ENHANCING MUNICIPAL SOLID WASTE MANAGEMENT THROUGH INCORPORATION OF EXTENDED PRODUCER RESPONSIBILITY IN LUSAKA ZAMBIA

by

MUTINTA MATAMBO

A dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the degree of Master of Engineering in Environmental Engineering

THE UNIVERSITY OF ZAMBIA

LUSAKA

2021

COPYRIGHT DECLARATION

DECLARATION

I declare that the contents of this dissertation are entirely my own work, except for the specific and acknowledged references to the published work of others made in the text.

To the best of my knowledge and belief, it contains neither material previously published by another person nor material to which a substantial extent has been accepted for the award of any other degree of this or any other university.

Author's Full Name: Mutinta Matambo

Signature: ……

Date: ……

Supervisor's name…… ……

Signature: ……

Date: …….

CERTIFICATE OF APPROVAL

This dissertation of Mutinta Matambo is approved as partially fulfilling the requirements for the award of the degree of Master of Engineering in Environmental Engineering of the University of Zambia.

NAME	SIGNATURE	DATE
Examiner 1: ……..……..	…….	……...…
Examiner 2: ……..……..	…….	……...…
Examiner 3: ……..……..	…….	……...…
Chairperson: ……..……..	…….	……...…

ABSTRACT

The visionary concept of extended producer responsibility (EPR) policy advocates a system that aims to increase waste recovery and recycling. Extended producer responsibility policies have been widely adopted since the 1990's, particularly in developed countries as an effective instrument for sustainable waste management. Zambia is currently adopting EPR law on some selected products with plastic as a packaging material being priority since inception of EPR law. Food stuffs and other products on the market are sold to majority of Lusaka residents and are later carried in plastic bags. After consumption, these packaging materials are discarded randomly. The increasing quantities of packaging materials thrown away and the inability of local authorities to cope with the increase makes it absolutely necessary to assess the lifecycle of these materials and the roles stakeholders connected to its life play in managing waste. This research was carried out to investigate how the EPR concept could be useful in promoting recovery and recycling of packaging waste materials, making conditions better for waste separation and thereby enhancing efficient biological waste conversions. It explores the roles of institutions in fostering EPR policies, assesses the motivation for producers to engage in waste recycling practices and possible ways to influence producers and consumers towards a transition to sustainable production and consumption behaviour. The research was carried out by an inductive analysis of 14 interviews and 60 questionnaires survey administered across the six EPR stakeholder groups of the Zambian packaging landscape with a response rate of 83%. Primary data was analysed using Statistical package for social sciences (SPSS) and excel. Based on the analysis it was observed that solid waste in Lusaka is high in organic content and the improper separation of organic and inorganic materials from the waste streams, use of inappropriate techniques, lack of developed institutions, poor financial status are the main reasons that make it difficult to manage these wastes. It was also revealed that EPR arena encompasses stakeholders ranging from government, NGO's, producers and consumers as its main actors and are linked. Government regulates EPR policies while NGOs boosts the competence of the local communities to create awareness of waste management problems. Producers have the financial and physical responsibility of their products which includes packaging materials (plastics) and are willing to embark on sustainable production towards product design they however, linked the problems associated with plastic waste management in the city to consumer behaviour. There is more room for consumer behaviour to be influenced towards sustainable consumption once EPR policy will gradually start to come into effect, as the specific regulations and targets are defined and published in the present and future. It is expected that EPR would be a useful tool that would help in reducing the volume of waste and encourage biological waste conversions.

Keywords: *Responsibility, Producer, Packaging, Material, Sustainable, Waste*

DEDICATION

I dedicate my dissertation work to my daughters,

Amberose and Latoya

and loving Husband,

Gregory,

who have been a source of encouragement during the challenges of graduate school life. I am forever thankful for having you in my life.

and

To all the people that share in the philosophical thinking of "waste as resource"

ACKNOWLEDGEMENTS

I would firstly, like to express my sincere gratitude to Dr. Edwin G Nyirenda for his endless guidance, support, encouragement and patience throughout the course of my study. I ascribe the success in completing the project report to his persuasiveness and effort. One could not wish for a committed and friendlier supervisor.

I would like to thank the participants involved in this research, especially those who took part in the interview and questionnaire administration process. I am very grateful they took the time out of their busy schedules to be involved.

To my family and friends thank you for your unconditional support, to my colleagues under the environmental engineering class (2018-2020), I am very grateful for the research tips and unending knowledge shared that contributed to the success of my research.

Lastly, I would to give my special thanks to my husband Gregory and our two daughters whose patience, support and love warranted me to complete research work.

TABLE OF CONTENTS

List of Tables

List of Figures

List of Abbreviations

ADF: Advance-disposal-fees

CE: Circular Economy

CBOs: Community Based Organizations

DfE: Design for Environment

ECZ: Environmental Council of Zambia

EPR: Extended Producer Responsibility

GDP: Gross Domestic Product

HH: Households

LAC: Latin-America and the Caribbean

LCC: Lusaka City Council

NGO: Non-governmental organization

OECD: Organization for Economic Co-operation and Development

PRO: Producer Responsibility Organization

WEEE: Waste Electrical and Electronic Equipment

ZABS: Zambia Bureau of Standards

ZEMA: Zambia Environmental Management Agency

Glossary

Eco-design: “Systematic integration of environmental considerations into the design process across the product lifecycle” (Bhamra, 2004, p. 557)

Free-riders: Producers that enjoy the benefits of the EPR system without paying the corresponding fees, including producers that under-declare their volumes.

Sustainable Development:” Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987)

Stakeholder: In this research, it refers to any group that affects or is affected by the EPR law, aligned with

Freeman’s (1984) definition.

Orphan products: Products that are on the market but whose producer cannot be identified.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter introduces the research topic and gives a panorama of the whole research process. It starts by giving a background of the research, its setting and distinctly outlines the statement of the problem. The objectives and research questions of the research study are indicated subsequently together with a brief explanation of the methodological approach used. It finalises by giving a brief description of the layout of the dissertation.

1.2 Background

Zambia has steadily increased the pressure on its natural environment. On one hand, its economy has been based on the extraction of natural resources, mainly mining and on the other hand is a key player in agriculture. This has resulted in a sustained economic growth over the last decades, which has brought a significant increase in the wellbeing of communities and as such, has been accompanied by a similar rise in the level of population, urbanization and subsequently waste production. Hoornweg and Bhada-Tata (2012) points out that municipal solid waste is one of the most important by-product of an urban lifestyle. For this reason, increases in waste generation is usually associated with population growth, economic growth and urbanization. Sjostrom and Ostblom (2010) provide evidence that waste per capita increases can be closely linked with increases in economic growth. A relationship of this nature between waste generation and economic and population growth calls into question the sustainability of meeting human needs within an ecologically finite earth. Solid waste management challenges are felt most keenly in developing countries like Zambia; Lusaka City to be specific as a major consequence of development and modernization. The development is also a source of the elements that create the stubbornness' problems and challenges facing the developing countries; this is a situation that plays out as a paradox of development (Blight and Mbande 1998). It is clear that urbanization is increasing the amount of waste generated that later has to be collected and disposed of, a situation that strains most developing countries and African cities (Medina, 2010).

The current problems associated with solid waste in Lusaka City may be related to other factors: Inadequate funds, shortage of refuse collection equipment and low capacity in skilled labour force (Majura, 1997). Adebayo etal 2011, highlights that inappropriate techniques, lack of

developed institutions, poor financial status and very centralised (top-down) choices that are simply imported from Industrialised western world, to be transposed or applied in the developing world context, which possesses its own uniqueness in many aspects, resulting in less than favourable outcomes. Western businesses, International organizations and Banks sometimes facilitate such transfer of technology, nevertheless the experience shows the results have not been quite effective (Medina 2010, Blight & Mbande 1998).

Zambia's population is growing at an average rate of 2.7% per year, the country's total population is projected to grow from 13.7 million recorded in 2011 to 17.9 million in 2020 and further rise to 26.9 million by 2035 with Lusaka being the largest populated province amounting to 1.7million (Central Statistics Office, 2013). Higher population living and working in urban areas, higher income level and higher amount of waste generated by businesses cause the increasing complexity and quantities in the waste stream (UN-Habitat, 2010; cited by Adebayo et al 2011). This increasing urban population of Lusaka City produces a disproportionately high volume of domestic waste (also called Municipal Solid Waste that includes food and yard waste and inorganic waste from residential, commercial and institutional activities). The daily amount of waste generated in Lusaka is 826 tonnes/day at the rate of 0.5kg/person/day, amounting to 301,840 tonnes annually (UN-Habitat, 2010). Only 30% of waste generated by the city is deposited at Chunga landfill (MCA Zambia, 2016). The city overburdened with the provision of basic services as water, electricity and sanitation have difficulty in establishing an effective municipal solid waste management strategy. This situation is made far worse by the lack of provision of waste management infrastructure such as good access road network and sewer or waste disposal systems. It is also further compounded by the existence of an unplanned (spontaneous) or not well planned nature of urbanization (Moonga et al 2017). Much of the waste is then released into the environment with improper management, increasing human health risks for the communities as a result of air pollution due to waste burning; soil and water pollution caused by direct contact or leachate; spreading of diseases by animals like insects and rats; the release of methane due to anaerobic decomposition (Suez Lyonnaise des Eaux, 1998 cited by Medina, 2010; Visvanathan and Glawe 2006). The agglomeration of waste in the street and sewer systems pose flooding risks, mostly in slum areas, as well as deteriorate common spaces and distant ecosystems that receive toxic by-products carried away by run-off water (Garfi et al 2009).

It is worthy of mention that the waste management cost in the developing countries context is expensive for the municipalities, taking a high percentage of the municipality revenues,

accounting for up to 50% of the budget in some cases (Cointreau, 1982 cited by Medina, 2010) and, despite the high cost the collection rates are between 50 and 80 percent, and the disposal practices are usually open dumping, throwing of garbage in public spaces and burning it in the backyard (Cointreau, 1982). In addition, the high urban poverty levels make it difficult to increase revenue for municipal waste management.

The Environmental situation has not been overlooked by the government and the country has been committed to improve it, particularly since the creation of Environmental Council of Zambia (ECZ) now Zambia Environmental Management Agency (ZEMA) through the Ministry of Environment and Natural Resources. A *waste management law* which includes *Extended Producer Responsibility (EPR)* scheme was introduced by ZEMA in August, 2018 particularly for packaging material (plastic product category). The article on ZEMA's media page read "Zambia Environmental Management Agency has brought into effect the Environmental Management (Extended Producer Responsibility) Regulations, 2018 Statutory Instrument No. 65 of 2018. This implies that plastic carrier and flat bags, that do not meet the Zambian standard on Plastics Carrier Bags that is ZABS standard ZS719 which is 30 Microns of thickness, will be banned. Henceforth, to manufacture, trade and commercially distribute domestically produced and imported plastic bags which are below 30 microns of thickness will be illegal." (www.zema.co.za). This law will gradually start to come into effect, as the specific regulations and targets are defined and published in the present and coming years.

Extended Producer Responsibility (EPR) is, according to OECD (2001), an environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the postconsumer stage of a product's life cycle. A core characteristic of extended producer responsibility (EPR) policies is that they place some responsibility for a product's end-of-life environmental impacts on the original producer and seller of that product. The intent is to provide incentives for producers to make design changes that reduce waste, such as improving product recyclability and reusability, reducing material usage, and downsizing products. (OECD, 2001,2016a,2016b; European Commission,2014, Kunz et al 2018) stresses that an EPR system is a regulatory instrument that aims to increase the reuse and recycling rates of products, stimulate development of the recycling industry, prevent and reduce the amount of waste, reduce the use of virgin resources and stimulate the eco-design of products. To achieve its objectives, the regulation requires producers to take responsibility for the collection and recycling of their products after the end of the lifespan, transferring costs from local councils to the private sphere of the economy (OECD, 2016b; Kunz etal 2018). EPR regulations were

first introduced in Sweden by Dr Lindhqvist in 2000 more than 20 years ago, and today there are at least 395 EPR programs in the world (Kaffine and O'Reilly, 2015). Nevertheless, these products vary widely in their implementation models, such as in the products considered, different organization instruments and mechanisms, roles and responsibility of stakeholder (OECD, 2001). According to (European Commission, 2014), the different schemes also vary in their technical and economic performance as they are influenced by national and industry characteristics.

