supermarket chain, UCHUMI. Prestige also claims that it is not known for sure how fast the bags will degrade as the technology supplier did not give any guarantees and no field tests have been conducted in Kenya. The proposed bags are expected to cost as much as 30% higher than the conventional ones. Hence, given such a cost increment, it is only the formal sector which accounts for less than 5% (e.g. UCHUMI) which could afford to pay the premium; the remaining informal sector (e.g. street peddlers) is not expected to go for such alternatives (Kantaria, Bimal. 2005, July 22. Personal interview).

As much as the Nakumatt-PIL endeavour is commendable, in the opinion of the author, the fact that the bags are labelled both 'biodegradable' and 'recyclable', while they are of the photo-degradable type, could be misleading. This could have a bearing on recycling and composting activities. The merits and de-merits of compostable plastic bags over degradable ones is not explored. From resource utilization point of view, it goes without saying that both recycling and composting seem to have advantages over simple photodegradation which is wasteful. This needs to be further explored. A similar evaluation, by the author, of the Prestige-UCHUMI plan to launch degradable bags indicated that it is not well thought through as regards the environmental and cost implications as well as on possibilities to go for compostable bags.

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[60] The scene of plastic bags hanging from trees is probably the most telling impact of post-consumer plastic bags in the Kenyan environment as discussions with residents indicate.

[61] PIL claims that the test standards used were BIS 9845/1998 and ASTM 5208.

4 Plastic Bag Waste Policy: Experiences of Others

This chapter presents various case studies of policy interventions implemented in different countries in response to growing plastic bag waste. The objectives are to: (a) obtain practical insight into the different approaches used; (b) identify their successes and failures; and (c) use the experiences as an input to develop a plausible strategy for the Kenyan context. The experiences of Australia, Bangladesh, Eritrea, India, Ireland, Rwanda, Somaliland and South Africa are reviewed.

Due to availability of data and their relevance to developing countries, the Indian and South African cases are studied here in some detail. The Irish and Australian interventions are presented because of their strong reliance on one particular instrument although other support measures are also used. The Irish case is presented elaborately as it is notable in attaining a sizable reduction in wasteful consumption and owing to its relevance to the investigation of policy packages to address the problem in Kenya. The experiences of countries which adopted extreme measures is also assessed, namely that of Bangladesh, Eritrea, Rwnda and Somaliland.

4.1 The Indian experience

4.1.1 Overview

The Indian plastic industry is undergoing growth at a rate of about 17%, which is higher than the rate experienced elsewhere. For a population of about one billion, the total consumption of plastics is about four million tons per annum (Narayan, 2001, p 16). Current estimates put per capita consumption of plastics for India at 4kg/year while China, for example, has 18kg/year (Indian Centre for Plastics in the Environment, 2005). The value for developed nations is 80-100kg/year (Ren, 2003, p. 27). In addition, India is reported to have a relatively high plastic recycling rate of 60% as compared to the world average of 20% (ICPE, 2005).

According to Vijay Merchant (2005, May 10. Personal interview) about 135 000t of vest-type plastic bags are used annually in India. Taking a derived figure of 275 bags/kg, i.e. 3.6g/bag (Narayan, 2001, p.31), a rough estimate for the whole of India would be in the order of 37 billion per annum. However, this per capita consumption of only 37 compares low in comparison to many countries, e.g. 235 for Australia in 2004 (Australian Government Department of the Environment and Heritage, 2005).

The following are the root causes of plastic bag littering and the resulting environmental problems in India (Narayan, 2001, p vii): (a) the throw-away culture linked to the bulk of the bags due to their low cost; (b) the inefficient collection and disposal of MSW; (c) neglect of plastic bags by rag pickers who find collection of these items laborious and non-profitable; and (d) poor performance of the plastic recycling sector which is characterized by obsolete machinery, unskilled workforce, etc.

Narayan (2001, p. 31) further explains that this wide-spread littering of plastic bags has resulted in some environmental and social problems in India. They include:

a) **Choked soils**: A sizable quantity of plastic bags present in the soil in some parts of India is hindering free flow of water, air and nutrients thereby limiting plant growth.

b) **Choked drains**: Peculiar to India is the prevalence of strong monsoons, which in the absence of proper drainage could result in fatal flooding. Plastic bags have been identified with blocked drainages.

c) **Animal deaths**: Most commonly reported incidents are cows ingesting plastic bags. In coastal areas of India, the death of aquatic animals like turtles has also been reported.

d) **Risk of poisoning**: This is particularly the case with inferior quality recycled bags which make use of lead and cadmium as colouring agents.

4.1.2 In-place Legislation

The only rule that addresses plastic shopping bags in India is the *Recycled Plastic Manufacture and Usage Rule* of 1999. Issued by the Ministry of Environment and Forests (MoEF), it has the following features (MoEF, 1999): (a) it prohibits the use of plastic bags and containers made of recycled plastic for storing, carrying, packaging of foodstuffs; (b) it demands that such bags be in their natural shade or white; (c) it requires carry bags and containers made of recycled plastic and used for purposes other than storing and packaging foodstuffs be manufactured using pigments as per Bureau of Indian Standard (BIS) specifications; (d) it demands that recycling of plastics be carried out as per BIS specifications; (e) it requires manufacturers of recycled plastic carry bags to mark them accordingly to BIS specifications, and to be marked as recycled with percentage of recycled material stated; and (f) it specifies the minimum thickness of bags made of virgin- or recycled plastics to be not less than 20μm.

The bags responsible for creating most of the littering in India have thicknesses of 5-10μm (Narayan, 2001, p.39). Hence, the rationale behind the rule is to have thicker bags in circulation and thereby create incentives for collection by the waste pickers (*Ibid.*).

This rule was revised in 2003 with a view to introduce modified provisions, of which the most important ones are (MoEF, 2003): (a) title modification, i.e. the *Plastic Manufacture, Sale and Usage Rules, 1999*; (b) an exemption of bags made exclusively for export purposes; (c) an additional requirement prohibiting the manufacture, stocking, distribution or selling of carry bags less than 20cm x 30cm; (d) a minimum weight requirement i.e. 50 carry bags made of virgin or recycled plastics should weigh at least 105g; and (e) the need for registration of manufacturing facilities with the State Pollution Control Board prior to commencement of production.

Since provinces in India are empowered to take measures independently, some States tried to address the plastic waste menace by either adopting the national rule or formulating their own initiatives (Narayan, 2001, p. 34).

4.1.3 Results Achieved

(Narayan, 2001, 37-48) made the following observations on the outcomes by using Mumbai as a case study:

a) It had an inherent limitation in bringing about waste and litter minimization as it primarily sought to achieve this by promoting re-use and recycling. On the contrary, the root causes of littering, namely profligate consumption, indiscriminate use & disposal and lack of effective waste management system were not adequately addressed.

b) The ban on bags less than 20μm [reportedly] did not alleviate littering. Issues of blocked drains, choked soils and threats to animals were not addressed.

c) Minimum thickness of 20µm did not achieve the desired reduction in wasteful consumption.

d) Success has been achieved in discouraging coloured bag use in food packing.

e) The 20µm bags remained unattractive to the waste pickers and continued to be littered.

f) Re-use of plastic bags by consumers has not become habitual.

g) The regulation resulted in increasing consumption of virgin plastic raw material without any appreciable gain on the anticipated benefits. The reasons were: (1) 20µm bags mean more raw material requirement; and (2) the rule was successful in discouraging the use of recycled bags for use in food packaging replacing them by virgin material. The beneficiary from this was the raw material manufacturers.

h) Enforcement was difficult as the task of controlling thickness is logistically complicated. Manufacturers also found ways around the rule by producing bags with corrugated surfaces to give a false impression of a thicker bag.

Merchant (2005, May 10. Personal interview) describes small improvements in recent years in cities that have initiated strong anti-litter programs. Accordingly, cities like Mumbai, Kolkata, Bangalore, Chennai, Surat, Goa have reported improvements after the Rule and its amendments came into force. Similarly, tourist towns like Matheran, Mahalblshwar, Tirupati, Ooty and Nilgiris have disclosed similar improvements. The indicators of improvement, he cited, take the form of vendors providing waste bins near their stalls or shops (for fear of losing their license). He is also of the opinion that local municipalities have not provided sufficient bins at the required intervals which has remained one cause of littering and that behaviour of the population has not changed owing to lack of efforts to create awareness.

4.2 The South African Experience

4.2.1 Overview

According to a study conducted by Bentley West Management Consultants, about 8 billion plastic bags are consumed annually in South Africa. Out of this, large retailers account for 2.6 billion and smaller retailers take the balance of 5.4 billion. For the close to 44 million people in South Africa, the per capita consumption of Plastic bags could be derived as 182, which is higher than India.

The plastic bag littering problem in South Africa is so grave that the bags have come to be known as the new national flowers of the country competing with the true national flower *protea* (SADEA, 2000). An International Coastal Clean-up (ICC) report for South Africa indicated that in the country, the top three marine litter items are cigarette butts, caps & lids and plastic bags, which accounted for about 17%, 15% and 13% in that order of the debris collected (ICC, 2003).

4.2.2 In-place Legislation

The Plastic Bags Regulations of South Africa was issued by the DEAT in 2002. It came into force one year later in 2003 after the accompanying Compulsory Specifications were enacted (PFSA, n.d.).

The following are its major stipulations (University of Cape Town, 2002): (a) it prohibited the manufacture, trade and commercial distribution of plastic bags made of plastic film for use within South Africa and having a wall thickness of less than 80μm; (b) the manufacture, trade and commercial distribution of plastic bags of thickness 30-80μm for use in South Africa is allowed provided they do not have printing, painting or marks of any kind unless demanded by law; (c) the manufacture, trade and commercial distribution of bread bags made of plastic film of 25-80μm thickness is permitted for use within the country provided they do not have printing, painting or marks of any kind unless demanded by law; (d) the prohibition made an exemption to shrinklene and flimsy bread bags made of plastic film; and (e) it provided a legal instrument for penalties on offences, i.e. any violator is made liable to (1) a fine of South African Rand (R) 100 000, or (2) imprisonment for a period of up to ten years, (3) or both; and (4) a fine not exceeding three times the commercial value of the good to which the offence was linked. It applies to plastic bags given to a shopper at the point of sale (secondary packaging) and hence excludes bags used for primary packaging of loose goods, e.g. rice, flour, etc (Plastic Federation of South Africa, n.d.).

Soon after its enforcement, it faced an outcry from the labour unions, i.e. the Congress of South African Trade Unions (COSATU) and the National Council of Trade Unions (NACTU) (UNEP-DTIE, 2004, p.33). Together with the Plastic Federation of South Africa, and the Chemical and Allied Industries Association, the unions claimed that the regulation failed to strike a balance between the need for a clean environment and that for a job. They also projected a loss of about 7 000 jobs in the bag manufacturing industry and further losses in the value chain of over 71 000 jobs (*Ibid.*). This resulted in the first public hearing on the case which brought government officials, business and labour unions together in the National Economic Development and Labour Council (NEDLAC). Parties of NEDLAC agreed that a joint research be carried out to determine the potential socio-economic impact.

Following, a study was commissioned through the Fund for Research into Development, Growth and Equity (FRIDGE), coordinated by NEDLAC. The study assessed the socio-economic impact of moving to thicker vest-type carrier bags (VCBs) (COSATU, 2002) which are summarized below (BWMC, n.d.). First, the envisaged introduction of the regulation, first to a minimum thickness of 30μm and then 80μm after six months, was not considered feasible given that an 80μm bag requires a totally different manufacturing technology. Further, the thicker bags are also primarily produced from LDPE whereas thinner bags use HDPE and thereby requiring high capital outlay to make the required changes. Second, with an 80μm requirement, it was anticipated that the VCB industry could close down. Third, although an increase of thickness could stimulate recycling, limits were perceived due to barriers to economics of recycling, estimated at a maximum of about 10-15% of production. Improvements above this require the creation of additional demand. Fourth, in addition to the undesirable consequences on the local upstream raw materials manufacturers, negative impacts on the VCB making industry, the retail business, and on employment was also reported.

Following the study, labour unions raised their concern in NEDLAC meetings. As a result, the government acknowledged, among others, that there would be high job, and revenue losses (COSATU, 2002). Subsequently, a Memorandum of Agreement (MOA) was entered between the DEAT, representative of the labour unions and the business community in September 2002 (PFSA, n.d.). The main features of the MOA are: (a) a joint understanding to

adopt a thickness which would allow retention of jobs while at the same time pose minimal impact on the environment; (b) transparency and disclosure on the costs of bags; (c) agreement on type and amount of printing ink; (d) consensus on the need to develop recycling markets; (e) the need for a levy; and (f) prevention of illegal importation of bags (SAGI, 2004).

The legal minimum thickness, that followed the MOA, is 30μm with a tolerance of minus 20% which gives an absolute minimum thickness of 24μm. The legal thickness prior to the regulations was only 17μm (Creamer Media's Engineering News, 2003). According to the revised standard, a 'recyclable-friendly' ink has to be used for marking and printing and the quantity used, on dry basis, should not be above 2.25% of the weight of the bag (*Ibid.*).

Also according to the MOA, retailers should transfer the full cost of the bags to the consumer and reduce the price of goods accordingly (SAGI, 2004). In addition, a voluntary levy of 2 cents per bag has to be paid by registered importers and manufacturers until an appropriate excise tax is imposed which is payable into a trust fund set up to educate the public, promote recycling and clean up highly littered areas (*Ibid.*). In addition, an agreement was made to establish what is known as *Section 21 Company*, whose objectives would be to encourage and manage the collection, reuse and recycling of plastic bags and create jobs; it is expected to be financed through a mandatory levy that would be paid by manufacturers and collected by the National Treasury of South Africa (DEAT, 2003). Decisions were also reached to enforce strict control at ports of entry; hence, the South African Revenue Service in collaboration with South African Bureau of Standards is currently controlling import of bags (*Ibid*).

4.2.3 Results Achieved

There is no published material on the performance of the South African regulation. However, the following information is compiled from various sources.

Before the regulation, the cost of plastic bags was integrated into food prices. Hence, even if consumers did not receive a bag, they were still required to pay for it. With more transparency and choice for consumers to buy a bag or not, it is reported that they benefited from lowered food prices (SAGI, 2003).

In addition, the coming into force of the regulation resulted in a drop in wasteful consumption of bags, especially in stores where consumers pay separately for bags. Bag manufacturers reported that at the beginning sales dropped to 10% (of previous levels) and have with time stabilized to 30% of previous levels (UNEP-DTIE, 2004, p.34). The DEAT received reports from bag manufacturers claiming a projected drop in local production ranging from 50% to 80%; one major manufacturer, *Transpaco*, reported a drop to 10% of the pre-regulation production capacity (CMEN, 2003). The regulation also influenced public understanding as the negotiations were given wide coverage in the national and international media. Although this was not intentional, it reportedly contributed to increased environmental awareness (UNEP-DTIE, 2004, p.34).

The Minister of DEAT, in a briefing he gave to the South African parliament on 16 September 2003, disclosed that there is no scientific survey conducted indicating the effect of the regulation on the environment. He, however, disclosed that numerous feedbacks from various sectors of the society have been received hinting on improvements (DEAT, 2003). Such reports include farmers claiming less/no choking of cattle as well as tourists remarking on the noticeable decrease of plastic bag litter in the countryside. The Minister summarized

the changes due to the regulations as a reduction in consumption of plastic bags by consumers; re-use of bags by consumers; heightened awareness by consumers on the need to reduce littering and hence less plastic being disposed of in manner that is detrimental to the environment (*Ibid.*).

4.3 Other Countries

4.3.1 Ireland

Overview

In Ireland, plastic bag waste was of serious concern as it made most of the visible litter in the rural environment (University College Dublin, 2003). Plastic bags released in the environment easily travel long distances and often attach themselves to hedges and trees. This unsightly scene becomes more prominent during winter when deciduous trees shed their leaves (*Ibid.*).

In 1997, the Irish government published a Statement of Intent on the use of environmental taxation which recognised the benefits of using economic instruments in achieving environmental objectives. Consequently, the plastic bag levy was introduced in March 2002 as a direct result of this Statement (Patel Tonra, 2004). A levy of Euro 0.15 was placed on all plastic bags including biodegradable bags targeting shoppers at point of sale. Exceptions were made for plastic bags used to contain fresh produce and re-usable bags with a value exceeding Euro 0.70 (PNSW, 2004, p.4). Retailers are legally obliged to pass it on directly and itemise it on consumer sales receipts (*Ibid.*).

According to the Irish Department of the Environment, Heritage and Local Government (DEHLG) about 1.2 billion plastic bags were used annually prior to the levy (MSNBC, 2005). The levy resulted in 90% decrease in the use of disposable plastic bags and provided close to Euro 20 million in funds to date (Patel Tonra, 2004). In 2003, plastic bags amounted to only 0.3% of the country's litter stream compared to 5% before the levy (MSNBC, 2005).

Very little literature was available to the author on the ex-post evaluation of the Irish Levy. However, a study entitled *Applying environmental product taxes and levies: Lessons from the experience with the Irish plastic bag levy* was carried out in 2003 by the Department of Environmental Studies of the University College of Dublin (UCD). The remaining three sub-sections present a brief summary of this study.

Theoretical background

Theoretically speaking the Irish plastic bag levy falls in 'the category of second best approach' where a product tax is imposed to internalise external costs. These costs arise due to 'too many' plastic bags in the Irish environment. Hence, the tax is not a Pigovian[62] tax as it is not explicitly set at a level that internalises costs to the Pigovian optimum. Rather it was fixed at Euro 0.15 per bag with the assumption that it would be sufficiently high to give most consumers 'pause for thought', and motivate them to bring their own reusable bags. No attempt was made to identify marginal external costs and determine the optimum level of tax.

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[62] Pigou (1960) made the case for environmental taxation. If pollution is imposing costs on society that are not borne by the perpetrator, these external costs should be internalized by imposing a tax on the pollutant in question. And this tax should be set at the level which reduces emissions to the point were the marginal benefits of internalization just equal the marginal costs of abatement (UCD, 2003)

The idea is that when people are faced with a choice where they can respond at relatively low cost to achieve a socially desirable end, they adapt quickly and in many cases willingly.

Salient Features

The revenues from the tax are 'ring fenced' in the Environment Fund for use in various environmental projects. The most important objectives worthy of mention are: (1) finance costs of administration of the tax itself; (2) support programmes for the prevention of waste; (3) promote development of products that are less environmentally harmful (4) aid producer-initiatives in designed processes and products that prevent or reduce waste generation; (5) assist in the enforcement of by-laws related to waste management, litter prevention, etc.; and (5) promote environmental awareness, education and training.

Initial industry proposals for a voluntary take back scheme were not supported by government and lobby efforts soon ceased as it was clear that government was determined to proceed. Retailers were also initially concerned about being blamed for 'profiteering'. This initiated a publicity campaign by the DEHLG, which succeeded in conveying the reasons why the levy was being introduced. Butchers were also opposed to an indiscriminate levy on all plastic bags on the ground that meat products should be wrapped separately for hygienic reasons. This point was supported by the [Irish] National Food Safety Authority and some supermarket chains. It was consequently accepted by government and an exemption was given to plastic bags below a certain size when used for specific purposes.

That the design and implementation of the scheme involved broad consultation with the main industry representative, the Irish Business and Employers Confederation and the leading retailers, i.e. grocery stores. The commitment of the DEHLG was essential in ensuring collaboration amongst concerned stakeholders. This allowed the levy to go from concept to implementation. Without this commitment the voluntary scheme initially preferred by industry would have been selected. Stakeholder consultation ensured that one crucial element, namely the exemption of bags for separate packing of fresh food (for hygienic purposes) was permitted. However, some smaller retailers felt that consultation was biased in favour of their larger counterparts and the grocery trade.

The Irish experience indicates that a robust legislative and regulatory base is necessary to guarantee success. A similar attempt in Italy ended in failure: Italy introduced a plastics tax in 1994 which was challenged in court and was eventually withdrawn in 1997.

Results

Retailers found the effects on their business to be either neutral or positive. The additional costs of implementation in the form of book-keeping were low and generally less than the savings from not having to purchase bags. In addition, revenue collection and reporting is easily integrated with their VAT collection systems. Therefore, net additional costs are low and more than offset by savings from plastic bag purchase foregone and additional sales of bin liners.[63] Although shoplifting rose initially, it eventually returned to pre-levy levels.[64]

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[63] One outcome following a drop in plastic shopping bags consumption is higher demand for garbage bin liners. This happens for the simple reason that people use plastic shopping bags as bin liners, especially in developed countries. Similar outcomes were predicted by the Nolan-ITU study in the event of a legislated plastic shopping bag levy in Australia

Overall, households were in favour of the levy. The majority felt that the its impact in terms of convenience at checkouts was negligible but that the levy had added to their expense as they have either to pay the levy or buy reusable bags. All respondents [surveyed by the study] indicated that the impact on the environment was positive resulting in a noticeable reduction of plastic bag waste in the environment.

Prior to the levy, there were four plastic manufacturing firms operating in the country. One of these, with an annual turnover of Euro 2.54 million and employing 26 persons, went out of business following introduction of the levy. There is uncertainty as to whether this was a direct result of the levy.

The costs to government are low, i.e. set up and annual administration expenditures amount to Euro1.2 million and Euro 350 000 respectively. Advertising costs to launch the levy amounted to Euro 358 000. On the other hand, projections indicate that an estimated of Euro 10 to 11 million per year can be collected in revenues from the tax.

There is a large reduction in plastic bag use, i.e. about 90 per cent. Households felt that this implies less plastic bags in the environment. This, however, was not substantiated by field surveys. Many consumers also reported as feeling guilty when they forget to bring their own re-usable bag and are required to pay the levy.

The tax is likely to be more statically efficient[65] than an absolute ban, as it gives people [with high WTP] to get the bags with the levy paid. However, not much can be said on its dynamic efficiency[66] but there is still a high possibility that the Environment Fund can be used to finance R&D, so there may be some innovation in the future. While some losses in the plastics industry could be expected, the extent depends whether and to what extent alternative investment and employment opportunities can be provided.

Not much can be said on whether the levy was 'too successful' in internalising costs beyond the Pigovian optimum. The reason for this is that while costs of internalisation can be fairly well estimated, the value of the benefits is unknown. However, the key objective of DEHLG in enhancing public environmental awareness seems to have been achieved at very low net cost.

(PNSW, 2004, p.8). The author is of the opinion that similar effects might be expected in Kenya if a levy is imposed but the magnitude is believed to be lower for a number of reasons, e.g. low purchasing power, low usage of garbage liners.

[64] Although the author was not able to confirm this from published sources, Nishit Haria of Packaging Industries Limited in Nairobi mentioned increase in shoplifting in South Africa following the plastic bag regulations (2005, July 21. Personal Interview).

[65] According to the Pigovian thinking, the use of an environmental taxation has attractive features as compared to CAC approaches. The tax would achieve the optimum at minimum cost: that is to say, polluters for whom it is expensive to abate would continue to pollute and pay the tax while those for whom it is cheaper to cleanup would do so. The result is what economists call *static economic efficiency*- attainment of a given level of abatement at the least possible cost (UCD, 2004).

[66] The same argument goes that such a tax would stimulate innovation as new technology which could reduce emissions would be explored so as to reduce the tax bill. This constant incentive to innovate, driven by the tax, is what economists call *dynamic economic efficiency* (*Ibid.*)

4.3.2 Australia

Overview

The Australian approach is based on a Voluntary Code of Practice. Environmental News Service (2005) summarises its salient features as follows.

The major instrument used to address problem is the Voluntary Code of Practice adopted by the Australian Retailers Association (agreed in 2003). The Code aims to reduce plastic bag consumption by 50% by the end of 2005. If the target is not achieved a tax of 25 Australian cents per bag will be imposed by the government. This serves as a 'threat' as retailers believe a levy will cause administrative inefficiencies to retailers and cost consumers millions of dollars.

The commitment rate to the code by supermarkets is relatively high, i.e. 90%. However there is no wider participation from other business which issue plastic bags, e.g. fast food outlets, liquor stores, pharmacies, newsagents, etc.

The Code is backed by strong campaigns such as the *Say No to Plastic Bags* which is run by Clean Up Australia, a non-profit organisation, in collaboration with retailers and governments with a view to encourage consumers to reduce on plastic bag consumption and increase recycling. To facilitate the implementation of the Code, a kit (consisting of guidelines, in-store promotional items and staff training materials) was developed to help retailers on how to reduce consumption and increase recycling. The guidelines recommend a hierarchy of refuse-reduce-reuse-recycle. Alternatives are also suggested and made available at stores. These include cloth bags, polypropylene bags, recycled paper bags, string bags, baskets and boxes. Bio-degradable bags made of cornstarch were also recommended for some stores.

Results

Two recent reports issued in 2004 by Sustainability Consultants Nolan ITU and another by the Australian Retailers Association (both) indicate that the number of bags issued in the country has reduced by around 21% since 2002. The number of light weight carry plastic bags used by Australians in 2002 was an estimated of six billion; this dropped to an estimated of 4.77 billion in 2004.

According to the Nolan- ITU (2002), the major contribution to reduction in consumption has been made by supermarkets who managed a reduction in light-weight plastic bags by a factor of 25% (also confirmed by retailers). However, the participation of non-supermarket business (mentioned above) and small retailers is very low. Single-use plastic bags from these outlets are estimated to make up over 50% of all plastic bags issued in the country.

PNSW (2004, p.6), however, documented the following observation made by the Commonwealth Senate Committee set up to enquire into the possibilities of imposing a levy:

> *"… The only concrete commitments in the Code are for a 25% reduction in bags issued by the end of 2004 and an increase in the recycling rate of 15% by the end of 2005. The publicised target of a reduction in bags issued by 50% is only a targeted reduction in the Code. Additionally, the reduction targets in the Code will be adjusted to reflect business growth. This has the potential to legitimise reductions that are less than 25%, depending on the business growth of the retailers. Clearly the code of practice cannot be relied as the sole*

> *vehicle to phase-out bags in line with the Environment Protection and Heritage Council (EHPC) decisions."*

The same source documented that a supplementary report by the labour members of the committee claimed that voluntary approaches and a Code of Practice are unlikely to result in sufficient results and hence there is a need for mandatory legislative measures. In a similar tune, the Australian Greens have produced reports claiming that a levy should be imposed to satisfactorily address the environmental problem due to plastic bag waste (*Ibid.*).

On the other extreme, the Nolan-ITU report (2002, p.54) concluded that an outright ban on could be an excessive and inappropriate measure for Australia. However, it acknowledged the merits of a limited ban on bags with a high litter potential supplemented by other measures as a viable alternative.