Various studies have explored the implementation of EPR in solid waste management particularly in developed countries and less in developing countries. In an international oriented scenario, policy replication on international standards and the import of clean technologies from highly industrialised countries is not always compatible with the local conditions and cannot solve the environmental burden experimented in developing countries (Milanez, 2006). Nevertheless, best practises need to be carefully transposed to developing economies, as these mainly lack well-established waste management systems (Akenji et al., 2011). Further, the environmental effectiveness and cost of EPR's depends on external factors (European Commission, 2014, p. 76), namely:

- Development of waste management infrastructure
- Existence of harmonizing waste policy instruments
- Willingness and awareness of communities to participate
- Value of secondary material on the national Market
- Country geography and demographics

These factors need to be carefully transposed to Zambia a developing economy with an emerging recycling industry. UNEP (2005b) states that, due to the lack of funds African, Asian and Latin American ministries give more attention to other issues they consider more urgent than solid waste management.

The EPR literature has been heavily tilted towards the experience of developed countries, particularly Europe, Japan and USA, with comparably less research on its implementation to developing countries. Some example on the later can be found in literature on accumulators, medicines for human use and tires in Vietnam (Vietnam 2006), in South Africa on packaging waste (Nahman 2010) and in end-of-life tyres in Colombia (Park, Diaz-Posada and Meija-Dugand 2018). Existing literature is largely theoretical and conceptual, lacking more research done through specific case studies (Kaffine and O'Reilly, 2015, p.6).

1.3 Statement of the Problem

Food stuffs and other products on the market are sold to majority of Lusaka residents and are later carried in packaging materials (Plastics), after consumption these packaging materials are discarded randomly. The increasing quantities of packaging plastic materials thrown away and the inability of local authorities to cope with the increase makes it absolutely necessary to assess the lifecycle of these packaging plastic materials and the roles stakeholders connected to its life play in managing waste. This study will therefore seek to find answers to the many questions that this problem currently poses.

1.4 Research questions

The research questions were drawn up for the purpose of establishing the scope of the research. These are:

1. Who are the major producers of biological and non-biological waste?
2. Which factors influence both consumers and producers towards a transition to sustainable production and consumption?
3. How can producers be motivated to engage in waste recycling practices?
4. What are the roles of institutions in fostering EPR strategy for enhancing solid waste management?

1.5 Research Objectives

This research will contribute to the EPR literature through the main aim: The main aim for this research is to recommend an approach to integrate EPR in the municipal solid waste management of Lusaka Zambia, by promoting recovery and recycling of packaging waste materials, making conditions better for waste separation and thereby enhancing efficient biological waste conversions**.**

Furthermore, the objectives of this research are:

- Identify major producers of biodegradable and non- biodegradable waste
- Assess ways to influence both producers and consumers towards a transition to sustainable production and consumption.
- Assess the motivation for producers to engage in waste recycling practices.
- Identify stakeholders and the roles of institutions when fostering extended producer responsibility

1.6 Significance of the study

The purpose of the study is to examine the impact of incorporating extended producer responsibility (EPR) as an approach to encourage municipal solid waste reduction and improve biological waste conversion practises as a means of solid waste management and ultimately, improve the poor practices of municipal solid waste management that prevail in Zambia. Undertaking this research will be the baseline for the foreseeable future on solid waste management in Zambia.

1.7 Scope of the study

The research study focuses on describing in a general level the situation of the solid waste management of Lusaka City, Zambia. It will attempt to understand the role of Extended Producer Responsibility (EPR) in municipal solid waste management in the City of Lusaka, Zambia. It will then proceed to investigate how this concept could be useful in promoting recovery and recycling of packaging waste materials, making conditions better for waste separation and thereby enhancing efficient biological and non-biodegradable waste conversions From the Zambian EPR law, packaging has been chosen because it is the most advanced regulation. Secondly, packaging is arguably the most complex legislated product on the market, which means it can provide richer insights-, and requires a more participative role of consumers, producers and municipalities, three aspects this research explores.

The study will contribute by informing policy makers and key stakeholders on the impact of incorporating extended producer responsibility (EPR) as an approach to encourage municipal solid waste reduction and improve biological waste conversion practises as a means of solid waste management and ultimately, improve the poor practices of municipal solid waste management that prevail in Zambia. Undertaking this research will be the baseline for the foreseeable future on solid waste management in Zambia. The solid waste management approach to be developed will be done for policy makers and professional staff of urban government development agencies and non- governmental organizations for solving solid waste management problems in Zambia.

1.8 Report Structure

The dissertation is structured as follows: after this introductory chapter, a comprehensive review of the literature on EPR schemes is summed up, analysing its relationship to the Circular Economy and the development of the schemes. It further describes the Zambian EPR law, the various stakeholder groups affected by it, their roles and how the system will work according to the law and the theory. The third chapter describes the research methodology proceeded in the data collection and analysis, whose core aspect is the qualitative analysis of fourteen interviews and 60 self-administered questionnaires across the six most relevant stakeholder groups. Chapter Four presents the results and discussion, describing the most relevant experiences in developing countries of implementation of the packaging EPR law as a basis for gauging the possibility of its implementation in Zambia. Also, contrasting the findings with the literature in order to assess factors that would influence both consumers and producers towards a transition to sustainable production and consumption, assess the motivations for producers to engage in waste recycling practices. This will be followed by stakeholder identification and the roles of institutions when fostering extended producer responsibility. Chapter Four will be summed up by contrasting literature so as to identify the future challenges of developing economies as with regards to EPR early-stage implementation. Finally, Chapter Five summarizes this study, offering concluding remarks, limitations encountered and recommendations for future research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

If applied in an efficient and effective manner, EPR policies have the potential to fundamentally increase recycling rates, incentivize eco-design, reduce community's health risks, reduce the amount of waste generated and deposited into landfills and impact consumer behaviour (OECD, 2001, 2014, 2016b; Kaffine and O'Reilly, 2015; Kunz etal, 2018). In order to ensure the correct application of the law in Zambia and contribute to the literature, this research will start by exploring the connection of EPR schemes to the Circular Economy (CE). This will be followed by a review of the overall EPR landscape worldwide, including an analysis of the experiences in developing countries identified by literature. This will be followed by waste management context in Zambia to be explored, together with the actual development of the Zambian packaging EPR law and how the law works in theory, identifying the major stakeholders, their relations and roles in fostering EPR for effective waste management.

2.2 The Circular economy and EPR policies

The concept of the circular economy has gained popularity in the last decade, as a powerful framework to guide humanity towards Sustainable Development (Geissdoerfer *et al.*, 2018,). The modern world economy is based on a resource-intensive linear economy of "take, make, dispose", that has resulted in an increasing pressure on the natural environment, limiting of natural restoration and risking the development potential of future generations (Esposito, et al 2018). The CE aims at maximizing material efficiency and disengage resource extraction from economic growth (Esposito et al 2018). This is to be achieved by keeping resources in loops in biological or technical cycles, reducing waste and pollution, and regenerating natural systems (Ellen MacArthur Foundation, 2018). It is a framework that promotes the reduction, reuse, repair, remanufacture and recycle of products –in that order of priorities- in the economy, avoiding the extraction of virgin materials and deposition into landfills (Ellen MacArthur Foundation, 2014). CE application worldwide is still in its early stages, mainly focused on recycling rather than reuse, even though recycling is the least sustainable solution of the CE activities in terms of resource efficiency and profitability (Stahel, 2014). Nevertheless, great development has happened in the last decades in waste management and recycling in selected

countries (Cialani et al 2016), gratitude goes to the various EPR schemes that have been put into place.

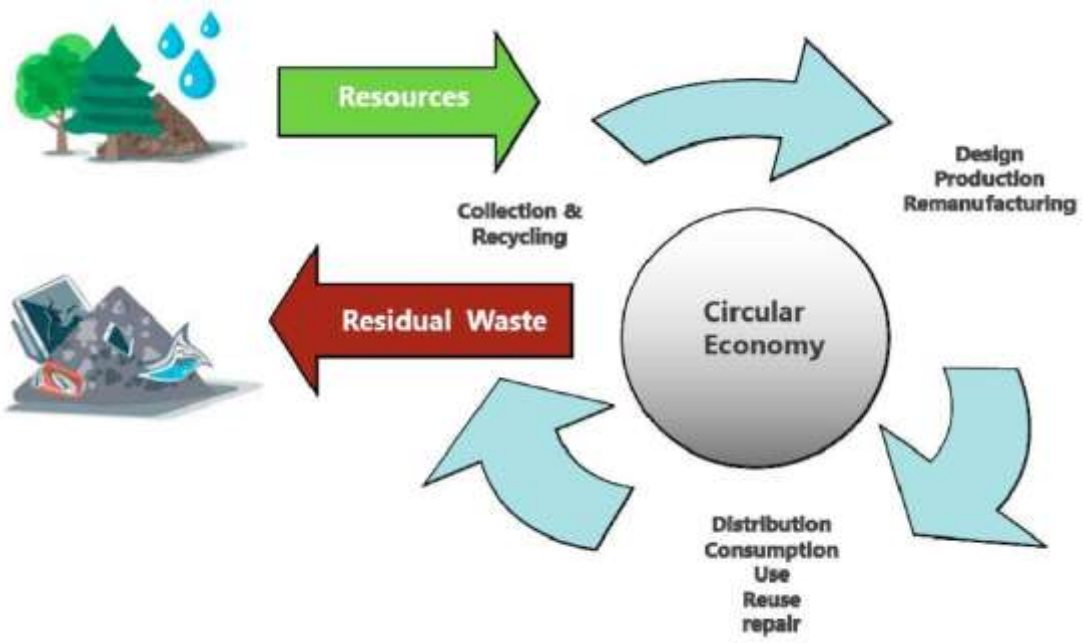


Figure 1: Circular Economy (Source-adapted from (https://www.mdpi.com/2071-1050/11/21/6139/htm))

2.3 Adopting Extended Producer Responsibility (EPR) As A Strategy To Tackle Solid Waste Management Issues in Lusaka City.

It would be impossible, and also pretentious, to propose a thorough strategy to solving the complex and problematic solid waste management situation in Lusaka city of Zambia. However, there are alternatives (though with cautious analysis) that might reduce the burden of waste in the environment and the communities. It is very important to use the word "cautious" because these alternatives should not be applied models from developed countries, though successful in the industrialized world, they cannot be directly transposed into developing countries like Zambia (Adebayo et al 2011). Following this reasoning and the different approaches described in the literature, a strategy called Extended Producer Responsibility (EPR) could be explored as a tool to enhance solid waste management in the developing countries (Zambia, Lusaka City). EPR basically aims to improve the end of life management of products and to foster a cleaner production. This idea implies the fact that to

reach a satisfactory treatment of waste, the characteristics and design of the products should be changed and not only the waste treatment procedures (Lindhqvist, 2000). In doing so, the EPR strategy translates some of the waste management responsibilities from consumers and municipalities to the producers of the products, and also reflects the initiative of internalizing environmental and social costs of production processes (e.g. Landfill disposal and natural resources depletion).