4.3.3 Bangladesh

The Bangladesh government imposed a complete ban on the sale and use of polyethylene bags in March 2002 applicable to the capital city, Dhaka (BBC NEWS, 2002). The ban was complimented by a massive public awareness campaign to persuade people not to use plastic bags; the main alternatives being promoted are jut bags (*Ibid.*).

Serious and repeated flooding in the country, which resulted in major loss of life were linked to blockage of drains by plastic bags (PNSW, 2004). Prior to the ban about 9 million plastic bags were thrown away in the capital of which only 10-15% were put in dustbins with the remainder ending up in drains, sewage channels and open spaces (Ealingfoe, 2002).

The powerful plastics industry in Bangladesh was strongly opposed to the ban. As a result, there have been reports of attempts to bribe government ministers to drop the regulation and when that failed even death threats (*Ibid.*).

No results are available to the author on the success of this ban in respect to the environmental policy evaluation criteria.

4.3.4 Eritrea

Eritrea adopted an outright ban as a policy instrument for plastic bag pollution prevention. In addition to not being bio-degradable, the blue plastic bags used in the country (also known as "flying bags"), are not strong enough to be used more than once (Inside Eritrea, 2002). The Eritrean ministry of Land, Water and Environment introduced the ban in January 2002 on "importation, production, distribution, and selling of plastic bags" (NEWS 24 COM, 2005). The ban is planned to be enforced through a 'hefty' fine on transgressors, The alternatives suggested are cotton and nylon re-usable bags (*Ibid.*).

The major concerns from plastic bag waste in Eritrea are choking of cows, goats and sheep; blockage of water culverts which in turn disrupt water supply; blockage of drains; and littering of towns and agricultural fields (Inside Eritrea, 2002). In addition, people also dispose of their garbage in these bags- a practice which intervened with natural degradation of organics (*Ibid.*).

No additional information was available to the author on the performance of the ban.

4.3.5 Somaliland

Somaliland (a self-declared republic in eastern Africa) also opted for an outright ban. IRIN NEWS (2005) provided the following information.

Plastic bag pollution in Somaliland is so prevalent that the bags have been labelled the *Hargeysa flowers* [Hargeysa is the capital city]. Bags fluttering from trees and shrubs are common sights. According to government officials, plastic bags have become both an eyesore and source of environmental problems in Somaliland. Of special concern to the country are harm to livestock, especially to those that feed on shrubs and clogging of storm and sewage drains especially by those bags that are used by *Khat*[67] traders.

The ban was issued by the country's Ministry of Trade and Industry on 1st of March 2005 and is entitled "*Banning importation, production and use of plastic bags in the country*" and is supposed to be backed by an awareness campaign. Three weeks after the ban, although officials say that it had taken effect, local people claim that use of the bags continues unabated.

Some consumers are of the opinion that the availability of free and alternative bags is essential if the ban on plastic bags is to be successful. Government officials say people should rely more on traditional bags like baskets made of natural materials like straw, reed, sisal, etc. However, consumers believe these options are not as cheap and user-friendly as plastic bags. Importers of the bags (who have the majority share in the market) opposed the ban. They claim that: (a) there are no cheaper and reliable alternatives; (b) the ban will result in a loss of revenue to the government; and (c) that it is a ploy to allow the single local manufacturer to gain a monopoly. Local environmental activists claim that the ban is not backed by the awareness campaigns. Assessments by also IRIN indicated that both importation and local production of the bags still continues regardless of the ban. Government acknowledges continuing local production due to lack of alternatives at the time.

No further information was available to the author on the current status and achievements of this ban.

4.3.6 Rwanda

Rwanda also went for a ban as a policy measure; some opposition from shop owners against the measure is reported (BBC NEWS, 2004). The ban applies to bags less than 100 microns on which import bans have also been imposed; this was supplemented by awareness campaign (UNEP, 2005, p. p.62). As a result, the disappearance of the black plastic bags in Kigali was reported (*Ibid.*).

As documented by the UNEP study cited above, a separate ex-post evaluation of the Rwandese ban has not been conducted. No additional information was found by the author.

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[67] Khat is a mild narcotic (stimulant) that is widely cultivated as a cash crop in Ethiopia, Somalia, Kenya and Yemen. Consumers buy it from retailers in flimsy plastic bags in which they later keep the undesirable parts, i.e. the stem and some leaves. Traders prefer to use plastic bags to keep the Khat leaves green and fresh. The bags along with the unwanted contents are usually thrown away becoming major litter items which clog drains in these countries. Animals like goats and sheep will be attracted to the stems and remaining leaves and will face the risk of ingesting plastics. This, for instance, is a major appearance of plastic bag waste pollution in the author's home country of Ethiopia.

4.3.7 Other European Countries

A different approach adopted by some European countries to manage post-consumer packaging including plastics is Extended Producer Responsibility (EPR)[68] (PNSW, 2004, p. 5). Although the method does not specifically address plastic bags, the aim is to encourage recovery and recycling of packaging in general. In such an approach, industry makes payments to designated bodies (Producer Responsibility Organisations) who arrange for the collection, separation, recycling and recovery of a pre-determined amount of packaging. One distinguishing feature of this approach is that fees paid by industry are not apparent to the purchasers of the products (*Ibid.*).

In Sweden for instance, due to the producer responsibility legislation, household waste, is divided into two flows, recyclables (PR waste) and the remaining waste under the jurisdiction of the municipalities (Mattesson, 2003, p. 28). See Table 4-1.

Table 4-1 Categorization of household waste in Sweden according to responsibility

PR flow (Recyclables)	Municipal flow (Remaining waste)
Newsprint	Heavy and bulky waste
Packaging: paper, plastic, glass, metal	Hazardous waste
Tyres	Garden waste
Electronic & electric waste	Bagged waste (combustible/organic/rest

Source: Mattsson (2003)

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[68] Extended Producer Responsibility (EPR) is "*a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially to the take-back, recycling and final disposal of the product. Extended Producer Responsibility (EPR) is implemented through administrative, economic and informative policy instruments.*" (Lindhqvist, Thomas, 2000, p. v).

5   Proposed Policy and Technical Packages for Nairobi

The purpose of this chapter is to explore contextually appropriate policy packages and technical approaches that could address the environmental problems of plastic bag waste in Nairobi. This will be carried out on the basis of the theoretical framework developed in Chapter 2.

The key tool that will be used in the process (as discussed in Chapter 2) is the waste management hierarchy. Along with the requirements of sustainable MSW management, it will be used to guide the analysis. Owing to its principal importance to the case and its adaptability, the final proposals will be presented in the form of a reconstructed waste management hierarchy.

The input-output model of public policy evaluation (based on intervention theory) is also used as a heuristic tool. For a selected list of policy instruments, an attempt will be made by the author to show how the policy packages are supposed to function along with the major assumptions. The assumptions will be based on the experiences of other countries to make them realistic.

As shown in the framework for evaluation, the key findings of the contextual assessment, the experiences of other countries and the selected environmental policy evaluation criteria will be used to identify the packages for Nairobi. Following is a brief outline of what is supposed to be undertaken in this chapter:

a)   Summarizing the actual environmental problems of plastic bag waste in Nairobi city and identification of desirable ends;

b)   Establishing root causes and causal chains;

c)   Setting controllable intermediate goals for remedial intervention;

d)   Exploring applicable policy instruments and technical approaches along with a discussion of their pros and cons; and

e)   Identification and packaging of policy instruments and technical approaches for Nairobi city both for the short-to-medium term and long term.

5.1   Summarizing Environmental Impacts and Identifying Desired Ends

From the discussions in Section 3.4, the following are identified as the actual environmental impacts of plastic bag waste in the Kenyan context: choking of animals; choking of soil; blockage of drains & rivers; blight of landscapes & trees[69]; non-renewable resource depletion; and non-degradable waste accumulation. Indirectly, plastic bags are also linked with *'flying toilets'* which are serious public health concerns. They also contribute to air pollution due to the prevalence of open burning of waste in the country as they appear in relatively high proportion in the waste stream. Justifiably, the desirable scenario is a state where each of these environmental impacts are minimised.

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[69] The unsightly vista (blight) they cause to landscapes and trees is notable in view of the fact that the country is a renowned tourist destination due to its vibrant wildlife and beautiful scenery.

5.2 Establishing Causal Chains

On the basis of the contextual evaluation, the cause-effect relationship leading to the actual environmental impacts can be depicted pictorially as in Figure 5-1 below. A short explanation follows the diagram.

Figure 5-1 Plastic Bag Waste Environmental Problems: Causal Chains
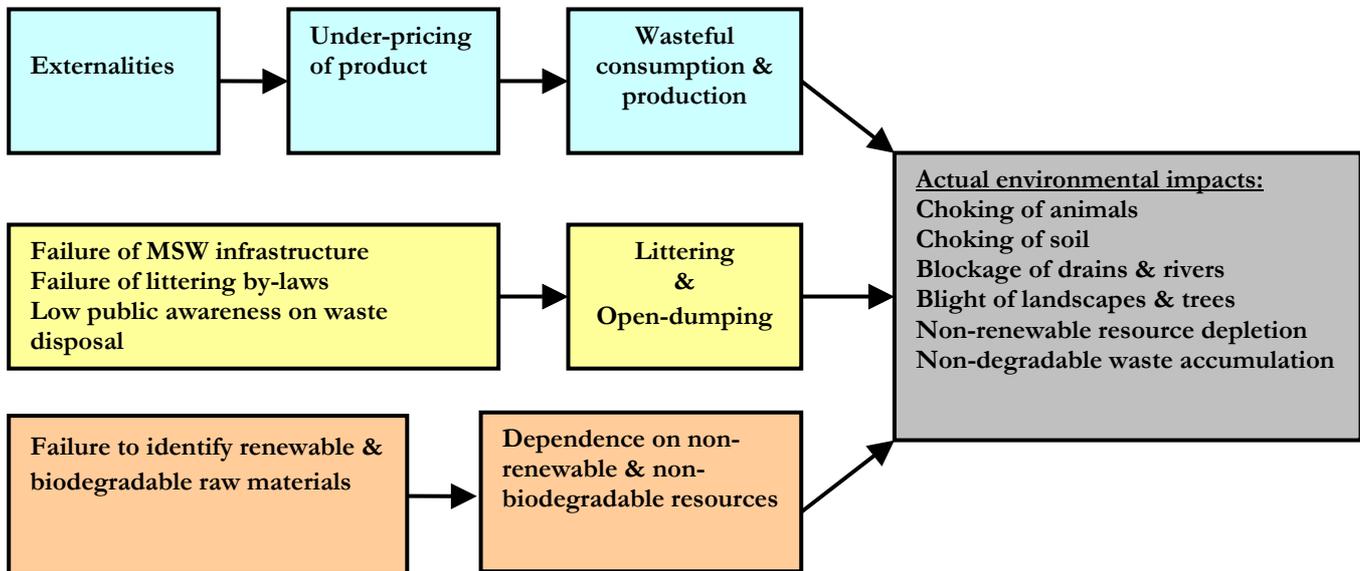
5.2.1 Market Failures: Externalities in Production and Consumption

Plastic bags in Kenya [like in other countries] principally serve use-and-throw consumerism. This is possible because they are overly cheap. The next question to ask is why are they cheap? A number of reasons could be speculated but in the opinion of the author, the following two seem self evident.

The first is the fact that plastic bags need relatively small quantity of material to produce without loss of function thereby allowing savings on raw material costs.[70] Manufacturing processes have also been perfected to suit plastic raw materials contributing to efficient production and thereby cost savings. The second reason [as is the case with many unsustainable products] is the existence of externalities.[71] Two instances are identified, i.e. resource depletion and end-of-life treatment costs not internalised in the product cost.[72] Assuming sustainable production and consumption is desirable, all lifecycle costs must be factored in before judgements could be made as to whether one particular alternative is

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[70] This resource efficiency feature of plastic bags (for instance, in comparison to paper bags) is discussed in Section 1.1.

[71] In chapter two we have seen that with externalities, the market mechanism does not allocate resources efficiently and results in market failure which is an imperfection in the market mechanism that prevents optimal outcomes. If pollution costs are external, firms will produce too much of a polluting good. Externalities arise both in production and consumption and can be accounted for. A short description follows (Coastline Community College, 2005):
Externalities in Production: When external costs exist, a private firm will not allocate its resources and operate its plant in such a way to maximize social welfare.
Externalities in Consumption: A consumer wants to maximize personal welfare. When people abandon old cars in the street instead of hauling them to scrap yards or they use vacant lots as dumps, they are substituting external costs for private costs.
Remedies: We have to change our patterns of production and consumption. This entails economic costs – restricted consumption choices, more expensive ways of producing goods and higher prices.

[72] An example that can be cited is a case mentioned to the author by manufacturers: although local industry acknowledges that thicker gauges are easier to recycle (allow better material recovery), consumers prefer flimsy ones as thin as 6 microns which are cheap and hence affordable to throw away (Srivathsan, P.S. 2005, July 21. Personal Interview).

cheap. This is not the case with conventional plastic bags and they give the 'false signal' to consumers on their actual life cycle costs. This claim is backed by a number of studies (UCD, 2003; Patel Tonra, 2004).

The cheapness certainly leads to wasteful consumption and disposal in many fronts. For instance, during his stay in Nairobi, the author was able to observe that take-away consumerism is commonplace in the City. A number of food items such as French fries and others that can best be served on plates are on offer for take-away (wrapped in flimsy plastic bags). As discussed previously, even the practice of 'flying toilets' is linked with cheap-to-throw plastic bags having film thicknesses as low as six microns. Eventually, all of these bags end up in the environment causing the undesirable impacts. In this situation, neither the consumer nor the manufacturer is made to pay for the external costs.