More than a policy instrument, EPR is a policy principle implemented through different mechanisms encompassing regulatory, economic and information actions e.g. take back programs, product taxes and environmental labelling, which should be combined to achieve specific goals and be cost effective (Walls, 2006; Nahman, 2010). It is important to notice that these instruments can involve compulsory and/or voluntary activities that bring about effectiveness when a careful analysis of the context is performed. Furthermore, EPR can be implemented in a variety of ways, ranging from voluntary industry initiatives to mandatory regulations imposed by government (Widmer et al., 2005; Walls, 2006; Nnorom and Osibanjo, 2008).

Table 2. 1: Policy instruments under the EPR Umbrella

Category	**Examples**
Regulatory instruments	Take-back programs (mandatory or voluntary), including the provision of infrastructure; reuse and recycling targets; minimum product standards; prohibitions of certain hazardous materials or products; disposal bans; mandated recovery/recycling obligations
Economic instruments	Product taxes, input/material levies, virgin material taxes, collection fees, disposal fees, deposit-refund schemes, subsidies, tax/subsidy combinations
Information instruments	Environmental reports; environmental labelling; information provision to consumers, collectors, recyclers, etc. through education and awareness raising campaigns

Source: adapted from (Widmer et al., 2005; Nnorom and Osibanjo, 2008).

Here the word “cautious” comes again mostly because EPR was born in Europe (Lindhqvist, 2000) and is immersed in a theory called Ecological Modernization (EM) developed by and

for high income countries (Milanez, 2006). It is not within the scope of this document to describe EM, however it is important to say that the environmental burden posed by the increasing natural resource extraction in developing countries to feed the consumption in developed countries usually lead to the emergence of serious environmental impacts. Therefore, the EM postulation of a global win-win situation, which means economic growth and sustainable environment at the same time, is far from the truth (Martinez Alier, 2002). That is why it is believed that EM works in the developed countries but not in the developing countries, and can be referred to as a pro capitalist theory, because it does not threaten institutions that are in favour of political arrangements built on capitalist principles (Orsato and Clegg,2005). EM proposes that the environmental problems can be solved with the modern technological advancements in a context where the policies of liberalization and privatization are applied (Kumbamu, 2006). Nevertheless, as this technology belongs to industrialized countries, the application of EM practices in developing countries usually leads to institutional and technological dependence as well as the entry of multinational companies into the developing countries to commoditize the natural resources. In an international oriented scenario, policy replication on international standards and the import of clean technologies from highly industrialized countries is not always compatible with the local conditions and cannot solve the environmental burden experimented in developing countries (Milanez, 2006).

Instead of using Ecological Modernization (EM), the theory of Political Ecology (PE) is employed to explain the incompatibility caused by the gap in social, economic and power (political) factors between low income and high income contexts. PE promulgates a worldwide sense of equity and fairness, or environmental justice (Martinez Alier, 2002), idea that justifies the responsibility of developed countries (represented here as multinational companies operating in developing countries) toward the environment, responsibility that includes sound waste management practices like EPR.

From this reasoning, and knowing that developing countries are several steps behind in the application of EPR (Nnorom and Osibanjo, 2008 cited by Nahman, 2010), the aim is to work with the sheer concept of EPR, the few experiences in developing countries. The idea is to extract the concept of EPR from the EM theory and to see if it works in a developing country context in the light of PE theory. This decision is supported by the differences between developed and developing countries in the area of waste management. According to UNEP (2005a) and Nahman (2010) the following observations are seen to be the usual practice in the developing countries:

- "Low labour costs and extreme shortages of capital, which together call for low tech solutions to Municipal Solid Waste Management problems;
- A waste stream dominated by organic waste, which means that: a) incineration is difficult unless undertaken in conjunction with a program that achieves source separation of organics, and b) composting is especially important if large amounts of waste are to be diverted from landfills;
- A complex informal sector that is very active in the collection, separation, and recycling of waste;
- Significant mixing of industrial hazardous wastes with Municipal Solid Waste;
- Few people who are adequately trained in solid waste management activities, and a high proportion of the urban population with low levels of education;
- Inadequate physical infrastructure in urban areas, which makes collection of waste particularly difficult." (UNEP, 2005a; p. 15)
- "Consumers tend to reuse or dump products rather than recycle;
- Recycling is undertaken largely by the informal sector, making organized collection difficult to implement and posing risks to the environment and human health. In spite of these discouraging differences, EPR can have a significant effect in one of the common practices of solid waste management in developing countries: biological waste conversion (which includes composting and digestion processing). As a high percentage of the municipal solid waste in Lusaka; Zambia is organic (World Bank: What a waste, 2012), composting could be used to take advantage of the aerobic decomposition of the waste to form humus like products called composts, which can be used as fertilizer in agriculture, and digestion processes can also produce bio fuel from the anaerobic decomposition of the waste. However, these practices are rarely effective because inorganic waste is mixed with the organic waste (Hoornweg et al., 1999). Hence, EPR could help to improve biological waste conversion by enhancing separation of waste from the source.

It is clear that structural changes are needed at the societal level because technology and science cannot tackle every environmental issue. Nevertheless, this kind of changes depends upon long term negotiation, implementation and evaluation processes. Consequently, preventive technological innovation (which encompasses equipment development, product redesign and resource efficiency) seems to be a medium term alternative, shaped by policies (e.g. EPR

policy) that encourage the participation of all stakeholders, like producers, communities and NGOs.

2.4 Theoretical Conceptualization of Extended Producer Responsibility

Schubeler 1996 highlights that municipal solid waste management is a complex task which depends as much upon organisation and cooperation among households, communities, private enterprises and municipal authorities as it does upon the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal. This makes it crucial to develop waste management approaches that link not only stakeholders who have connection with the lifecycle of a project but also assigns them appropriate responsibilities. The Extended Producer Responsibility (EPR) concept is one approach that has been acknowledged to offer great possibilities of creating such linkages and assigning responsibilities to waste management.

The concept EPR is an environmental strategy based on the polluter pays principle. It seeks to create the financial incentives for producers to implement waste reduction and recycling processes either individually or through co-operations with other producers. It is an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle (Nicol and Thompson, 2007). The Organisation for Economic Cooperation and Development (OECD) (2001) recognises two related features of EPR policy namely the shifting of responsibility (physically and/or economically; fully or partially) upstream to the producer and away from municipalities and the provision of incentives to producers to incorporate environmental considerations in the design of their products. Shifting the economic responsibility of waste management towards producers requires them to pay for any related post product consumption, disposal and recycling costs. Shifting the responsibility of physical waste management towards the producer infers both the direct and indirect handling of a disposable product, including take-back for recycling (Nicol and Thompson, 2007). This leverages local governments from the huge physical and financial burden of managing municipal waste. Hoornweg and Bhada-Tata (2012) provide evidence that managing solid waste is often the single largest budget item of local governments in developing countries.

Mandating producers to pay for the lifecycle environmental cost of their products provides economic incentives to implement green production and disposal processes. During the product

development phase producers may thus be concerned with improving product design in terms of material and energy usage and pollution prevention. Other environmental considerations at product design phase include waste minimization, reuse or recyclability, material conservation, pollution reduction, lower toxicity and "eco-design" (Walls, 2006). Efforts of producers resulting from EPR can be summed up as geared towards not only reducing the waste disposal burden on the environment but also ensure that resources are efficiently utilized in satisfying human needs.

A number of policy instruments are being employed to shift responsibility for product and packaging waste from government and taxpayers to producers and consumers. Relevant to the objectives of this paper, these include *regulatory instruments* such as mandatory take-back schemes, minimum recycled content standards, materials and product bans and restrictions and *economic instruments* including advance disposal fees, virgin materials levy and deposit/refund systems. Several policy instruments indicate that the implementation of EPR varies from country to country. Its implementation has been largely successful especially in OECD countries and within the European Union (EU) (Packaging Recovery Organisation Europe, 2011). That Nonetheless the concept remains controversial. Whether it is environmentally effective and economically efficient is a key question and one that is hard to answer if individual manufacturers become responsible for managing the whole process of their products' waste (Hanisch, 2000). Some producers engaged in EPR usually contribute financially to the cost of product recovery and recycling to be carried out on their behalf to increase their economies of scale. A common example is the Green Dot system widely in use within the EU.

It should be mentioned here that within the concept of EPR, the obligation to manage products once they become waste does not rest only with producers. Sharing responsibilities across the product chain is an inherent part of the concept (OECD, 2001). All actors including producers, consumers, distributers, disposers, importers, local governments and society at large must participate in EPR policy initiatives to optimise its effects. In the United States of America (US Environmental Protection Agency, 2012), the call for everyone involved in the lifecycle of a product to take up responsibility to reduce the product's environmental, health and safety impacts is referred to as product stewardship.

Theoretical Framework

Adopting Extended Producer Responsibility (EPR) Strategy to tackle Solid Waste Management Issues in Lusaka

EPR-An environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle (Nicol and Thompson, 2007).

Packaging material in solid waste management is a complex task which depends as much upon organization and cooperation among stakeholders as it does upon the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal (Schubeler, 1996). EPR is one concept that has been acknowledged to offer great possibilities of creating stakeholder linkages and assigning responsibilities to waste management (Kavaarpou, 2013).

Conceptual Framework

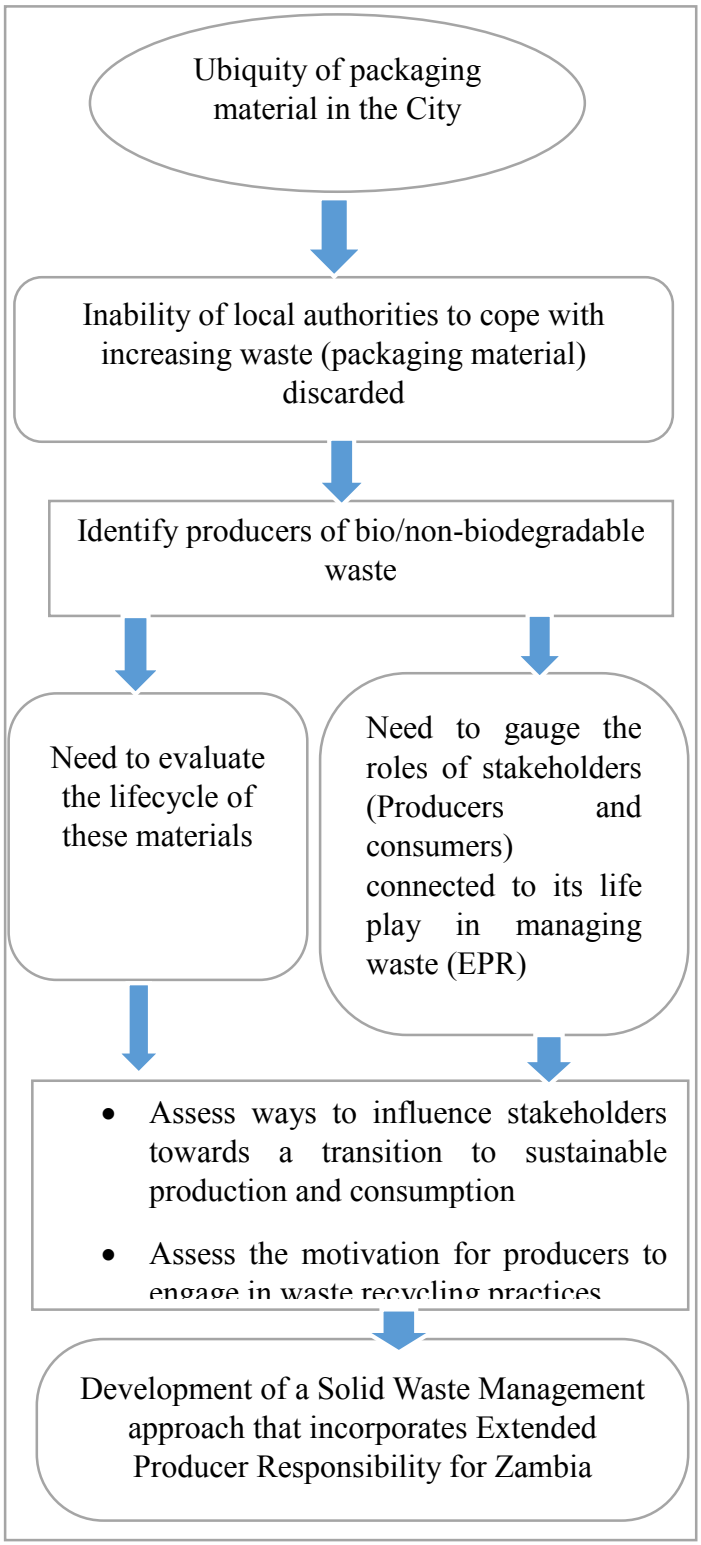


Figure 2: Theoretical and Conceptual Frameworks

2.5 International EPR Landscape and Application Models

Lindhqvist Thomas in 1990, first introduced EPR programs in Sweden and has since appeared in several European countries in as early as the 1990's and their adoption has been increasing since. Over 72% of existing schemes have been implemented since 2001, the year of the release of the *OECD Guidance Manual for Governments* (See Figure 2), which now accounts for over 395 EPR policies around the world (Kaffine and O'Reilly, 2015, p. 24). In terms of products covered under EPR schemes, the most frequent are small consumer electronics (35%), seconded by packaging and tyres (17% each), as displayed in Figure 3 (Kaffine and O'Reilly, 2015, p. 23). In terms of geographical distribution, Europe and North America account for 90% of the running EPR schemes worldwide, 48% and 42% respectively (OECD, 2016b, p. 20). However, legal initiatives are growing in numbers in developing countries in Asia, Oceania, Africa and Latin America and the Caribbean (LAC). In LAC, Chile, Mexico, Brazil, Argentina and Colombia are implementing their first EPR schemes, with the treatment for potentially hazardous electronic waste being the most common one (OECD, 2014, p. 5). The schemes worldwide vary in the mix of policy instruments they consider (See Appendix 1 for EPR policy instruments descriptions), with various forms of take-back requirements being the most widely used (72%), followed by advance-disposal-fees (16%) and deposit/refund systems (11%)[1]. Other policy instruments, i.e. upstream combined tax/subsidy, recycling content standards, and virgin material taxes, are rarely being implemented (Kaffine and O'Reilly, 2015, pp. 22–23). Besides the policy instruments and range of products being targeted, EPRs vary in other factors. The most relevant are:

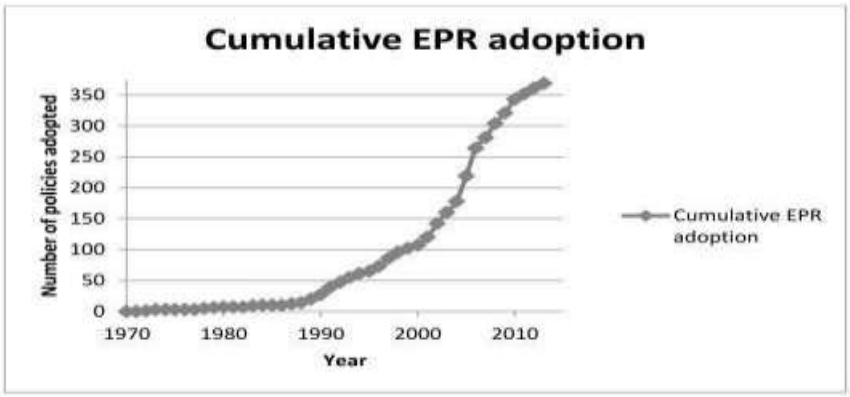
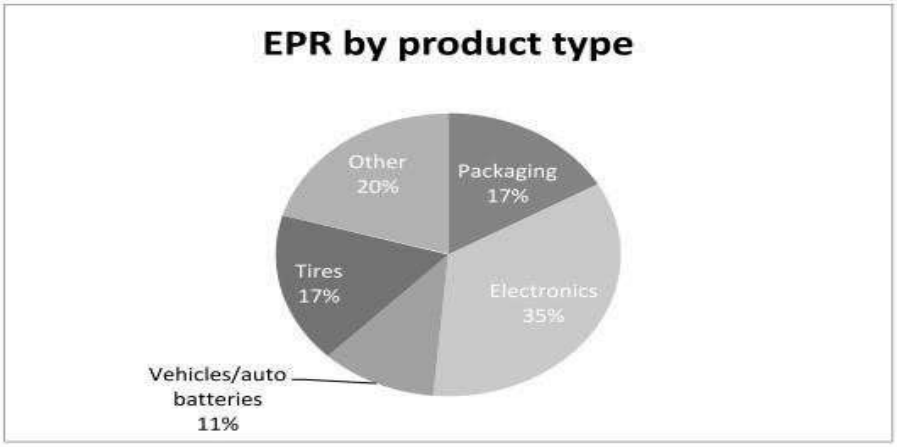


Figure 3: Cumulative EPR adoption **(**Source: (Kaffine and O'Reilly, 2015, p. 23)

[1] Policy instruments being used for packaging are 48% take-back, 39% deposit-refund and 12% advance deposit – fee (Kaffine and O'Reilly, 2015, p. 23)



Source: (Kaffine and O'Reilly, 2015, p. 23)

Figure 4: EPR by product type

- Whether if the scheme is mandatory, i.e. imposed by legislation, or voluntary, i.e. "product stewardship" programmes (OECD, 2016b, p. 22)
- Governance structure (OECD, 2016b, p. 57), which could be based on individual or collective *Producer Responsibility Organizations* (PROs) (See section 2.7.1 for the definition of PROs). These can be on Tradable Credits, as handled in the UK packaging system, or government-run, as the Chinese scheme for WEEE.
- Type of responsibility assigned to producers, that could be financial or organizational, or both (European Commission, 2014, p. 81)
- Allocation of responsibilities among stakeholders (See section 2.5 for a description of stakeholder groups). Particularly relevant is the role of local councils, which regularly remain in control of some aspect of the waste management
- How the full cost of managing a product's end of life is defined and calculated, and whether the producer bears the full costs or a portion is assumed by different stakeholders. Cost considers collection, treatment and recycling, and potentially the costs for public information and awareness campaigns, waste prevention actions, and the monitoring and surveillance of schemes

In terms of the impact of EPRs, acknowledging data limitations and methodological challenges, there is evidence of the increase in the collection and recycling rates of affected products (i.e. environmental effectiveness). For example, Japan increased the recycling of packaging by 27%

between 1997 and 2000 (OECD, 2014, p. 8). There is also evidence supporting the reduction in waste disposal as an impact of EPR adoption (OECD, 2016b, p. 25), which can be seen in the general trend among OECD countries (See Figure 4). In other aspects, data suggests that EPR systems have reduced the financial burdens on public budget, for example, in 2012 in France, the total municipal spending on waste was around €9.7 billion, with €630 million obtained through "eco-contributions" and an additional expense of €230 million for treatment of used products that came from producer organizations (ibid, p. 29). Nevertheless, not all EPR objectives have been fulfilled as expected, as one of the main goals is preventing waste by impacting eco-design, and results on this have been less than originally hoped for (ibid, p. 27). Several studies have evaluated this last mentioned issue, and the general conclusion is that even though EPR schemes contribute to eco-design, other factors have a more relevant role (ibid). The evidence further suggests

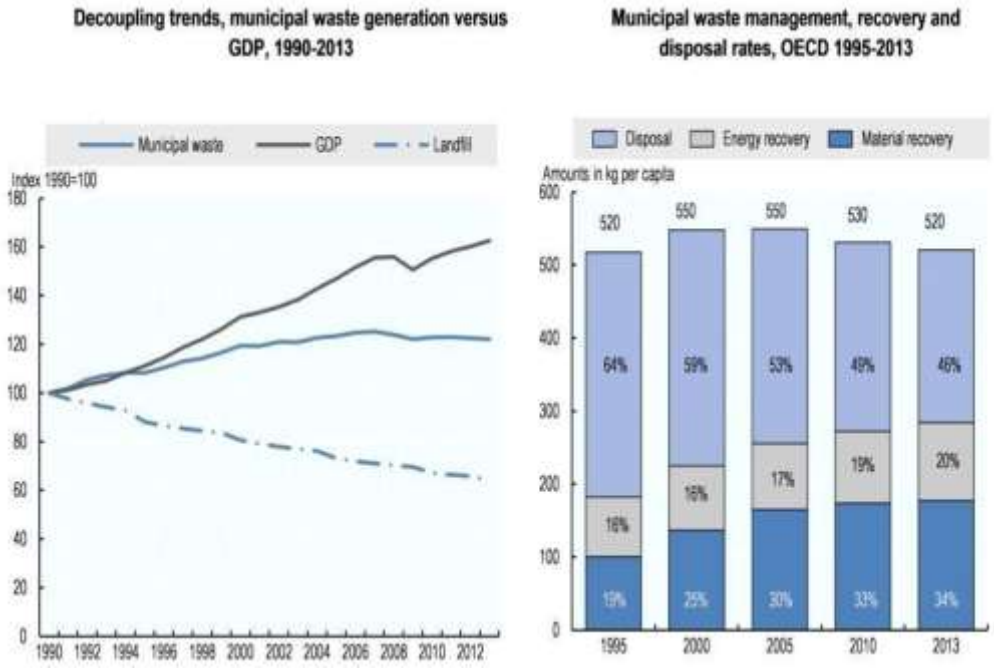


Figure 5: Trends in municipal solid waste management in the OECD (OECD, 2016b, p. 25)

that EPRs generate economic opportunities, such as an increase in technological and organizational innovation, diversification on resource supply and support to the creation of "green jobs" (ibid, p. 29). One critical characteristic that is frequently explored in the literature is the cost-effectiveness of the different types of EPR schemes, though due to the lack of transparency and availability of reliable data and the many subtle differences in schemes, it is difficult to be measured and compared (European Commission, 2014, p. 20). A thorough study

on this matter concluded that, even though there is no single model that emerges as the best performer in cost-effectiveness, the best-performing ones were not necessarily the most expensive ones (ibid.). As can be seen in Figure 4, the cost-effectiveness of selected European EPR packaging varies greatly. For example, the UK recycles 61% of the volume put on the market –considering households (HH) and commercial and industrial (C&I) waste- (Total of 167 kilograms per capita a year), charging 1.1 EUR per capita a year to producers; whilst Germany charges 11.5 EUR/cap./year and has a 75% rate of recycling (Total of 90 kg/cap./yr. of HH waste). The UK has a tradable credit system where the fees charged only represent 10% of total costs of the system, while in Germany producer fees represent 100% of collection and treatment costs of separately collected packaging (plus participation in communication and clean-up costs).

2.6 Waste Management in Zambia

Zambia waste management is expected to change with the implementation of the EPR law. The daily amount of waste generated in Lusaka is 826,000kg amounting to 301,840, 000kg annually (UN-Habitat, 2010), of which about only 15 % of the total waste generated by the city was collected and disposed of at a designated dump site in 2001 (ILO, 2001). It was later established in 2016 by the Millennium Challenge Account Zambia (MCA Zambia) that only 30 % of the waste generated by the city is deposited at Chunga landfill (MCA Zambia, 2016). The 30% waste generated deposited at the landfill composed of mostly the waste characteristics categorised in table 2 (waste not segregated), (LCC unpublished 2019).