5.2.2 Institutional and Infrastructural Failures

The situational analysis clearly indicated that after use, plastic bags are not appropriately disposed of. Rather, they end up as litter or in open-dumps. This can be attributed to a number of reasons.

Primarily, there is an evident failure in the city's MSW management system. This is exhibited by the absence of adequate collection and treatment schemes for plastic waste on one hand and enforceable dumping and littering by-laws on the other. It can as such be argued that neglect of plastic bag waste by the formal and informal recovery sectors could be one manifestation of institutional failures taking the form of inappropriate policies and standards.

David Mungai (2005, July 6. Personal interview) elaborates on the different forms that institutional, infrastructural [and policy] failures take place in Nairobi. Primarily, he cites mismanagement of resources by local authorities to have a bearing on garbage collection activities like many other public services. He also explains that planning has not been much of a difficulty in the area whereas implementation has fallen short of expectations. In addition, inadequate as the NCC by-laws are, the problem has been compounded by an inability to enforce what is in place. To these, he adds lack of adequate incentives for people who would like to work in the MSW area, most importantly recycling.

Another crucial issue is low public awareness in proper waste disposal. As a result of this, consumers throw away and do not source-segregate and dispose in designated areas. This has been pointed out as one of the causes of the problem through interviews of a number of concerned officials (Mbegera, M.O. 2005, June 29 & July 5; Kimilu, Damaris. 2005, June 30; Maranga, Crispus. 2005, July 14). David Mungai (2005, July 6. Personal interview) further explains that lack of adequate awareness on sustainable management of MSW at all levels has been one contributing cause to the problem.

5.2.3 Unsustainable Resource Base

Once they are in the environment, plastic bags continue to accumulate principally aided by their low degradability. As present-day plastic bags are based on non-renewable raw materials, they fit into the linear mode of production and consumption which is unsustainable as it contributes its share to the depletion of scarce resources. Although there are some attempts in Nairobi to shift to degradable plastic shopping bags (a joint endeavour of some supermarkets and manufacturers), the trend is towards photo-degradable bags. The core issue of non-renewable resources still remains unaddressed.

5.3 Exploring the Remedies

Based on the model and its accompanying description above, it can be argued that intervention measures should aim at changing the unsustainable behaviours associated with plastic bag production and consumption. These take the forms of wasteful consumption; littering & open-dumping; and resource depletion & waste accumulation. Changing these to a desirable state, of course, requires addressing the root causes and formulating corrective policy and technical instruments accordingly.

Of these, the first two (wasteful consumption & production and littering & open-dumping) can be realistically addressed in the short to medium term. This is also what the intervention measures of the various countries reviewed in the previous chapter tried to address first and foremost. The problems of dependence on non-renewable resources and use of non-biodegradable raw materials needs to be addressed in the long-term so as to tackle the resulting environmental impacts.

5.4 Setting Controllable Intermediate Goals

As discussed above, the bulk of the actual environmental problems follow as a result of wasteful consumption and production, and irresponsible disposal. It follows that these can be taken as intermediate parameters of intervention and control in the endeavour to reach a desirable state of the environment. The underlying reason is that they are to some extent measurable and hence controllable. The actual environmental impacts also follow as a direct consequence of these factors.

In addition, with proper administration and the right outputs (measures), desirable intermediate outcomes can be attained leading to the targeted ultimate outcomes. Figure 5-2 below is a simplified representation of the envisaged process as per the input-output model of public policy.

Figure 5-2 Causal chains and intermediate goals
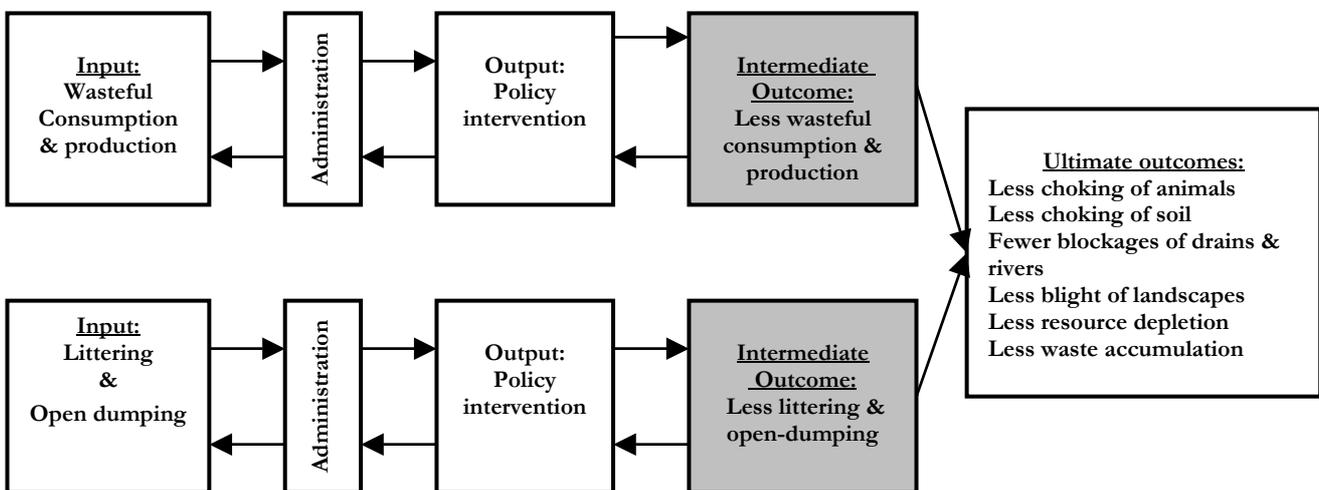
5.5 Exploring Available Corrective Measures: the Pros and Cons

An assessment of different interventions employed worldwide to deal with the environmental problems of plastic bag waste indicates that there are basically two main approaches: (a) to reduce the amount of plastic bags used in the first place with the focus placed on consumers; and (b) to improve collection and recycling facilities by placing focus on the post-consumer stage. These experiences are also in line with the requirements of sustainable waste management practices and the waste management hierarchy. PNSW (2004) has also made these observations. The rationales and pros and

cons of the different approaches are summarised here to facilitate selection and packaging of appropriate measures at a latter stage.

5.5.1 Instruments for the Pre-consumer Aspect

The country case studies indicate that on the pre-consumer side various policy instruments, i.e. regulatory, economic and informative instruments have been used to tackle the menace of plastic bag waste with different outcomes. A brief assessment follows below.

Regulatory Instruments

a) Outright Bans

These have been applied in Bangladesh, Eritrea and Somaliland. From the country case studies, it can be observed that although outright bans could resolve the problem, they under perform in respect of other criteria. Primarily, they are not cost effective alternatives. This was one reason why they were not adopted in Australia, Ireland and South Africa. Availability of substitutes is also a determining factor which could lead to strong public opposition as was the case in Somaliland. In addition, enforcement of outright bans is very difficult and costly which was also the case in Somaliland.

This research, therefore, disregards an outright ban as a solution to the problem in Nairobi. Situational analysis indicated that the plastic bag manufacturing sector in Kenya is vibrant with a sizable turnover and employment capacity. It generates revenues for the country as it exports its products to neighbouring countries. In addition, there are as yet no reliable substitutes to plastic bags. Such a measure will, therefore, be costly and will lack the support of Industry (including MoTI).

b) Minimum Film Thickness Standards

These approaches have been used in India and South Africa. Supplementary measures are minimum weight and dimensions. They are primarily intended to make a shift towards reusables by phasing out one-way bags. An additional perceived benefit is that post-consumer bags would be collected and recycled specifically by the informal sector. Such measures could meet their intended targets if properly formulated and enforced. The experience in South Africa, India and the on-going endeavours in Kenya indicate that industry, in general, could be opposed to such measures although they acknowledge its positive implication to recycling. The South African 80 micron regulation was a case in point. In addition, such standards might not also meet the intended targets if the specifications are ill formulated. In India, the 20 micron regulation did not initiate the desired collection by 'rag pickers'. As a result, specifications on minimum size and weight have to be introduced.

The need for such standards to address the problem in Kenya is quite justified. The importance has been felt already by all concerned stakeholders (e.g. KEBS, MoTI, KAM, NEMA, KIPPRA). A minimum thickness standard has hence been gazetted. The major question here is at what level it should be set. KIPPRA and NEMA propose a 30 micron regulation. KAM is opposed to this and prefers the current KEBS standard of 10 microns (HDPE) and 15 microns (LDPE and LLDPE). Since the flimsy ones are normally made from HDPE, it can be assumed that the standard relevant to this research is 10 microns. Theoretically, such standards have to be set on the principles of marginal analysis (practically difficult). In practice, a trial and error approach has to be followed to see if the standards have brought acceptable changes at affordable cost. From the experiences India and South Africa, however, the author is sceptical as to whether a 10 micron standard will lead to the desired results. While determining the right minimum thickness standard for Kenya is beyond the scope of

this research the need for such a standard is acknowledged.[73] In addition, an accompanying minimum weight standard for bags could lead to better results as was underscored by the Indian experience.

The assessment in Chapter 3 indicates that KEBS is capable of undertaking such measures. The existing penal codes and the Counterfeits Goods Bill in pipeline will provide strong legal supports.

Economic Instruments

The economic instrument that has been widely used on the pre-consumer side is a levy. It has been successfully applied in Ireland and South Africa. As discussed in Chapters 2 and 4, it is used as an instrument to internalize external costs due to too many waste plastic bags in the environment. The experiences from Ireland and South Africa show that a levy can effectively impact on wasteful consumption and bring about the desired changes in behaviour, especially by consumers. In Australia, a levy is used as a threat in the event the voluntary code of practice fails to meet its commitments. While there is some challenge associated with a levy in respects of acceptability and enforceability, the experiences of Ireland and South Africa show that it is practically enforceable and has a number of advantages (see the Irish case study).

This research stresses that an economic instrument has to form the cornerstone of any intervention measure in Nairobi. This argument stems from its predictable success in regard to environmental effectiveness and the fact that it can internalise external costs. Both theoretical and practical evaluations indicate this. If properly set, it can be cost effective and face minimal opposition from industry and consumers. The contextual evaluation has shown that KRA is capable of undertaking the job if delegated. Hence, enforcement is not expected to be a crucial problem. The modalities of implementation have to be worked out as they are outside the scope of this research.[74] Given the experiences of such institutions as KIPPRA, the author is of the opinion that workable modalities could be prepared to suit the case of Kenya.

Informative Instruments

The importance of awareness campaigns and environmental education is underlined by all stakeholders [especially in Kenya]. On the pre-consumer side, these instruments can be used to impact on profligate consumption by informing and educating consumers. They can also be tailored to promote re-use culture as against use-and-throw consumerism. The only questions that might be raised are on their (goal and cost) effectiveness. Understandably, such measures must be designed and implemented carefully for satisfactory results and of course without neglecting cost implications.

With due consideration to (goal and cost) effectiveness, these instruments can be utilised as support instruments in endeavours to tackle the problem in Nairobi. As already discussed, UNEP has also recognised their importance and has made them part of the package for its pilot project in Nairobi. This research has, however, found no instances where they have been used as stand alone measures.

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[73] The author is of the opinion that a 30 micron standard could be environmentally effective but will face questions on cost-effectiveness. It certainly will have to face resistance from Industry.

[74] The ones recommended by KIPPRA (as discussed in Chapter 3) appear logical to the Author.

5.5.2 Instruments for the Post-consumer Aspect

Regulatory Instruments

Post-consumer regulatory measures include minimum percentage on recycled post-consumer waste[75] and by-laws on littering & illegal dumping. The former is particularly important when it comes to improving demand for recycled products. The experiences of India and South Africa are valid here. The issue has been also pointed out by recyclers in Nairobi and the on-going Ten Point Action Plan which has a current commitment of 15%. The importance of effective by-laws on littering and illegal dumping is not debatable. In the opinion of the author, this is a measure accepted by all stakeholders (owing to its legality). Given the current state, the need for one in Nairobi is highly justified. The problem remains that of enforcement as is the case with the existing by-laws.

Compulsory source-segregation of waste can also be taken as one regulatory measure. The importance of source separation is widely acknowledged both in developed and developing countries as a source-reduction principle and to support recycling and composting. Such measures, however, were not encountered in practice in the countries studied. The author is of the opinion that enforcement of such regulations is difficult, especially where public awareness is low. Even in developed countries where such regulations exist, e.g. Sweden, the desired output is achieved due to high public environmental awareness and not because the regulations were adequately enforced (RVF, 2003).

Economic Instruments

Product policies based on EPR form the basis of managing packaging waste in general in some EU countries. Lindhqvist (2000, p. iii) discusses the different forms of responsibility in EPR which he calls liability, economic responsibility, physical responsibility, informative responsibility and ownership.[76] Although these varying forms of responsibilities are possible, EPR schemes that are in operation today have commonalities (American Chemical Society, 2000). These, among others, include focus on the post-consumer phase of products which in turn requires physical and/or financial responsibility for product waste management; and the setting of target quotas for waste reduction and recycling. This implies that EPR requires producers either to take back post-consumer products and manage them through reuse, recycling, or remanufacturing, or delegate this responsibility to a third party, (PRO), which is paid by the producer for waste management (*Ibid.*).