2.6.1 Characteristics of waste in Lusaka

Domestic waste in Lusaka accounts for 80 % of the total waste generated in the city and the remainder is commercial waste coming from industries, markets, hotels and hospitals (LCC, 2003). The characteristics of domestic and commercial waste are presented in Table 2:

Table 2. 2: Characteristics of Domestic and Commercial waste (LCC, 2003; ILO, 2001)

Waste Component	Domestic Waste				Commercial Waste
	High Density	Medium Density	Low Density	City Average	
Paper and Cardboard (%)	2.7	4.2	7.3	4.7	12.0
Metals (%)	1.6	1.8	2.3	1.9	6.0 *
Plastics (%)	3.0	4.8	6.7	4.8	7.0
Glass (%)	0.8	2.6	2.5	2.0	1.5 *
Textiles (%)	1.7	1.4	1.1	1.4	0.5 *
Putrescibles (%)	24.8	55.0	68.7	49.5	23.0
Soil, Ashes & Dust (%)	65.6	30.2	11.7	35.8	50.0
Weight (kg/day)	0.56/ca p	0.54/cap	0.41/ca p	0.50	1.7/stall
Density (kg/)	395.0	309.0	495.0	399.7	12.0
* total of 8 % for metals, glass and textiles as established in secondary data sources reviewed and distributed as shown based on recycled waste characteristics at the landfill					

From Table 2. Food waste obviously has the highest percentage, followed by soils ashes & dust and plastics in order. Overall it can be deduced that organic component of solid waste stream is the most significant in the city. In this context, the average city's municipal waste content is 49.5% organic material (LCC, 2003; ILO, 2001). In another study conducted by the UN-Habitat (2010), the problem of illegal garbage dispose is very extensive in Lusaka. Table 3 shows the quantity or percentage of garbage generated and illegal disposal accounts for the highest amount since only about 26 % is disposed using acceptable procedures.

Table 2. 3: Selected municipal solid waste statistics for Lusaka UN-Habitat (2010, p. 67)

Description	Quantity or %
Total tonnes municipal solid waste (MSW) generated per year	301,840 tonnes
Generation per capita in kilograms per year	201
Percentage coverage	45
Percentage disposal in environmentally sound landfills or controlled disposal sites of total waste generated (estimate)	26
Percentage diverted and valorised of total waste generated	6

The UN-Habitat (2010) highlights that organic waste constitutes the highest component of the MSW in Lusaka alongside what is categorised as others (furniture, clothing, tyres

etc.). The other categories, that is, plastics; metal; paper; and glass constituted less than 10 % each as illustrated in Figure 5.

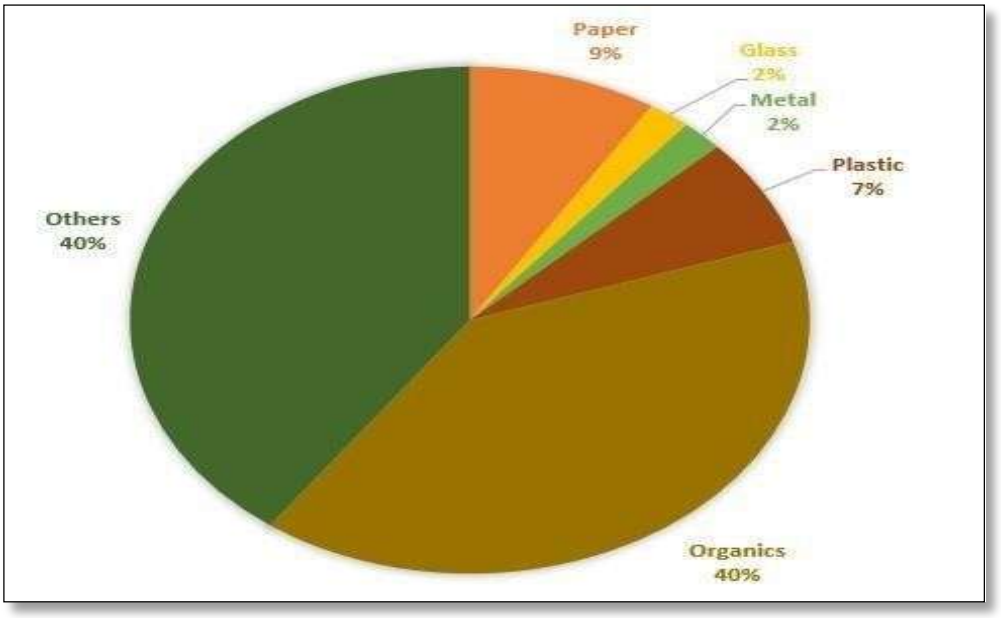


Figure 6: MSW composition by weight in Lusaka, UN-Habitat (2010, p. 129)

According to the statistics stipulated in Figure 5 packaging material categorization. The collective percentage in Lusaka of packaging material accounts to 20% and is summarised in Table 4 below:

Table 2. 4: Packaging recycling rates potential in Lusaka. Based on UN-habitat (2010)

Packaging Material (Category)	Lusaka (%)
Glass pack	2%
Plastic pack	7%
Paper and Cardboard	9%
Metallic pack	2%
Total packaging	**20%**

Packaging makes up to 20% of municipal waste in Lusaka (UN-Habitat, 2010), offering a great potential for the impact of successfully implementing EPR law.

2.7 Extended Producer Responsibility in the Packaging Industries in Zambia

Developing countries have been far slower than developed countries in implementing EPR (Nnorom and Osibanjo, 2008). Some of the difficulties associated with implementing EPR in developing countries are as follows (Widmer et al., 2005; Nahman and Godfrey, 2008; Nnorom and Osibanjo, 2008):

- Consumers tend to re-use or dump products rather than recycle
- Recycling is undertaken largely by the informal sector, making organised collection difficult to implement and posing risks to the environment and human health.
- Consumers are unwilling to return goods for recycling or pay for disposal of their waste
- Lack of awareness among consumers and collectors of the environmental and health
- Impacts associated with inappropriate waste handling and disposal, and of the benefits of recycling, including potential financial rewards
- Lack of funding to finance recycling or even adequate waste management
- Lack of safe and efficient infrastructure for recycling or appropriate waste management
- Absence of waste management and recycling legislation/regulations and/or enforcement
- Lack of adequate capacity, skills and technology
- Lack of reliable data for designing efficient waste management/recycling strategies and for making rational investment decisions

Nevertheless, there has been increasing mention of EPR in recent environmental and waste management legislation and policy documents in Zambia. The Zambian government signed a commitment to improving its environmental legislation. As a result, *Extended Producer Responsibility* through Zambia Environmental Management Agency (ZEMA) was approved and published and came into force on the 17th August 2018 (SI No.65 of 2018) of the Environmental Management Act of 2011. This regulation is still under stakeholder consultation concerning the collection and recycling targets and hence, will come into force once the corresponding decrees and regulations that are presently being discussed are published. The decrees will determine the recollection and recycling targets, besides other general aspects of the law. Currently, multi-stakeholder's consultation committees are being summoned, in order to provide feedback and relevant information to the leaders of the legislative initiative. Since its publication, packaging material particularly plastics that are below 30 microns have been banned from use by the public on the market. Further a fee has been tagged to packaging material (plastics bags/carrier bags) applicable to consumers when shopping in most supply chain stores. This is to encourage responsible shopping practices, recycling and to control consumer behaviour towards plastic waste (ZEMA 2019, unpublished). It should be noted that this research was carried at the early-stage implementation of EPR law in the country as such, it is difficult to tell how much the government has done as stakeholder consultation is still ongoing.

2.7.1 Extended Producer Responsibility Stakeholders

The EPR law in Zambia will directly or indirectly affect a diverse group of stakeholders, each of them with distinct interests. In order to understand the implications of the regulation and its implementation potential, it is necessary to identify the stakeholder groups. Based on EPR literature (European Commission, 2014; Kunz *et al.*, 2014; OECD, 2016b; Kunz, Mayers and Van Wassenhove, 2018) and definitions of the law (EMA.2011), the relevant stakeholder groups of the packaging EPR in Zambia are:

- **Producers:** Main stakeholders. Defined as whoever introduces a packaged product in the Zambian market for the first time (not necessarily the producer of the packaging itself), and are responsible the collection and treatment of the products' waste, generally through *Producer Responsibility Organizations* (PROs) Or the manufacturer, trader and

commercial distribution of domestically produced and imported plastic carrier and flat bags for use within the Republic, other than those having the properties in the Zambian Standard 719 on Plastic Carrier Bags and Flat Bags is prohibited (SI N0.65 of 2018; EMA 2011). It might be differentiated between large producers and SMEs, as the regulatory decrees will define if the second group is also required to comply with the regulation.

- **PROs:** Intermediaries that facilitate the fulfilment of producer's targets, subscribing contracts with waste operators and municipalities (Tomas, 2018). They charge fees to the producer they represent in order to cover their costs. There is no established PRO in Zambia to date.
- **Waste Operators:** They collect, consolidate, transport and manage the recycling of waste for PROs.
- **Informal Sector:** Zambian law considers the inclusion of the informal recycling sector, mainly waste pickers, as accredited waste operators, once they obtain the corresponding certification (LCC 2019, unpublished).
- **Government:** The Ministry of Environment and Natural Resources through Zambia Environmental Management Agency (ZEMA) is the national authority that leads to the establishment of the legal EPR framework. They will further provide an information and registration service that supports the system.
- **Municipalities:** Local government's play a crucial role. They currently manage household waste streams. The interaction between municipalities and PROs still needs to be defined. They will also be a key player in the communication strategies to consumers.
- **Other Governmental Bodies:** Additional institutions that have a particular interest in the EPR law are the Ministry of Health, interested in the health and safety risks related to waste management and regulator of the establishment of waste operations; the Ministry of Local Government Housing/Ministry of Finance, interested in the economic implications of the law.
- **Consumers:** Generators of the waste after the use-phase. Required to return the waste back into the system. Can be households or industrial consumers, the later can treat waste directly with waste operators. Their awareness –and willingness to cooperate- is crucial for the effectiveness of the program.
- **Retailers:** Required to facilitate the installation of waste collection points.
- **Environmental NGOs:** Institutions whose role is to represent the interests of the natural environment. The law considers their participation in the consultation process.
- **Communities:** People that live close to waste-treatment operations that are affected by the negative externalities of landfilling or waste incineration.

2.8 Treatment technologies of Solid Waste Management

The problems of solid waste management in developing countries like Zambia was introduced as one created by economic growth, population growth and urbanization. This section presents the various conceptual techniques and approaches that have been employed in dealing with this scourge. It looks at the failures and successes that have been recorded in different places as well as the flaws, operational challenges and strengths of the different technologies that have been implemented and make critical review of them, with the view of postulating on areas that hold good prospect and therefore need to be improved in the quest for delivering solid waste management solution in this context.

2.8.1 Biological Conversion technologies

Conversion technologies can be explained as a broad range of modern technologies capable of converting the so-called unrecyclable solid waste materials to useful products like renewable energy, green fuels and composts for example, in an environmentally friendly and beneficial way. Such technologies may include processes as chemical, thermal, biological, mechanical, or sometimes a combination of them, however excludes incineration, which is a waste combustion process. It is the focus of this section to concentrate on biological conversion processes to see how they have been applied to developing countries and how they can be improved using EPR and proper solid waste sorting at the source, discussing this subject under two broad categories namely, digestion and composting processing. Primarily, biological reprocessing can be simply explained as a process that involves biological composting and digestion processes to decompose waste materials that are organic in nature, such as food wastes and plant materials. The product is then compost for agricultural or landscaping purposes and can also be recycled as much. Nevertheless, these processes have the problem of emission of methane gas due to the anaerobic decomposition of the waste materials. The way to deal with this problem is explained in the sub-section that follows.

2.8.2 Composting

Composting can be thought as a form of recycling in which organic waste materials are processed to produce soil-like products known as composts. The method is controlled by employing microorganisms in the breaking down of organic fractions of solid waste (Seo et al., 2004). Technically, it has been defined as the biological decomposition of the organic component in waste into stable humus-like product whose main use is soil conditioning (Golueke, 1977). Thus, it is cheap and easy method of disposing organic matter in an

environmentally friendly manner. Composting has some benefits that make it attractive for application in solid waste management strategies, especially in the developing world considering financial, cultural and climate conditions. A properly managed compost facility is simple to operate, reduces nuisance potentials to the barest minimum and promotes clean and readily marketable finished products (World Bank, 1996). In addition, it necessitates a landfill space reduction where it is applied as a solid waste management technique (He et al, 1992). Also, surface and groundwater contamination (an aspect of landfill) is reduced considerably. In itself composting has potentials of leading to the reduction of waste blocking of water bodies like canal, rivers and drainages (World bank, 1996). It can enhance low transportation costs if decentralised and materials recycling. Experience from Asmara, the capital of Eritrea shows decentralized composting strategy proved to be favourable compared to centralised one and significantly reduced transportation cost which partly compensate the investment and operational cost of the decentralised system (Drescher et al,. 2006). Seo etal argues that in composting, there is minimal emission of greenhouse gases that have subsequent impact on global warming and climate change. In other words, although composting can create GHG emission like methane, it is minimal relative to other sources. Composts improve soil structure, water retention capacity and aeration, and also reduce soil erosion.

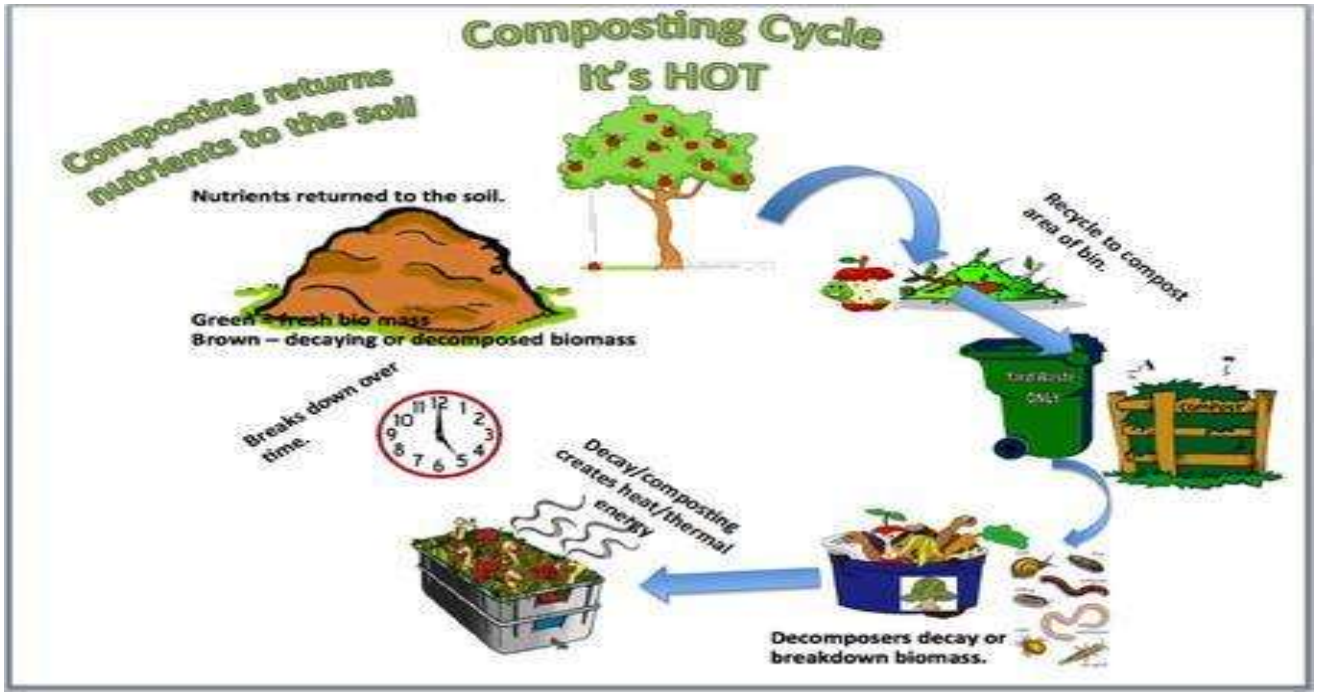


Figure 7: Composting cycle (Adopted from: www.http//:arnwine.weebly.com)

Adewale (2011) explains that sustainable waste management should be utilised to maximize the ability to reuse and recycle waste materials. It further clarifies that sustainable waste management as it applies to composting means recycling of organic waste materials to a

valuable and useful end point, arguing that composting is a sustainable waste management technique in developing countries. Nevertheless, this option even as cheap, environmentally friendly, wealth creating and sustainable as it seems, has recorded little or no success in most places. It has little record of operation in Africa, Latin America and other parts of the world where the facilities failed (UNEP, 1996). Hoornweg etal (1999) attributed such unsuccessful scenarios to failure to correctly predict composts market demand for finished product, poor pre-sorting of incoming wastes to remove non-compostable fraction, higher economic cost than those associated with landfilling same amount of waste, high cost of mechanization as opposed to manual labour and inability to understand and maintain biological conditions. Be that as it may compost has its success stories. It has been effectively employed to remediate soils and sediments with hydrocarbons (Williams and Keehan, 1993).

Additionally, the problems of composting which make it difficult to achieve success can partly be avoided and tacked head-on by proper waste sorting culture at the source, addition of lime which reduces heavy metals availability and proper compost maturity (Ciavatta etal., 1993).

This research upholds this view postulating its research findings on how implementation of Extended Producer Responsibility (EPR) concept could aid the proper sorting and separation of waste at the source, giving rise to an eventual efficient and effective composting.

2.8.3 Digestion Processing

Digestion process is a waste management technique, which employs the use of microbial organisms, naturally occurring in the waste material, in the decomposition or breaking down of biodegradable organic contents of wastes streams to release energy. It is a natural biological process referred to as anaerobic digestion that converts biomass into energy (biogas) in the absence of oxygen. Biogas produced in this process, which is a mixture of carbon dioxide and methane, can be used as a source of renewable energy for lighting, cooking or electricity generation, thereby replacing other sources of fuel while the residual called biogas is a nutrient rich fertilizer that can be used like compost (Voegeli and Zurbrugg, 2008). Here, methane gas production, which poses problem in composting as earlier indicated, is harnessed as energy. In this breaking down process, methane rich biogas is produced, hence facilitating the generation of renewable energy. Further, materials that would end up in the landfill can be utilized. The phenomenal methane emissions of landfill and the conventional generation with its associated carbon emissions are reduced and displaced respectively and has the potential to reduce the need for artificial or chemical fertilizer since the residual liquor and remnants are rich in nutrients and thus suitable for use an organic fertilizer on the farmland surrounding such a site.

(Voegeli etal (2008) explain that several problems, such as soil, surface and groundwater pollution through leachate, attraction of animals or the uncontrolled methane production are the results of inadequate treatment of the organic fraction of solid waste, arguing that biodegradable materials disposal is of particular significance in any waste management scheme. It was further stated that apart from composting or direct animal feeding, anaerobic digestion and bio-methanation of organic solid waste are considered promising treatment alternative for this particular waste fraction. This is promising because it is a relatively cheap technique when compared to other technologies like incineration. Moreover, the resulting products (renewable energy and compost) benefit the environment by reducing erosion; reducing dependency on energy production from other sources like fossil fuel; increasing the soil nutrient composition and reducing the amount of waste going to landfill and other methods of disposal.

Anaerobic digestion process has been around for a long while and practiced for years in developing countries. The first anaerobic digester was built in Bombay, India in 1859 and since then, the technique has become widespread throughout Asia such that as early as 1975, china and India implemented large schemes backed up by government for adaptation of small biogas plants used for cooking and lighting in rural households (Voegeli and Zurbrugg, 2008). In a similar way in Africa where anaerobic digestion is also known but less prevalent, such initiative called 'Biogas for Better life' aimed at installing two million biogas plants in ten years was launched in May, 2007 (Biogas for Better Life, 2008).

However, given the enormous waste disposal issues facing most urban centres in developing countries, it is greatly surprising that there exists very little accessible knowledge and information on technical and operational feasibility as well as challenges and opportunities in relation to anaerobic digestion as a waste treatment alternative for urban areas where market or kitchen waste is predominantly employed as feedstock (Voegeli et al, .2008). Voegeli etal, 2008) assert that while anaerobic digestion of organic household waste in centralised high-tech plants in the developed world has become increasingly popular in recent time, most regions of low and middle-income countries still lack appropriate low-tech alternatives. Nevertheless, they explain that South Indian experiences in particular, coupled with those described above point to the fact that anaerobic digestion of organic solid waste can be a promising technology for developing countries with a tropical climate. They state further that anaerobic digestion of organic solid waste possesses enormous potential for household solid waste management as well as biogas production, arguing that many private investors are convinced that this rather new waste treatment option will solve the urban waste problems and also produce energy.

Notably, every primary objective for establishing and operating such technology is the need for delivering waste treatment solutions whereby biogas production is only an added value by-product in the waste treatment process.

From the foregoing, it is evident that proper solid waste sorting at the source to obtain pure organic waste fraction, if seriously taken and vigorously pursued, might hold the key to unlocking the potentials of anaerobic digestion and aid the operation and smooth running of this type of technology to ensure its success in solving waste management problems in developing countries. For purpose of clarity, source separation of the organic fraction is needed because more value can be recovered from the recyclables in the non-compostable fraction (Gould et al., 1992) and also the resulting compost would be lower in heavy metals and visible plastic and paper, which makes for better quality and more desirability, although this would be an additional demand and therefore more labour intensive. IPPC report (2011) puts into perspective, the digestion processing of organic fraction of solid waste to produce bio-energy, which has found broad application in developing nations in the current dispensation, could be a very important factor that may shape the future of solid waste management scenarios therein.

2.8.4 Incineration

Incineration is the oxidative degradation of waste materials at high temperatures. Hence, it is a combustion process employed for solid waste mitigation. The main advantage of the process is that it reduces the volumes of waste and therefore, the demand for landfill space. If the ash from municipal solid waste incinerator is used for environmentally appropriate construction, it provides a low cost aggregate and further reduces the need for landfill capacity (World Bank, 1999). The main disadvantage is that it can be extremely expensive unless energy recovery techniques are also used. The heat produced by incineration can be utilized in an energy generation scheme, which is yet a polluting process. However, it is preferable to use a waste stream from which recyclable items have been extracted to save value since the recyclable materials are still valuable resources. Ran et al. (2000) states that incineration activity should not be considered a ‘disposal’ option, since there would still remain heavy pollutants and some quantity of ash left to be disposed of in a landfill perhaps at the end of an incineration process, in addition to some ash and chemical components dispersed in the atmosphere like dioxins which have carcinogenic effects. It further argues that instead, incineration should focus more on its waste-reduction potential, which can range between 80 to 95% by volume of waste. From an environmental point of view rather than economic standpoint, this is not really an attractive technology, hence Zerbock (2003) suggests that incineration is still an appropriate technology, for most poor or low-income with very few exceptions. The environmental hazard mitigation

components of incineration such as emissions scrubbers and the use of best available technology can cost as much as 35% of the overall project cost (Rand et al. 2000). UNEP (1996) reckons that huge costs and environmental issues have culminated in incinerators being shut down in many cities, some of which include Sao Paolo, New Delhi, Mexico City and Buenos Aires.