When it comes to packaging materials, Germany was the first country to introduce binding requirements on producers for the recycling and recovery of sales packaging (Clean Production action, 2003).[77] These requirements [as stipulated in the Packaging Ordinance] place full financial responsibility on manufacturers and distributors for the packaging they create. Accordingly, retailers and producers are required to take back a fixed and yearly increasing percentage of packaging materials and recycle them in accordance with the requirements set in the Ordinance. This, however, proved difficult as it was impractical to identify and return packaging to individual producers which resulted in the alternative [provided by the Ordinance] for the setting up of a non-profit PRO carryout the task (*Ibid.*).[78]   In the opinion of the author, this short discussion on the German

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[75] A related regulatory measure is compulsory minimum recycled content (of post-consumer waste).

[76] For detailed explanation, the reader may look in to Lindhqvist (2000).

[77] The successes of EPR schemes implemented in Germany (the packaging ordinance of 1991) and that of Sweden are cases in point. The policy is also increasingly been taken on by Asian countries (e.g. South Korea) and in North America (Canada).The reader might be interested to look into these cases.

[78] This PRO is called the *Duales System Deutchland* (DSD).

Packaging Ordinance, in connection with packaging and EPR, indicates that the most plausible form of responsibility to producers [including plastic bags] is financial.

While EPR schemes on packaging are common, no specific adaptations of such policies to plastic bags were found in the countries looked at in this research. Nevertheless, the success of EPR schemes as economic instruments and as tools for forging design improvements by manufacturers (for better environmental performance) is well acknowledged (Lindhqvist, 2000 & Tojo, 2004). On the other hand, while the idea of a deposit-refund system has been contemplated in many places, it has not been taken on.

The challenge that could be anticipated (particularly in Africa) as regards EPR schemes is that of enforcement and acceptability (by the producer). As discussed above, EPR schemes involve the allocation of recycling quotas by the government. To comply with these quotas, companies have to resort to PROs as commonly practiced in Germany and Sweden.[79]

Regardless of the challenges it might have in respect to acceptability and enforcement, the Deposit Refund System (DRS) can be experimented as an alternative. The justification here is the expected gains on other criteria, primarily environmental and cost effectiveness. Kaseke (2003, p. i) has underlined the importance of DRSs as economic instruments to control of urban litter in Africa by taking Harare (Zimbabwe) as a case study. He argues that DRSs are applicable to a wide range of products and by-products including beverage containers, car batteries, plastics and hazardous materials (*Ibid.*). Lindhqvist (2000) discusses the types of DRSs, the rationale behind them, and their use towards high collection rates as briefly presented in Box 4 below.

Box 4 The Deposit refund System: Types, Historical Development and Applications

Deposit-refund systems can be divided into natural and artificial systems. Natural systems exist because of the real value of the refillable container and the consequent desire of breweries and other fillers to recoup the container. The refund had to be high enough to motivate consumers to return the container instead of keeping it for their own purposes or throwing it away.

With the changes in manufacturing technology, transport prices, salary levels, etc., the economic rationale of refillable bottles gradually disappeared, and one-way packaging rapidly expanded its market share. Triggered by the debate on energy and material wastefulness, combined with littering problems, individuals and society started to discuss the reintroduction of refillable containers and, along with them, deposit-refund systems. It was now in many cases not a question regarding a system where the fillers wanted the bottles because of their value, but rather that the bottles should be returned in order to fulfil societal objectives of reducing littering and combating wastefulness. Consequently, the deposit-refund system became an artificial system, imposed on the market by societal concerns.

Deposit-refund systems are in many instances seen as the best solution when very high collection rates are desired. The general notion seems to be that the existing deposit-refund systems are, overall, very successful in achieving high collection results. Many of the traditional deposit-refund systems for beer and soft drinks in refillable glass bottles are claimed, where they still exist, to lead to an almost 100% return rate. This is the case for the 33-centilitre glass bottles in Sweden and Denmark. In these cases, as well as in other comparable countries, the refund sums are most often fairly modest, that is, in the order of USD 0.03-0.15.

Source: Lindhqvist (2000, p.82)

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[79] Detailed accounts of EPR schemes in these countries and elsewhere is presented by Lindhqvist (2000).

Other economic instruments in this category are tax and duty waivers, and preferential electric charges. Specific mention of such incentives in the country case studies was not encountered. However, it was a central issue raised in Kenya, i.e. both by the regulatory bodies (NEMA and MoTI) and manufacturers and recyclers of plastics. The elements for such incentives are also ingrained in legislations like EMCA, 1999. To this can be added public procurement of recycled products as an additional measure. The rationale is the simple fact that government is one of the big purchasers of a number of items. The products identified in the contextual study, i.e. plastic sheeting for construction and plastic lumber can be earmarked for such incentives measures.

The role that such instruments could play to address the problem in Nairobi is well taken by this research. It goes without saying that policy instruments need to be designed meticulously to avoid perverse effects; however, this issue is outside the scope of this study and will not be dealt with further.

Informative Instruments

Awareness campaigns and environmental education can also be used to mange the post-consumer side of the problem. Through these measures consumers can be encouraged to source-segregate and responsibly dispose of plastic waste. Manufacturers could also be urged to ingrain life-cycle thinking on the products they manufacture. The fact that these instruments cannot be relied as standalone measures is already underlined.

Voluntary Approaches[80]

One additional instrument that has been used to mange the menace of plastic bag waste is Voluntary Codes of Practice by retailers. This was particularly the case in Australia. While some success was registered, environmentalists and some government officials express doubts respecting the significance of this as a stand-alone measure. In the Australian case, there were difficulties in meeting the proposed targets; the results could also be interpreted as desired.

In Kenya, the Ten-Point-Action Plan was a case in point. Supermarkets have also taken measures in the provision of bins for take back of packaging waste including bags. The results were that no sizable strides were made.

In view of the above, voluntary approaches are not recommended as self-sufficient measures for Nairobi. This research, however, recognises them as important support tools. In relative terms, they have acceptability and ease of enforceability and could be integrated to supplement other instruments.

5.5.3 Evaluation on the Basis of Identified Criteria

Table 5-1 summarises the discussions above by presenting an evaluation of the various options on the basis of the selected criteria. It shows that a plastic bag levy, a deposit, a minimum thickness and weight standard, and an outright ban can potentially be used as stand-alone (core) measures with varying degrees of success. It should however be noted that in all cases where these options have been applied as core instruments, supplementary informative efforts were also in place as support measures.

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[80] Voluntary Approaches are separately stated due to their different nature. Although no detailed literature review was carried out on their classification, some studies (e.g. Policy Research Initiative, 2005) of Canada take them as informative instruments.

The evaluations indicate that a levy performs very well in almost all of the criteria and is well tested in practice. It should therefore form one of the core instruments. A deposit is also *potentially* capable of yielding acceptable results in respects of the criteria. One challenge is that it has not been used in practice for plastic bag waste. It is suggested as the second best option.

Table 5-1 Evaluation of Relevant Policy Measures Using Identified Criteria

| Criteria	Policy Instrument						Voluntary Approaches
	Economic		Regulatory		Informative		
	Levy	Deposit	Outright ban	Minimum thickness & weight standard	Awareness campaigns	Education	
Environmental effectiveness	**Very high.** Addresses the root cause of wasteful consumption which will have a bearing on littering and ultimately on the actual environmental impacts.	**Potentially high.** Enables high return/collection of post consumer/litter items thereby alleviating the actual environmental problems.	**Very high** (assuming it is properly enforced)	**High.** Principally intended to encourage re-use, which also makes bags expensive to throw-away.	Low	Medium	**Low.** They are subject to the 'wish & whim' of the retailers or manufacturers. Failed to meet commitments in Australia.
Cost-effectiveness	**Very high.** Can be set at the right level and hence become cost-effective. The experiences in Ireland showed this potential in practice.	**Potentially high.** Proven to be cost effective in the clean-up and recycling of litter items such as aluminium cans and PET bottles in Sweden.	**Very low.** Costly as it results in the closure of bag making industry.	**Low.** Is a traditional CAC approach. Those who can pay the full environmental costs for one-way bags not allowed to.	High	High	High
Incentives for long-run improvements	**High.** Can be made preferential to give incentives to environmentally-desirable products.	**Potentially high.** The threat of a deposit on one-way materials could encourage reusables. Other environmentally desirable products can be promoted in the same manner.	**Low.** Although bans on hazardous materials ("sun setting") may provide incentives for the development of safer alternatives, the ones on plastic bags in Bangladesh, Eritrea and Somaliland did not bring about long-run improvements. Availability of local know-how is a determining factor.	**Low.** No such improvements as a result of the Indian and South African regulations.	Low	Low	**Low.** No such incentives were reported in Australia.

Criteria	Policy Instrument						Voluntary Approaches
	Economic		Regulatory		Informative		
	Levy	Deposit	Outright ban	Minimum thickness & weight standard	Awareness campaigns	Education	
Enforceability	**High.** Relatively easy to enforce as practical experiences in Ireland and South Africa indicated. In Kenya, KIPPRA and other stakeholders believe it is enforceable.	**Low.** Take back of (highly contaminated) bags might prove a problem and contentious. Set up of PROs might be required.	**Very low.** Difficult, It requires strict monitoring of ports and illegal manufacturers. Strong punitive measures must all be in place	**Low.** Thorough monitoring of the informal sector and ports of entry required. Punitive measures must be available. Indian and existing Kenyan experiences show the difficulty	**Very high**	**Very high**	**Very low.** There is high prevalence of informal sector, i.e. retailers. Commitment rate expected to be very low
Political acceptability	**Medium.** Its rationales are acceptable to many stakeholders as a means of internalising externalities. Some level of opposition from manufacturers and retailers expected if tax level is set very high.	**Medium.** Its rationales are acceptable to many stakeholders as a means of litter control.	**Very low.** Strong resistance from manufacturers, retailers and consumers as indicated in the experiences of Bangladesh and Somaliland.	**Low.** There were strong oppositions in South Africa. In Kenya Industry is opposed to the 30 micron regulation.	**Very high**	**Very high**	**High.** Highly preferred by industry as was the case in Australia and Kenya.
Summary: Potential as a stand-alone measure	**Very high**	**Medium**	**High**	**Medium**	**Low**	**Low**	**Low**

5.6 Policy Packages and Causal Chains

The need and rationale behind packaging various policy instruments were discussed in Chapter 2. The issue is of utmost significance to plastic bag waste because of the necessity to mange both the pre and post consumer aspects of the problem (as per the waste management hierarchy). This approach, in turn, results in a tier of priorities, i.e. reduce, reuse, recycle/compost, incinerate, and landfill as discussed previously. Attainment of these priorities, in turn, has to be facilitated by a number of enabling instruments, i.e. regulatory, economic and informative.

On the basis of the input-output model of public policy, the anticipated causal chains (amongst the outputs, intermediate outcomes and ultimate outcomes) for a three-fold intervention measure can be reconstructed as indicated in Figure 5-3 below.

Figure 5-3 Main Assumptions & Causal Chains in a Three-fold Intervention Measure
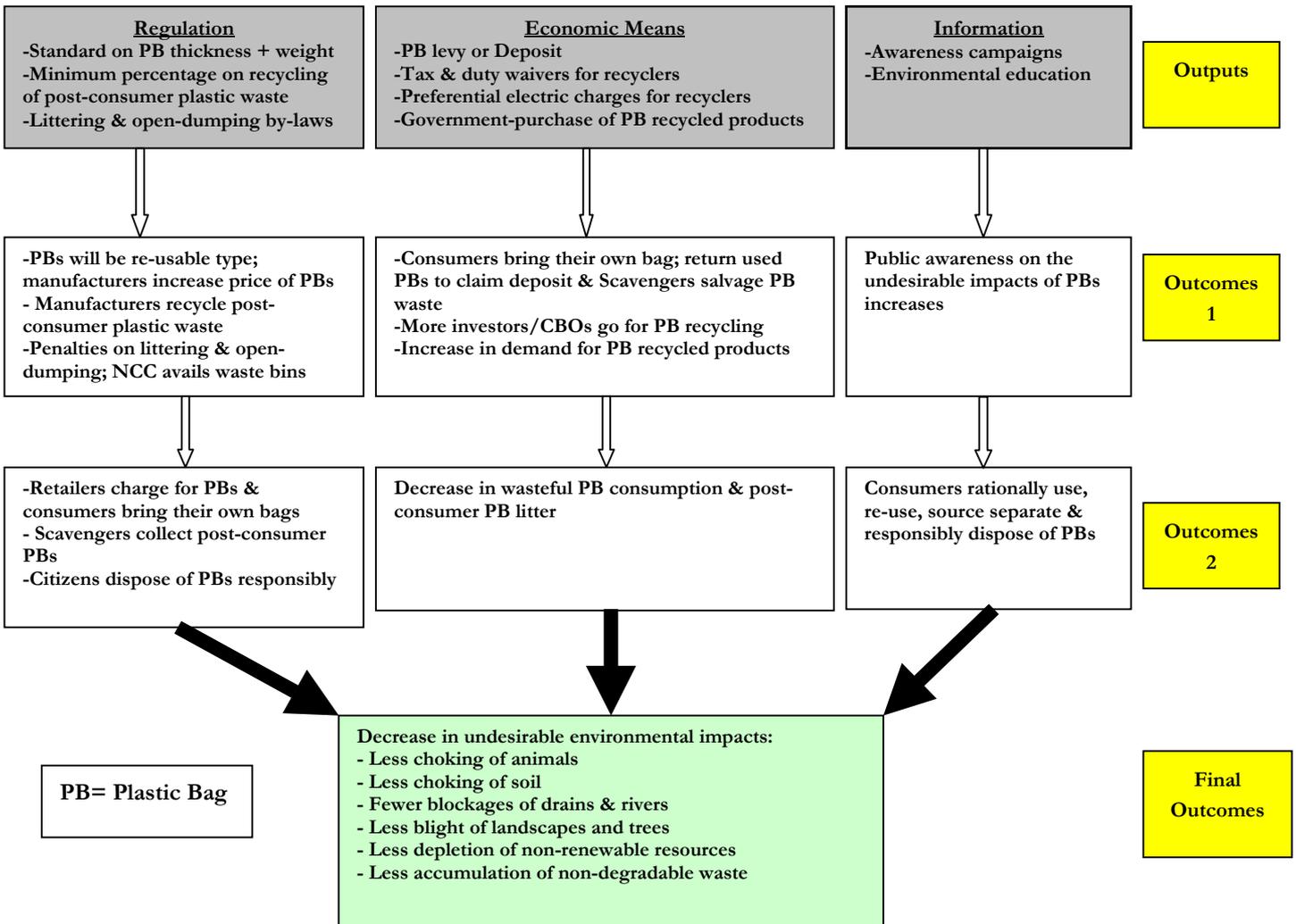
5.7 Proposed Policy Measures and Technical Approaches for Nairobi

5.7.1 Short & Medium Term: Alternative I (Including a Levy)

In line with the above discussions, the package of policy measures and technical approaches for the short-to-medium term for Nairobi is reconstructed in the form of an applicable waste management hierarchy as indicated in Figure 5-4 below. Detail descriptions follow the diagram.

Figure 5-4 Reconstructed WM[81] Hierarchy & Enabling Instruments-I
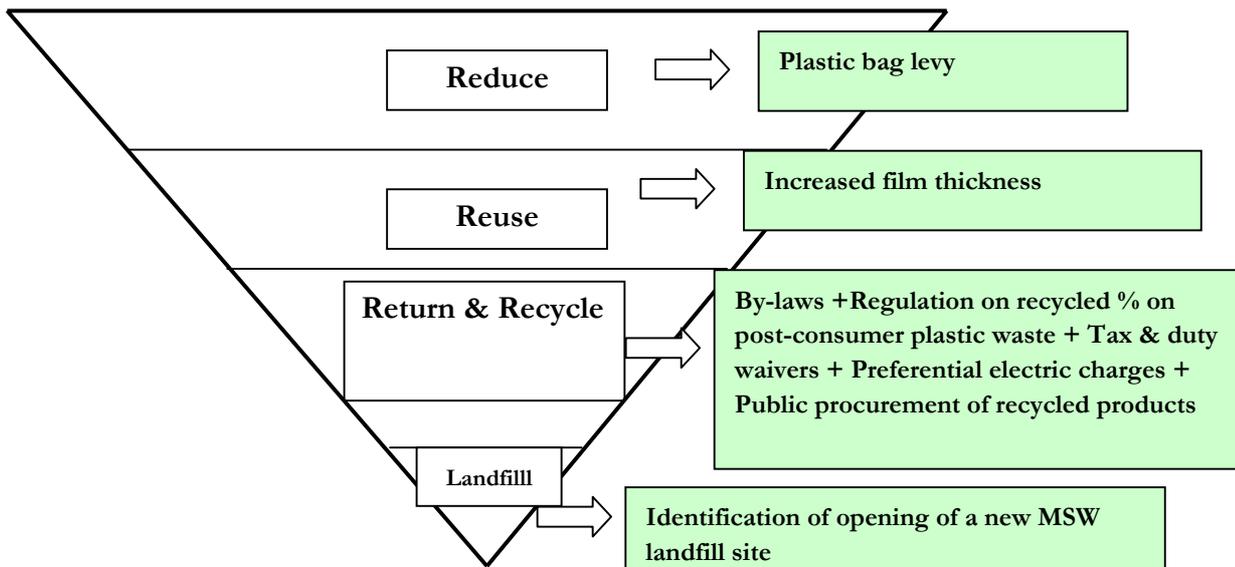
The reconstructed waste management hierarchy addresses both the pre- & post consumer aspects of plastic bags. The first two requirements, i.e. reduction and re-use address the pre-consumer phase and are 'management' approaches. The second two, i.e. recycling and land-filling are 'technical' approaches which address the post-consumer phase. The primary target should be reduction of wasteful consumption with corresponding compensation from re-use to be encouraged with the provision of more durable thicker plastic bags and alternatives such as cloth and traditional bags. The technical option to support these is a well functioning recycling scheme. Landfilling is the last resort for whatever non-reusable wastes that has to be disposed of in the end.

Reduction

Reduction is primarily to be achieved through the introduction of a levy on each plastic bag sold (except re-usables[82]). For maximum effect, the levy should be made transferable (by law) to the consumer. This way, it is possible to induce the intended shift in consumer behaviour towards rational use and re-use of plastic bags. For ease of implementation, it is recommended that the levy be collected from bag manufacturers and importers. This is essential as direct collection from customers will be problematic in a country where a sizable percentage of businesses, e.g. kiosks, are informal and most do not use the receipt system. KAM officials have also expressed concerns as regards the challenges of collecting a levy from the predominantly informal sector in Kenya (Kantharia, Bimal and Kimilu, Damaris, Personal interviews). The same argument is supported by the UNEP (2005) study. One disadvantage of collecting the levy from manufacturers and importers could be loss of 'steering

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[81] WM= Waste Management.

[82] Reusables can be defined by their specifications (dimension and micron size) or minimum price (as in the case of Ireland).

effects' on consumers. This is to imply that the existence of the tax might not be apparent to buyers in comparison to the other option where it is collected directly from consumers at the point of sale. This in turn might not stimulate customers to come with their own bag or pay for one as was the case in South Africa.[83]

The optimal level of this tax needs to be determined through trial and error until the intermediate goal of reduction in wasteful consumption is met. A study has to be conducted both in the informal and formal sectors to realistically determine by how much consumption should be decreased without adversely affecting business.

It is very essential that funds raised through the levy be separately earmarked for environmental causes, i.e. (a) developing collection and recycling facilities for post-consumer plastic waste; (b) public awareness campaigns on source separation and responsible disposal;   (c) to cover clean-up costs of highly littered areas; and (d) research and development of alternative bags, e.g. cloth bags in the short to medium term. This was the case in Ireland and South Africa.

A support tool to bring about reduction in wasteful consumption is a public awareness campaign. The campaign could address individual consumers, supermarkets and kiosks. In addition to the common mass media (newspapers, radio, TV) other tailor-made means can be deployed, e.g. brochures.

Reuse

It is prudent to assume that reuse is also facilitated by the same instruments that impact on wasteful consumption. A levy makes one-way bags expensive leading to more durable (re-usable) options while awareness campaigns could be geared to discourage the use and throw culture and cultivate re-use. There is also one additional *technical requirement*, i.e. the film thickness of bags and their dimensions have to be rightly adjusted to make them more durable and also reusable. In addition, re-use could be facilitated by the availability of durable bags other than plastics, like traditional baskets.[84]

Recycling

The challenge associated with recycling of plastics has been discussed in Section 3.3.4. This research, however, suggests that it should form the main technical approach to mange plastic bag waste in Nairobi in the short-to-medium term. The underlying reasons (partly revealed by the contextual evaluation) are discussed below.

a) There are a number of plastic recycling industries already operating in Nairobi and elsewhere in Kenya. CBOs, like KEMA are also engaged in the salvaging of plastic waste to produce useful products. This implies that there is some infrastructure and local know-how to support such a venture.

b) There is the economic drive for recycling plastic waste as the discussion with industry was able to show. The present plastic industry in Kenya wholly depends on imported raw materials. Given the

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[83] In the opinion of the author the South African approach of transparency on the cost of goods and bags could help create the desired steering effects. This [again according to the author] has to be attained through awareness campaigns and voluntary commitment of the informal sector. The formal sector could play a pivotal role by itemizing the levy on receipts.

[84] It is anticipated that with a reduction in consumption due to the levy, market forces will create some demand for traditional re-usable bags.

relatively low labour costs, plastic waste could be collected and processed to be supplied to manufacturers at a competitive price as against virgin material.

c) Some products from recycled plastic waste (including bags) are opening up promising opportunities. A case in point is black plastic sheeting for building construction sites. Plastic posts are also being produced. Elsewhere in the developing world, there are evidences of recycling of plastic bags for various other applications. In India, waste plastic bags mixed with bitumen[85] have been used in the construction of road pavements (CMEN, 2005). In Uganda, they have been used for the manufacture of water pipes (*Ibid.*).

d) Other technical options like incineration and WTE facilities are not appropriate to the Kenyan situation as discussed in Chapter 3. Practical examples could be cited here. For instance, South Africa does not incinerate plastic waste to generate energy. The country has incinerators only for medical waste[86] whereas incineration of MSW is not yet found to be economical for a number of reasons, e.g. relatively low volume of waste in comparison to European countries and very stringent rules against incinerators (CMEN, 2005). The situation is similar in India. Narayan (2001, 57-58) has documented that despite the benefits incineration is providing in European countries, Indian waste is not appropriate for such applications as it contains only 3 to 7% of combustibles like paper and plastics by the time the waste reaches the disposal site. The reasons for this being the fact that these materials are usually salvaged close to the source by waste pickers. As a result, the calorific value at the time of disposal is relatively low (800-1000 kcal/kg) necessitating the addition of fuel oil to facilitate combustion (which is quite costly).[87] It also goes without saying that incineration comes in competition with recycling when it comes to plastic waste (also noted by Narayan, 2001, p. 59). Hence, with a source reduction approach as advocated by the principles of MSW management (also guiding this research), incineration, which relies on the supply of large quantities of waste with a high calorific value, cannot be simultaneously viable.

e) The experience of South Africa also shows that recycling is a plausible technical solution to plastic waste at the moment. The Plastics Federation of South Africa claims that the country is already recycling 25% of its plastic waste (CMEN, 2005).

However, a vibrant recycling sector can only be established through appropriate intervention measures. The following are suited to the Kenyan context as contextual evaluations and country-case studies were able to demonstrate.

a) **Ensuring high collection rate:** This is one of the cornerstones of an effective recycling system. With a levy (or deposit) in place, there would be funds available to cover costs of collection. As per the prevailing trend, which appears to be market-driven, the service can be outsourced to private companies and CBOs. The principal role of the NCC should be formulation and enforcement of by-laws on littering and illegal dumping. It can also play a crucial role through the provision of bins at road sides and in public places for proper disposal. Supermarkets and department stores can also help by providing collection bins for plastic products. This should not be a problem as some, e.g. Nakumatt and UCHUMI have already taken measures to this effect. In

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[85] Bitumen is a category of organic liquids which are highly viscous, black, sticky and wholly soluble in carbon disulfide. Asphalt and tar are the most common forms of bitumen (Wikipedia, 2005).

[86] From the discussion in the previous chapter, it will be recalled that the current situation is the same in Kenya.

[87] Narayan (2001, p. 58) also gives an account of a failed WTE project in India: Growing enthusiasm for incineration has convinced the Indian government to acquire an incinerator of Danish technology for use in Timarpur (Delhi). The project proved unsuccessful as it failed to take the characteristics of the Indian waste into account- which has high organic content. The plant, reportedly, lies unused although it has cost several millions of Rupees.

this alternative (with a levy) however, the management instruments to bring about high return rate are by-laws on littering and illegal dumping (supported by awareness campaigns).

b) **Market creation for recycled plastic products:** Market constraint for recycled products is a crucial problem as, for instance, experienced by KEMA. Hence, appropriate enabling instruments have to be in place if recycling is to emerge as a solution. In the first category is a regulation on recycling percentage on post-consumer plastic (bag) waste. The rationales and present status in Kenya is discussed in Section 5.5.2. In the second category are economic instruments including tax and duty waivers (on recycling machinery and factory supplies), and preferential power charges for recyclers. An additional instrument that may be considered is public procurement of recycled products. By making provisions in purchasing contracts favouring recycled products, the government can support recycling. Products that can be promoted in this way could be black plastic sheeting for building construction, plastic poles for fencing, park benches, etc.

c) **Provision of appropriate technology and know-how:** Some of the technologies used in the recycling of plastic waste are unsafe and sub-standard (e.g. KEMA case-study). This problem could be alleviated by the provision of support services by institutions like the Kenya Industrial Research and Development Institute (KIRDI) and ITDG. These institutions could help through the identification of appropriate technologies for plastic waste management in Kenya.

Landfilling

It is sensible to assume that material that cannot be recycled for various reasons requires proper disposal. As regards plastics, the reasons, among others, could be very high contamination, absence of recycling capacity of the waste bags, etc. In addition, all products will eventually have to be disposed of, even as fly and bottom ash from incinerators.

Given the unattractiveness of incineration and WTE facilities (as discussed in Sections 3.3.6 & 5.7.1), land-filling is the only option that can be considered to deal with the amount of plastic waste that could not be dealt with recycling.

The major challenge in the short-to-medium term, however, is the lack of a sanitary landfill site. To cope with the growing MSW volume in the city, there is urgency for a sanitary landfill where a small amount of plastic waste could also be co-disposed of. This might require re-settlement of the people around Ruai to get adequate space which will certainly increase investment costs but could be offset in operational costs (due to lower transportation costs) in comparison to remote locations. The fund to be obtained from the levy could be partly channelled to cover such costs.

The current tradition of open dumping is not 'best practice' as discussed earlier and cannot as such be recommended.