However, it does not imply that incineration holds no good prospects for certain developing world scenarios. Of course what proves result-oriented for particular country might not work for another. UNEP (1996) went further to describe the mode of operation of these different systems, suggesting that incineration plants should not be situated where prevailing wind conditions could spread emissions over heavily populated areas since airborne emissions is the most negative consequence of incineration. Thus, in any new construction of incineration facility, the use of emission reduction technology, no matter how expensive, should be compulsory. This makes it even more likely for incineration technology to dwell beyond the reach of less developed poor nations thereby lending credence, more weight and support to the claim that this is not an appropriate technology for the developing countries. Notably, many potentially toxic compounds, which are in conflict with public health, are volatized during incineration. These can be metals especially lead and mercury, organics like dioxins, acid gases like sulphur dioxide an d hydrogen chloride, oxides of nitrogen, carbon monoxide as well as dust (UNEP, 1996). This type of environmental pollution and hazards could worsen the environmental concerns in the poor developing world that do not have the financial capability to afford good healthcare systems. So, logically, it would be a transfer of a polluting technology to poor nations since incinerators do not make waste disappear- they reduce it to ash and to atmospheric emissions, both of which are potentially dangerous.

2.8.5 landfills

Land fill can be defined as a disposal site where solid waste, such as paper, glass and metal, is buried between layers of dirt and other materials in such a way as to reduce contamination of the surrounding land. Modern landfills are lined with layers of absorbent material and sheets of plastic to keep pollutants from leaking into the soil and water. Leverenz and Kreith (2002) explain that some wastes are simply not recyclable, as a result of the fact that eventually, they reach appoint of complete dissipation of their intrinsic value, which means that they cannot be recovered, and recycling itself produces residuals that need disposal. Consequent upon the above notions, proper landfill construction and operation entail carefully designed depressions underneath the surface of the earth, constructed in such a way as to circumvent any possible

linkage or contact between the immediate environment and the wastes themselves to prevent groundwater contamination which happens, constitutes huge risk to public health. Therefore, they require wide expanse of land with strict constructional and operational demands. Overall, landfills are a necessary but insufficient solid waste management concept. It could be considered as the pivot or function of all other solid waste management principles since all waste materials, after losing their intrinsic values, reach a non-recyclable and reusable stage, ending up in the landfills. Thus, an integrated approach is needed in tackling solid waste management issues as an all-inclusive approach with landfills at the centre of it all.

Various types of landfills could be identified as depicted by figure 2.6 namely:

1. Municipal solid waste landfill: uses plastic or synthetic liner to isolate trash from the environment
2. Sanitary landfill: uses a clay liner to isolate the waste from the environment
3. Industrial waste landfill: comprises non-toxic waste associated with industrial and manufacturing processes
4. Construction and demolition waste landfill: consists of the debris generated during demolition, renovation and construction of infrastructural facilities.

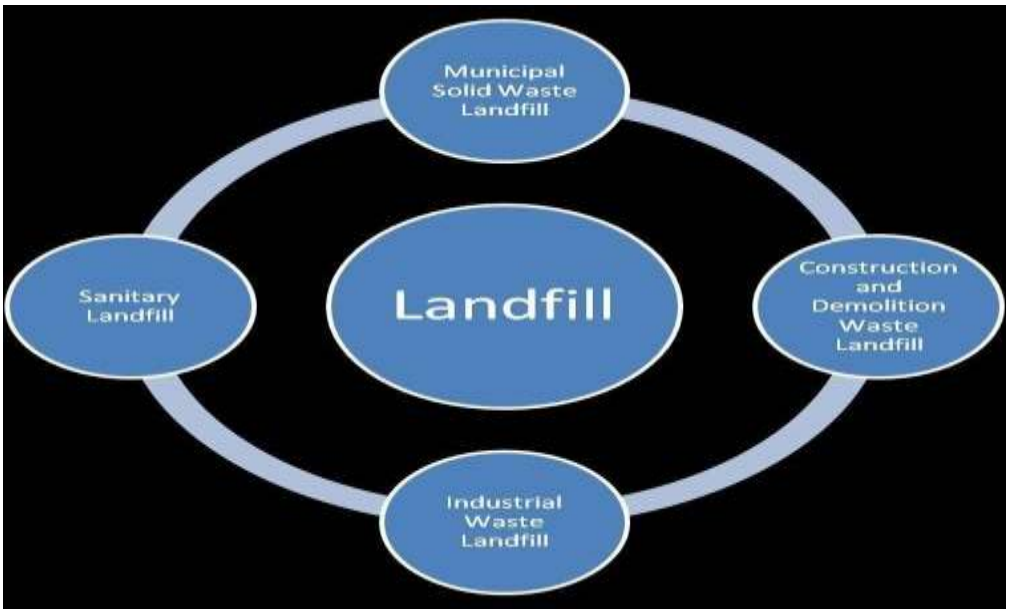


Figure 8: Types of landfills

(Source: http://sites.google.com/site/wastemanagementalternatives/types---of---landfills)

Landfills are the most widely used waste management option. Also, the oldest and most common final method of garbage disposal may be solid waste placement into landfills. It should be recognized that from the beginning, landfills were simply open controlled dumps. What differentiates landfills today from dumps is the degree of engineering design involved as well as administration and planning. However, as old and widely used as it can be, landfills have

two major disadvantages: probable groundwater pollution and methane emission into the ambient air. Abushammala et al. 2010 report that anaerobic decomposition of municipal solid waste in landfills generates gas containing roughly 50-60% methane (CH4) and 30-40% carbon dioxide (CO2) by volume. Hence, with global warming on the rise and other hazards, alternatives to landfills are needed more than ever before. That being said, it is still an attractive choice at present, especially with the consideration that we are still a far cry from zero-waste attainment. Regrettably though, most poor countries in Africa, Asia, and Latin America cannot afford it as it were, even as it remains very important in the scheme of things in the meantime. They still indulge more in the practice of open dumping with the fewest engineered landfills. A major setback of landfill technique in poor developing nations is the high cost or expensive nature of a properly well-engineered landfill. It is very expensive to design implement and maintain such a facility. Thus, the construction of landfills facilities is a focus of development assistance of the World Bank and other aid organizations. Even though these entities may provide the money to pay for such costs and give technical assistance, it will be the responsibility of government at the local and national scale to ensure that proper waste disposal is a practical and viable option in the long term (Zerbock, 2003).

The various solid waste management techniques as described above have been implemented in developing countries in different ways. They have either been successful in certain cases or failed in others. To properly understand the reason for their failures or successes, it is imperative to have a knowledge of the theory of Political Ecology in the first place, before looking into the experiences and examples from the world's poorest nations. In the contexts of politicised environment, governments of developing countries have so far found themselves a weaker entity functioning under the domination of a more powerful government of the developed world. Hence, Bryant etal (1997) stress that the conflicts over the natural resources in developing countries and the environmental degradation have been created by the unequal power and wealth distribution in society. Therefore, due to poverty and the quest for economic growth and development, the low-income nations find themselves in a situation where they have to attract foreign investments from multinational companies owned by industrialised countries by not formulating, not enforcing or by even relaxing strict environmental regulations. As would be expected, these companies contribute to solid waste generation that raises environmental concern in the developing nations to the detriment of the individual inhabitants of these cities and communities. It is imperative to reiterate here that these entities sometimes donate money to the poor nations to be channelled into waste management projects. Nevertheless, these funds do not consider local conditions and lack sustainability focus leading

to the failure of such projects. Lack of funds and skilfully trained staff to sustainably manage these technologies such as incineration technology have led to such projects being abandoned half way down the line. In essence, the continued domination of western poor over the poor nations by taking away their resources and creating environmental problems including waste issues therein leaves the question of how these wastes should be managed and by what technology open for discussion.

Evidence has shown that most of the techniques have not really been successful in developing nations. Experience in Nigeria show that most of the composting plants in various regions of the country have failed (Adewale, 2011), as well as other developing countries including Asia and Latin America. With regards to the landfills techniques, Johannesn etal (1999) reported certain failure experiences in developing countries as described below.

The Mobeni land fill near Durban, South Africa, designed to receive hazardous industrial waste for co-disposal with municipal solid waste, collapsed in November 1997, the reasons for the collapse were unknown. One theory conjectured that the high moisture content from the liquid hazardous waste and rainfall might have caused a slip between the polyethylene liner and the clay liner, leading to its eventual collapse. The collapse culminated in extensive odour problems in nearby communities as well as extensive costs entailed in restoring the landfill.

Also operational difficulties caused the Uganda's Mpewere landfill, inaugurated in 1995, to return to an open dump practice before its first anniversary. The landfill, owned and operated by the Kampala City Council, was for the first six months of operations, under the supervision of an experienced landfill from South Africa. Its eventual failure was blamed by officials on small operational budget of the landfill and the lack of local managerial expertise in operating a new landfill. As a consequence of these failures, unwholesome and improper waste management practices have been adopted in low-income countries like dumping which is the disposal of waste at an uncontrolled uncovered site of minimal or no structural design and is most practised MSW disposal option in the poorest countries (Garfi et al., 2009). The researcher concluded by identifying an appropriate solution for disposal as landfill for this case. Thus judging by three elements namely: several failure experiences of the various waste management technologies (Poor consumption altitudes, poor production solid waste management end-life cycle of a product), the continued domination of western power (that have the financial capital, skill and technology) over the developing nations and the poor financial status of the developing world in dealing with this plague, as perceived by some researchers and authors, it becomes logical to understand why intense research is needed to provide waste management solution in this context.

2.9 Stakeholder Mapping and Sampling

With the objective of understanding the relations between stakeholder groups and to guide the interview and questionnaire sampling process an analysis of the stakeholders' salience was conducted through a mapping exercise (See Figure 10), based on the framework proposed by Mitchell, Agle and Wood (1997). This framework categorizes stakeholders based on their *power*, *legitimacy* and *urgency* (For further explanation see Appendix 2). Key Stakeholders possess all three attributes, Expectant Stakeholders have two of them, and Latent Stakeholders only one.

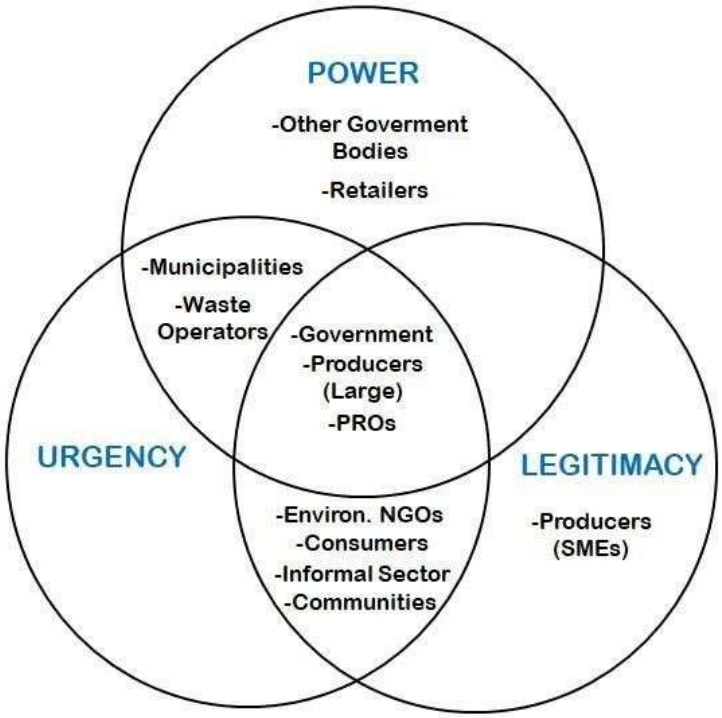


Figure 9: EPR law landscape stakeholder map (based on Mitchell, Agle and Wood (1997)

A brief explanation of each stakeholder position follows:

- **Government** *power* and *legitimacy* derive from the law they are working to implement, and the *urgency* comes from the pressuring deadlines they have.
- **Large Producers** have *power* over the EPR landscape because they drive the financial flows; the topic is *urgent* to them as it impacts their operation and costs; they are *legitimately* the key actors of the law.
- **PROs** have *power* over the waste management process, *legitimacy* due to the key role assigned by the EPR law and *urgency* to be established, as no PROs exists in Zambia this far.