5.7.2 Short & Medium Term: Alternative II (Including a Deposit)

This alternative is to be based with a DRS as against a levy proposed in alternative I. As indicated in Table 5.1, it is proposed as the second best option[88] and no additional comparisons will be made here between the two. The proposition is that a deposit is to be imposed on all bags issued (excepting re-usables) and set considerably high to create incentives for return. The deposit is to be refunded when

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[88] It is considered as the second best option based on the author's evaluation presented in Table 5-1. It is worthwhile to remember that the DRS has not been used for plastic bags in practice although its potential as a potent instrument is recognized.

the bags are returned to an authorized (designated) point.[89] As mentioned already, use of DRS in practice to manage post consumer plastic bags is not available to the author. Nonetheless, this and other similar approaches have been weighed up by various stakeholders in Kenya and elsewhere.

In Australia, a deposit of 10 to 15 Australian cents on each plastic bag was put forward as an alternative (threat) in the event the voluntary code of practice failed to meet the agreed targets (PNSW, 2004, p.13). This deposit is refundable when bags are returned to the designated stores. The advantages are the possibility to raise money for community groups [from litter collection] and convenience for retailers and consumers as one-way plastic bags would still be available (*Ibid.*).

In San Francisco (USA), a resolution for an ordinance requiring supermarkets to charge USD 0.17 for each plastic and paper bag was passed on January 25, 2005 (SFGate, 2005). Regarding this proposal, some experts interviewed by *SFGate* claimed that: (a) since there are no refunds for people who return bags, there will be no motivation especially to salvage bags from the waste stream; (b) for this program to be successful, there should be a deposit and refund similar to that for beverage containers; and (c) there should be both a reward and penalty, e.g. shops could charge consumers 17 cents for a bag or give them a 10 cent credit if they come with their own (*Ibid.*).

In Kenya, NEMA at one time considered a buy-back scheme, which was never implemented (Mbegera, M.O. 2005, June 29 & July 5. Personal interview). Although this is different from a traditional DRS, it highlights the need for financial incentive if post-consumer plastic bags are to be adequately returned. MoTI also underscores the absence of take-back incentives as a missing driving force for collection (Munyao, Gregory. 2005, July 7. Personal interview). Although the importance of using such incentives is enshrined in EMCA [currently being explored by NEMA] it is not yet implemented (Mungai, David. 2005, July 6. Personal interview). The use of DRS in Kenya is currently limited to the beverage industry, i.e. a deposit on reusable glass bottles which is refunded upon return. The deposit ranges between Ksh. 10 and 25 for soft drink and beer bottles, respectively. The system has been popular not only in Nairobi but other parts of Kenya because of its ease of administration which involves collaboration with wholesalers, retailers and consumers (UNEP, 2005, p.18).

Figure 5-5 shows a reconstruction of the proposal in the form of an applicable waste management hierarchy. Short explanations follow the diagram.

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[89] Although the combined use of a levy and a deposit is theoretically possible, the author believes that such a dual approach could be more than required and too complicated to administer. Hence, the author contemplates a DRS as a stand-alone economic instrument to mange post-consumer plastic bag waste.

Figure5-5 Reconstructed WM Hierarchy & Enabling Instruments: II
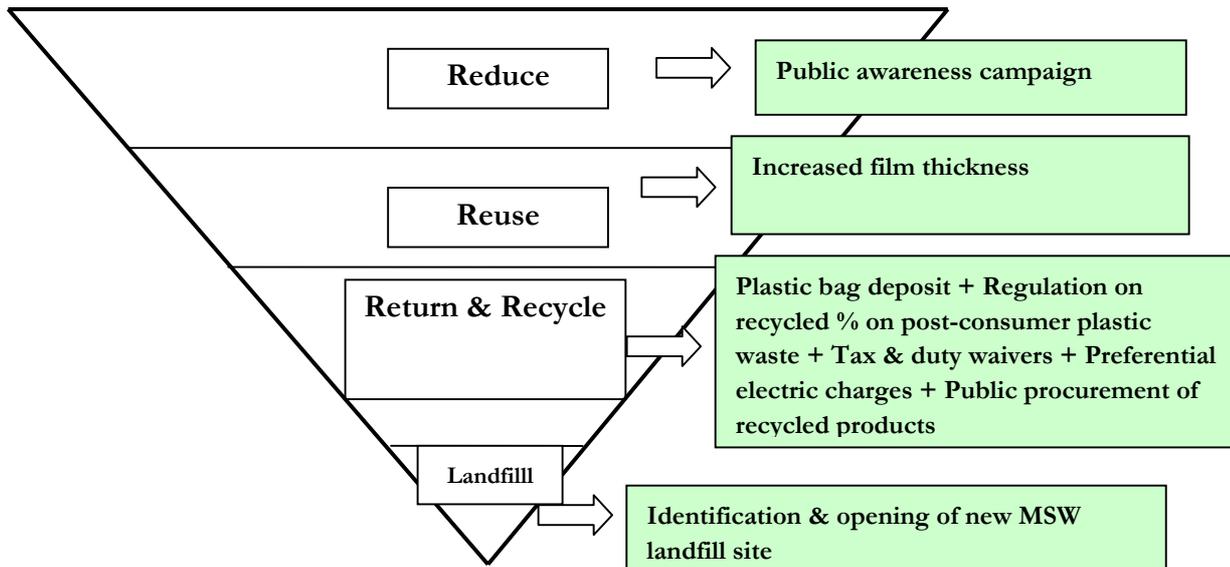
The system is conceived as a post-consumer waste management system, i.e. collection to be facilitated by a deposit on all bags. The type of DRS suited to plastic bags has to be determined through careful assessment of the pros and cons of each alternative.[90] In this research, the term DRS is used to imply a traditional system in which an explicit deposit and a refund is made on item by item basis.

Additionally by-laws are to serve as support tools. Reduction of wasteful consumption, being desirable, is to be achieved through awareness campaigns. A minimum thickness standard is to be adopted to facilitate re-use. The other instruments are envisaged to render the same incentives as described for the first alternative.

5.7.3 Long Term

The long-term solution for the plastic bag waste problem has to hinge on changing the nature of the product itself. Today's plastic bags are based on non-renewable resources. They are also non-biodegradable. Undoubtedly, a sustainable product system has to go away from today's linear mode of production and consumption (e.g. today's plastic bags) towards the cyclical mode characterising natural systems. This argument can be substantiated by UNEP's Concept Note for Regional Project on Sustainable Consumption and Production of Plastics in Africa (UNEP, 2004, p. 28):

> *"… As was noted in the Johannesburg Plan of Implementation, there is a strong need for a fundamental shift in society's consumption pattern in order to achieve global sustainability. African countries are well positioned in order to realize such fundamental shift by adopting sustainable alternatives which include the production of Environmentally Degradable Plastics (EDPs) using locally available renewable resources."*

The rationale and details of the UNEP-ARSCP project on plastics is presented in Appendix 1.

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[90] In the opinion of the author, determination of the right DRS applicable to plastic bags could be one area of future research (see Section 6.2).

Figure 5-6 Reconstructed WM Hierarchy and Enabling Instruments: Long term
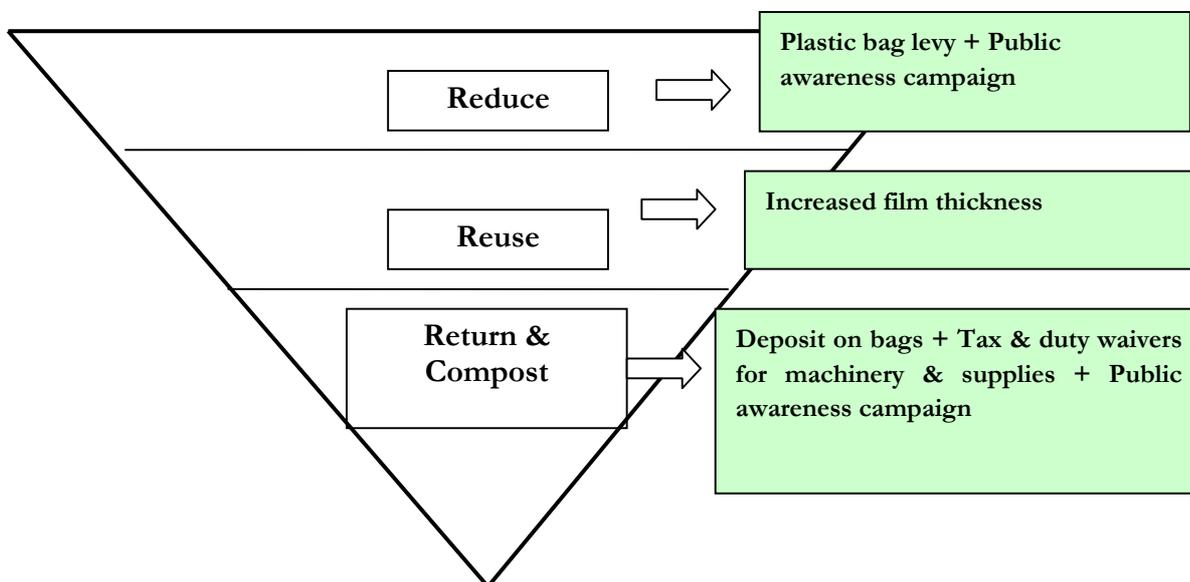
Considering the world-wide trends and the contextual realities of Kenya, one plausible strategy is moving towards compostable bags. Given Africa's and Kenya's relatively high organic content of MSW, such bags can be expected to play an important role by facilitating composting activities. This also means no landfilling of bags is required. This desired scenario is shown in Figure 5-6 above.

In line with the principles of sustainable MSW management, reduction of wasteful consumption is always desirable, even in this scenario. Hence, a modest plastic bag levy could be imposed to this effect. However, current cost data indicate that EDPs are much more expensive than conventional plastics. This could mean these premiums are sufficient economic incentives to bring about reduction and hence, no levies might be required, however, details have to be worked out in this regard.

Re-use, as discussed in the short-term alternatives, is to be facilitated by a minimum thickness standard. This could also stimulate collection of littered bags by scavengers. In addition, a public awareness campaign for reduction and re-use is to be used as a support instrument.

The technical solution in this scenario is composting. It is to be facilitated by measures such as deposits on bags; tax and duty waivers on composting machinery and supplies; preferential electricity charges for industrial-scale composters; and awareness campaigns as supporting tools.

As discussed in Section 3.8, there are a number of pre-conditions that have to be met if the shift from conventional to compostable bags is to become a reality [particularly in the Africa]. The following can be recalled:

a) There should be a reliable source separation of waste to obtain organic fractions that are not contaminated with inorganics. In particular, hazardous waste (including HHW) must not find its way into compostable fractions. Mixed waste composting has an adverse impact on the quality and marketability of the compost; hence separate collection of organic waste and removal of non-compostables are necessary in many developing countries (Ren, 2002, p.30).

b) As expected, the market for compost must be well developed. In the EU, for instance, waste regulations and landfill directives are driving the compostable plastic industry by encouraging composting of organic solid waste; such rules coupled with high tipping fees create higher demand for compostable products (Biocycle, 2002).

c) Justifiably, there should be a high level of public awareness and effective by-laws against littering.

d) As per the intent of the UNEP-ARSCP project, appropriate raw materials and technologies for the manufacture of compostable bags should be made available. This can be facilitated by a number of organisations, foremost amongst them being ITDG and UNEP. NEMA, KEBS, KIRDI and KNCPC could play roles as local counterparts. Specifically, ITDG could contribute quite a lot as this is in line with its objectives and as it has a thorough understanding of the MSW stream in Nairobi.

e) In addition, the pros and cons of bio-degradable plastics (presented in Section 3.8) should be favourably addressed if satisfactory results are to be obtained from compostable plastic bags in Africa.

As discussed in the foregoing sections, there is already a tendency towards using (bio-) degradable shopping bags in Kenya (at least by Nakumatt and UCHUMI) which should be commended as it is an expression of concern to the environment. It is also an indication that conditions are suitable for contemplation of a broader use of bio-degradable bags.

Regarding the current state of affairs, however, the author is of the opinion that these endeavours lack clear directions. In the first instance, the costs and benefits of the launched degradable bags is not weighed. Since these bags are inherently non-renewable, the approach could certainly be questioned from resource utilisation standpoint. Second, there is no national standard on what constitutes '(bio-) degradable' bags and the moves by supermarkets and industry do not seem well thought-through.

In conclusion, compostable bags could be one-way out of the current plastic waste menace. For this to be realised, there should be concerted efforts from all stakeholders and the pre-conditions described above have to be fulfilled.

6 Conclusions, Recommendations and Future Research

6.1 Conclusions

This concluding section wraps up the main findings of this research by trying to answer the research questions raised at the beginning.

What is the current status of plastic bag waste pollution in Nairobi?

The current state of plastic bag waste pollution in Nairobi is alarming. Concerns have been expressed from various stakeholders, namely the public at large, government institutions, environmental NGOs, and even plastic manufacturers and supermarkets. Notable public figures including 2004 Nobel Peace Prize winner, Wangari Mathaai, and president of Kenya, Mr. Mwai Kibaki attach urgency to the problem and to finding solutions to this menace because of serious environmental implications. In response, a number of initiatives are coming and some are already underway. Industry's Ten Point Action Plan and UNEP's Pilot Project for Plastic Waste Management in Nairobi can be cited as examples. A study for the use of economic instruments for MSW management in Kenya (joint UNEP-NEMA-KIPPRA undertaking) has rightly singled out plastic bag waste as the primary area for such an intervention. Above and beyond such documented evidence, any observer can confirm the severity of the plastic pollution problem in Nairobi based on visual observations alone.. It is there for everyone to see.

What are the associated undesirable environmental impacts?

A number of the undesirable impacts are also common to other developing and developed countries. In the first category are choking of animals and soils; blockage of water ways and rivers; and blight of landscapes and trees. To this could be added their indirect contribution to air pollution as open air burning of MSW is a common practice and as plastics (predominantly bags) appear in excessively high proportions in the waste stream. Flimsy plastic bags also indirectly contribute to the *'flying toilet'* nuisance as they are cheap to dispose in such fashion. In the second category of environmental problems are depletion of non-renewable resources as present-day bags are made of mineral products; and accumulation of non-biodegradable waste due to the nature of the raw materials used.

What are the underlying causes?

Externalities are the primary causes of the problem. External costs from end-of life environmental impacts and as a result of resource depletion are not factored in the product costs. As a result, plastic bags have become exceedingly cheap to serve the profligate use-and-throw pattern of consumption and production. On a par with this are institutional failures which take two major forms: inability of the NCC to discharge its MSW collection & treatment duties; and inadequacy of the NCC by-laws to deter littering and illegal dumping. Other reasons are very low public awareness on proper disposal of waste including source segregation. Still another one in this category is absence of life-cycle thinking amongst manufacturers.

What policy packages and technical approaches could be adopted to resolve the problem in the short-to-medium and long terms?

The solutions will have to be formulated as corrective measures to the root causes. The principal causes being externalities, the corrective measures, proven from theoretical evaluation and practical experience, are economic instruments. Set at the right level, a levy imposed on one-way plastic bags could stimulate desired change in consumer behaviour, i.e. rational use and re-use of plastic bags.

Therefore, a levy should form the core instrument in intervention measures to tackle the menace as it performs well in regard to the relevant criteria of environmental effectiveness, cost-effectiveness, incentives for long-run improvements, enforceability, and political acceptability. Though not experimented with plastic bags, a deposit and refund is also a potent and proven economic instrument in addressing similar environmental problems due to materials that end up in the litter stream.

Institutional failures should also be fixed. Of special significance are formulation and enforcement of workable by-laws on littering and illegal dumping. Another regulatory measure is also required to promote the re-use culture. This being a practice encouraged next to reduction, the necessary technical requirement has to be fulfilled, i.e. minimum specifications on film thickness and dimensions of plastic bags. These specifications could also help in the collection and recycling of post-consumer plastic bags (if complemented by a minimum weight requirement). The by-laws and standards form the regulatory instruments of the corrective policy packages for the problem.

Lack of awareness on the environmental impacts of plastic wastes, their proper disposal, and on life cycle thinking will have to be addressed through well formulated informative instruments, namely awareness campaigns and education for all actors involved with production, use and disposal of plastic bags.

There being a requirement to manage both the pre-and post consumer aspects of the problem in line with the requirements of the waste management hierarchy, all the above instruments need to be packaged (horizontally) to serve the various purposes. This is the underlining reason for using a package of three-fold instruments.

The technical solution proposed (in the short-to-medium term) is recycling followed by sanitary land filling. Additional economic instruments like tax and duty waivers and preferential electric tariffs should be considered to promote recycling. Minimum requirements on recycled post-consumer plastic could also promote this activity. Due to the very low calorific value of MSW in Nairobi (high organics and moisture content), high investment cost and lack of expertise, incineration cannot be a viable technical solution to the problem. Furthermore, the reality is that recycling and incineration compete for the same materials when it comes to plastics. This is an additional reason why operating both poses a conflict. The second technical solution recommended [in that order] is a sanitary landfill. The need for such a landfill is justified by widespread illegal dumping and open-air burning of mixed waste in Nairobi and not as such as a solution for plastic bag waste. This need has become even more pressing as a result of the growing volume of MSW and the need to close the existing dumpsite which has caused adverse environmental impacts. The proposal being made here is that whatever plastics that cannot be recycled for various reasons could be co-disposed of in such facilities.

The long term technical solution should address the very nature of the materials from which the products are manufactured, which are non-renewable and non-biodegradable. Of course, this not a problem to Nairobi alone but is a global concern. Solutions have to come by way of investigating bio-degradable materials such as environmentally degradable plastics. One promising trend world-wide (though not yet fully viable) is compostable plastics. Holding a number of challenges and opportunities, these materials can be explored as long-term solutions. For this to be a reality, a number of pre-conditions have to be met. Foremost amongst them, a culture of source separation [of organics] which is a requirement for the production of uncontaminated compost and for which compostable bags are expected to perform very well. This proposition should however be viewed as one plausible approach to the futuristic and challenging scenario of sustainable consumption and production.

In conjunction with this, promotion of traditional bags is also one supporting (technical) solution both in the short and long term. Reduction of plastic bag consumption initiated by economic instruments is expected to create demand for re-usables where traditional bags can be expected to find a niche market. They, therefore, come in as bags in re-usable category and not as complete substitutes to plastic bags.

6.2 Recommendations

An attempt was made in Chapters 5 and 6 to answer the research questions posed at the outset and thereby fulfil the objectives of this research. While this remains the main task, the author would also like to reflect upon issues that are of special significance to the case under investigation.

The first point is the need to upgrade the overall waste management system in Nairobi city. This is not expected to be an easy task. The remedies can only come through combined efforts of all stakeholders around the issue. For instance, the NCC could expedite the formulation and gazettment of practicable by-laws which will also have to be strictly enforced. This applies as well for policies on privatisation of the MSW sector, public private partnership and promotion of CBOs. In a similar move, NEMA could work on the formulation and gazettment of incentive measures for people who would like to invest in the MSW management area. In so doing, it could collaborate with a number of organisations like KIPPRA.

One crucial issue that has to be addressed in connection to MSW management is the identification of a new sanitary landfill site. While the existing challenges are well taken by this research, the need for such a facility is justified in view of the adverse environmental impacts of the existing dumpsite and that of illegal dumping and open-air burning.

In addition to the creation of favourable policy environment, identification of appropriate recycling and composting technologies for the Kenyan [and African] context could enhance the success of the post-consumer management side of plastic bags. Recycling machinery that can handle contaminated plastic waste to produce plastic poles and sheeting could be one area of investigation. Another one is raw materials and process technology for compostable plastic bags. A number of institutions can jointly work on these problems, e.g. NEMA, ITDG, UNEP, KIRDI and KNCPC.

The issue of market creation for recycling and composting products deserves attention both in the short-to-medium and long term. It determines the success of intervention measures involving these two technical solutions. Hence, there is a strong need to develop and implement a package of incentives to foster these approaches.

Environmental consciousness is certainly of paramount importance. The focus here is the rational use of resources and solid waste disposal. The culture of source segregation and responsible disposal of MSW needs immediate promotion. This is where well designed and continued public awareness campaigns and education will be useful.

As discussed in Chapter 3, a number of studies, proposals and initiatives have dealt with (or are dealing with) the plastic bag waste menace in Nairobi. While the endeavours are commendable there is a need to coordinate all efforts for a better outcome. In fact, there is a need to formulate and enforce a plastic bag regulation primarily to do away with the menace and to guide any such endeavours. The author believes that the proposals in this research could be of some use.

On a broader note, other African urban centres could gain valuable insights from the experience of Nairobi. There is wide documented information on the case and a number of initiatives are also underway. This research has tried to make a compilation of these and evaluate some proposed

solutions. The author believes that the analyses and proposals put forward by this research will be of some use to many urban centres in Africa. Definitive solutions to each will, however, have to be based on contextual evaluation of each city.

6.3 Future Research

In the opinion of the author and based on the findings of this study, the following are two areas that need future research.

The first area for further research is that of Environmentally Degradable Plastics and under this category the issue of compostable bags. This paper has tried to reflect upon pros and cons of this option but not in sufficient detail. Are they really viable at all and particularly in Africa? Are sufficient sustainable raw material resources available to support their success? What are the broader life cycle environmental impacts? These and a number of other questions need to be investigated in further research.

The second area is that of the Deposit Refund System. Can it resolve the problem at hand? This paper has discussed its potential as a potent economic instrument to address environmental impacts of items that end up in the litter stream based on the experiences of other countries. The type that could best work for plastic bags along with modalities of implementation was not investigated. One problem is that actual experiences on the use of such systems to mange plastic bag waste are not available to learn from [at least to the author]. Small scale experimentation might be an interesting area of investigation in the future and along with it a detailed evaluative study to determine its suitability before scale-up and full-fledged implementation.

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Abbreviations

AMREF	African Medical and Research Foundation
ARPEA	Applied Research in Preventative Environmental Approaches (course, IIIEE master's program)
ARSCP	African Roundtable on Sustainable Consumption and Production
CAC	Command-and-Control
CBO	Community Based Organisation
CBS	[Kenya] Central Bureau of statistics
COSATU	Congress of South African Trade Unions
DEAT	[South Africa] Department of Environmental Affairs and Tourism
DEHLG	[Irish] Department of the Environment, Heritage and Local Government
ELCI	Environment Liaison Centre International
EPR	Extended Producer Responsibility
EU	European Union
EUR	Euro
FRIDGE	[South Africa] Fund for Research into Development, Growth and Equity
HDPE	High Density Poly Ethylene
HHW	Hazardous Household Waste
ICC	International Coastal Cleanup
ICPE	Indian Centre for Plastics in the Environment
IPEP	International POPs Elimination Project
ITDG- (EA)	Intermediate Technology Development Group- (East Africa)
IETC	International Environmental Technology Centre
JICA	Japan International Cooperation Agency
KAM	Kenya Association of Manufacturers
KEBS	Kenya Bureau of Standards
KEMA	Kayole Environmental Management Association
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KIRDI	Kenya Industrial Research and Development Institute
KNCPC	Kenya National Cleaner Production Centre
Ksh	Kenyan Shilling [1 USD= 75Ksh; 1 Euro= 91KSh]
LDPE	Low Density Poly Ethylene
LLDPE	Linear Low Density Poly Ethylene
MIW	Medical and Infectious Waste
MOA	Memorandum of Understanding
MoENA	[Kenya] Ministry of Environment and Natural Resources
MoEF	[Indian] Ministry of Environment and Forests
MoTI	[Kenya] Ministry of Trade and Industry
MSW	Municipal Solid Waste

NACTU	[South Africa] National Council of Trade Unions
NCC	Nairobi City Council
NEDLAC	National Economic Development and Labour Council
NEMA	[Kenya] National Environment Management Authority
NGO	Non Governmental Organisation
NIMBY	Not In My Back Yard
PET	Poly Ethylene Therephthlate
PFSA	Plastic Federation of South Africa
PNSW	[Australia] Parliament of New South Wales
PIL	[Kenya] Packaging Industries Limited
POP	Persistent Organic Pollutant
PP	Poly Propylene
R	South African Rand
R & D	Research and Development
RDF	Refuse- Derived-Fuel
SABS	South African Bureau of Standards
SAGI	South African Government Information
t	Metric Ton
UNEP	United Nations Environment Programme
UNEP-DTIE	United Nations Environment Programme- Division of Technology, Industry and Economy
UNIDO	United Nations Industrial Development Organization
UNDP	United Nations Development Programme
USD	United States Dollar
WTE	Waste-To-Energy
WTP	Willingness-to-Pay

Appendix

Appendix 1 Rationale and Overview of the UNEP-ARSCP project on plastics in Africa

The production of alternative packaging materials including EDPs would provide multiple macro-economic benefits that go beyond the protection of the environment. This includes the broader contribution to national poverty reduction strategies through the production of local resource based products, the creation of employment and enhancement of productive capacities. Over the last few months, UNEP's Regional Office for Africa has been requested by a number of African countries on how to deal with the growing problem of plastic waste. While there is a very strong willingness on the part of African Countries to meet the challenge of plastic waste, lack of capacities has been recognized as the major impediments towards the solution.

The 'UNEP-ARSCP Project on Sustainable Consumption and Production of Plastics in Africa' is developed based on the above background with a purpose of addressing the problem of plastic waste management in Africa in the context of the 10 Year Framework Programme on Sustainable Consumption and Production as outlined in the Johannesburg Plan of Implementation. The project is proposed to be implemented by UNEP in collaboration with the African Roundtable on Sustainable Consumption and Production (ARSCP), the Secretariat of the African Ministerial Conference on the Environment (AMCEN), UN-DESA and other relevant partners.

Based on the series of consultation that have been carried out with regional experts and international partners, it has been proposed to adopt the following triple track strategy in order to promote the sustainable production and consumption of plastics in Africa.

Track one: Provide technical assistance to African countries on how to develop and implement a sound strategy on sustainable consumption and production of plastics and thus a comprehensive plastic waste management programme for selected urban centres.

Track two: Develop a partnership that would enhance the required technical and marketing capacities for the establishment of industries that produce affordable alternatives including environmentally degradable plastics (EDPs) based on locally available raw-materials within the region.

Track three: develop a communication strategy to provide information to citizens/consumers on the environmental impacts of plastics with a purpose of influencing consumer behaviour towards sustainable consumption practices.

While recognizing the importance of putting the required effort on the above tracks, this project attaches particular attention to the promotion of a fundamental shift through the production of EDPs based on renewable resources. The project shall be initially implemented in five selected African countries and will later be expanded to other African countries based on the experience to be gained from the first phase.

Source: UNEP (2004, p. 28)