- **Municipalities** hold the *power* to the waste flows today, and the definitions of the EPR law are critical to them, therefore their *urgency.*
- **Waste Operators** have normative *power*, as experts in waste management, and the definitions of the law are of critical importance to their operations, thus their *urgency.*
- Under the norms and values of Zambian society, and also because the EPR law considers them as legitimate players, it is fair to state that environmental NGOs, consumers, communities and the informal sector have *legitimate* concerns on the results of the EPR law implementation- The reason being, outcomes of EPR implementation are of critical importance to them, therefore their *urgency.* They do not possess factual power over the process, though this could change over time, as they become key stakeholders if their needs are not covered.
- **SMEs Producers** have been considered in the consultation process, and the outcomes of the law could potentially affect their competitiveness, which gives them *legitimacy*. Though as for today, the law does not specify obligations to them, thus not attributing *urgency* to them or any factual *power.*
- **Retailers** are a channel of resource collection, which gives them *power*, but as the law remains to be implemented they present no *urgency*.
- **Other Governmental Bodies** have the *power* to influence MMA decisions, but they are not leading the implementation or explicitly considered in the law, therefore the lack of *legitimacy*. And because the EPR law is not the priority in their agenda, *urgency* was not attributed to them.

These are embedded in an institutional system that have a significant role in fostering EPR for effective waste management.

According to Mitchell *et al* (1997) (See Appendix 3 for more details), *key stakeholders* (MMA and large producers) require the highest attention, followed by the *dangerous stakeholders* (Municipalities and waste operators), who could gain legitimacy through regulation or social consensus and become key stakeholders. Attention will also be put on *dependant stakeholders* (Environmental NGOs, consumers, communities and the informal sector), who have legitimate and urgent claims but depend on the legislation, though could potentially gain power through

social movements. *Latent Stakeholders* (SMEs, retailers and other governmental bodies) require less attention and will not be considered in the sampling process.

2.10 Key selected issues for EPR Implementation

The research identifies key selected issues for EPR implementation. Several local councils set their zero waste goals to "diversion of waste from landfill"; however, diversion of waste alone may not be enough as it requires innovative design and sustainable consumption to achieve the long-term goals. The 3R principles (reduction, re-use and recycling) are among the top three in the waste hierarchy and they are considered as the founding principles of sustainable waste management system (Cited by Atiq, 2017). A number of approaches have been identified in various studies such as eco-design, responsible shopping behaviour in relation to waste avoidance and prevention. Waste prevention is one of the most important issues and it requires collective social awareness and knowledge on waste and innovative manufacturing and business models. Awareness and transformative knowledge are often believed to motivate behaviour change in relation to pro-environmental lifestyle choice. Responsible and sustainable consumer behaviour is another important issue in waste prevention (Cited by Atiq, 2017). Collaborative consumption increases efficiency in resource consumption and enhances social collaboration. The collaborative ownership or collaborative consumption model promotes service-based business and waste prevention. Therefore, re-circulation (circulate the materials in the supply chain for a repetitive use) of post-consumer products through re-use and re-sell is important and it boosts the circular economy and enhances social capital. Waste management and treatment technologies are used in solving waste problems for more than centuries. EPR takes the position that science and technology alone cannot solve the waste problems sustainably, as it requires community participation, service infrastructure, regulatory policy and environmentally friendly treatment technology. A number of studies have identified that effective collection systems, decentralized waste recycling centres, social technology such as recycling, composting, regulatory policies such as pay-as-you-throw (PAYT) and environmentally friendly advanced waste treatment technologies are the key issues in waste management and treatment (Cited by Atiq, 2017). Thus, this study used the identified key selected issues for EPR strategy to meet the objectives of this research following the completion of literature review. Table 1 summarises the key issues for EPR implementation.

Table 2. 5: The key selected issues for Extended Producer Responsibility implementation.

Phases	Key issues for EPR implementation
Waste Prevention and avoidance	Innovative product design (cradle –to-cradle)
	Sustainable consumption
	Awareness and education of waste
	Transformative knowledge and willingness to change behaviour
	Producer Responsibility (take-back scheme)
	Collaborative consumption practices
	Market creation for post-consumer products re-circulation
	Extended product lifespan through repair/re-use
Waste management and treatment	Effective waste collection services (kerbside waste collection)
	Waste incentives (tokens, taxes , levy etc.)
	Decentralised recycling and resource recovery centres
	New infrastructures (bins, collection vehicles)
	Improve source reduction through pay-as-you throw principle
	Enabling social technology through community participation (recycling, composting etc.)
	Environmentally friendly waste treatment solutions
	Regulations on restricted mass use of landfill and waste-to-energy (WTE)
Monitoring and assessment	Available and reliable waste data
	Performance evaluation through EPR scheme research

Table 2. 6: Table of Gap Analysis

Author/Year	Findings	Gap
Kaffeine etal, (2015)	Findings were that EPR programs appeared in several European Countries (Sweden, Germany etc.) in the early 1990s and their adoption has been increasing since, and accounts for over 395 EPR policies around the world.	In most cases, EPR systems analysed were already in place evaluating environmental and economic impacts thus, leaving a gap in the study of early-stage implementation.
O'Reilly etal, (2015)	It was discovered that in terms of products covered under EPR schemes, the most frequent are small consumer electronics (35%), packaging and tyres.	The study was done outside Africa thus might not be representative to the African population
OECD, (2014)	The study found that legal initiatives are growing in numbers in developing countries in Asia, Oceania, Africa and Latin America and the Colombia (LAC). In LAC, Chile, Mexico, Brazil Argentina and Columbia are implementing their first schemes with the treatment for potentially hazardous waste being the common one.	This study was not done on packaging material. The study does not give specific African countries were EPR studies were done, thus might not be representative to the African population
Kavaarpuo et al, (2013)	The study in Ghana about drinking water plastic sachets (packaging material) found that, it is not economically motivating for producers to continue to collect sachets littered along streets as this increases their operational costs. Providing litterbins by producers also at vantage points to collect empty sachets could also prove economically unviable since producers were producing on a small scale basis.	EPR system analysed was already in place evaluating environmental, policy and economic impacts thus, leaving a gap in the study of early-stage implementation.

CHAPTER THREE: METHODOLOGY

3.1 Methodology

In order to explore the incorporation of Extended Producer Responsibility (EPR) schemes/policy to enhance solid waste management of Zambia in Lusaka City, a country case study (Bryman, 2012, p.66) was designed, doing a detailed analysis of identifying who the major producers are, assessing ways to motivate both producers and consumers towards sustainable consumption and production and assessing the motivations for producers to engage in recycling practices in Lusaka, to be compared to EPR literature. To do so the author of this research project undertook a mixed method approach by applying a qualitative and quantitative research with an inductive approach (ibid., pp.36, 380;), based on the data which was to be collected by semi-structured interviews and 60 self-administered questionnaires (see appendix 3 for model of questionnaire) across stakeholder groups of the Zambian packaging EPR landscape. Purposive sampling, recording and constant comparison for thematic analysis was used (ibid., p.568), guided by some of the principles of grounded theory (Glaser and Strauss, 1967). An inductive approach that facilitates the development of concepts when there is no specific guiding theory yet. (cited by Tomas, 2018). Quantitative data was analysed using SPSS and excel. EPR experiences from developing countries were used to analyse EPR to enhance solid waste reduction, as an aid to effective biological waste conversion and the roles of institutions in fostering EPR for effective waste management.

The analysis of Zambia: Lusaka City's case will offer an empirical study that will allow refuting, proving and complementing the EPR literature findings, and it was chosen to be combined with an inductive and flexible approach for the following reasons:

- Zambia offers the right conditions for the research; developing country with low rate of recycling
- Lack of rigorous research on incorporating EPR law of the Zambian solid waste management sector.
- Comparably less research on EPR law implementation on developing countries and little research on incorporating EPR law as a tool for enhancing solid waste management in Zambia.
- EPR literature is mostly theoretical and conceptual (Kaffine and O'Reilly, 2015)
- Literature has also remarked how there is no EPR model that fits all contexts (European Commission, 2014; cited by Tomas 2018) and the intrinsic complexity of EPR implementation (Gui etal.,2013; cited by Tomas)

The research is also designed as a Stakeholder Analysis (Brugha and Varvasovsky, 2000) to be developed in two phases: first, an exploratory stage, and later the main data collection stage.

Table 3. 1: Describes two research stages, their methodology, analysis and main outcomes**.**

Research Stage	Method	Data Analysis	Main Outcome
Exploratory Stage.	Literature review and desktop study.	Notes, classification and summary.	-Understanding of EPR strategies and its incorporation in enhancing solid waste management in Lusaka city, Zambia. - Stakeholders classifications
	Semi-structured Interview with experts.	Summary of notes and highlights of recordings.	-Tentative identification of major producers of bio/non biological waste. -Overall understanding of Solid waste management system in Lusaka, Zambia Contacts with potential interviewees
Data Collection Stage.	Semi-structured Interview with relevant stakeholders. Desktop study	Manual recording process of simplified interview transcriptions. Notes and summary	Identification of major producers of biological/non biological waste and roles of institutions in fostering EPR schemes.
	Administration of questionnaires to identified stakeholder groups	Use of Statistical Package for Social Sciences(SPSS) /Microsoft excel to interpret the data	-Assessment of possible ways to influence producers & consumers towards responsible production & consumption. -Assessment of motivating ways to engage producers towards waste recycling practises.

3.2 Mixed Method Research

The understanding of people differs and the use of a single method cannot reveal all aspects required for a particular research, which is why researchers need to use a mixture of appropriate methods Tunnicliffe and Moussouri (2003). Through amalgamation of qualitative and quantitative data, a better understanding of a research problem can be achieved as compared to using either approach alone (Creswell, 2003). Patton (2002) and Giddings & Grant (2006). presents that mixed methods research are useful in survey, evaluation, and field research

because of the broader focus it bears coupled with the capability of gathering more information in different modes about a phenomenon than single method design. The challenge of mixed methods research is presented by Aryl et al. (2009) as time consuming and the requirement of expertise to combine quantitative and qualitative research within one study. This is a limitation that has been acknowledged in this study and addressed through cautious yet strategic time management in order to complete the research within the academic year and also through additional training in research methods individually as well as postgraduate lectures.

3.3 Mixed Methods Research Designs

Concurrent and sequential designs are the two main characteristics which emerge from mixed methods. According to Bergman, (2008), the concurrent design brings together qualitative and quantitative data in parallel whereas the sequential design uses one type of data to build on the other. The concurrent design uses quantitative and qualitative methods separately in order to offset any weaknesses within one method with the strengths of the other method. In this design, both forms of data are collected in parallel or at the same time and then united into a single interpretation of the overall results (Creswell, 2003, p. 16). On the other hand, sequential designs arise when the researcher collects and analyses one type of data before using the other data type by implementing the methods in two distinct phases (Creswell, 2003). The researcher can either collect quantitative data first or qualitative data first, both approaches are possible.

As established earlier under the research design component of this study, mixed methods combine qualitative and quantitative data using four designs namely: explanatory, exploratory, transformative or nested designs. The reasons that influence selecting a type of mixed method design are presented by Rossman & Wilson (1991) as:

- to enable confirmation or corroboration via triangulation
- to elaborate or develop analysis, providing richer detail, and
- to initiate new lines of thinking through.

In a mixed method research, a researcher has to prioritise one type of data than the other data type (Creswell et al., 2003). Priority refers to the giving of either quantitative or qualitative method more emphasis in the study. Each design of the four presented has its own utility, procedures, strengths and weaknesses that are dependent upon the research context, however based on the research questions and objectives of this study, the selected design was the Sequential Exploratory Design (Creswell 2003; Creswell et al. 2003; Creswell & Plano Clark (2007).

This is summarised in Figure 10:

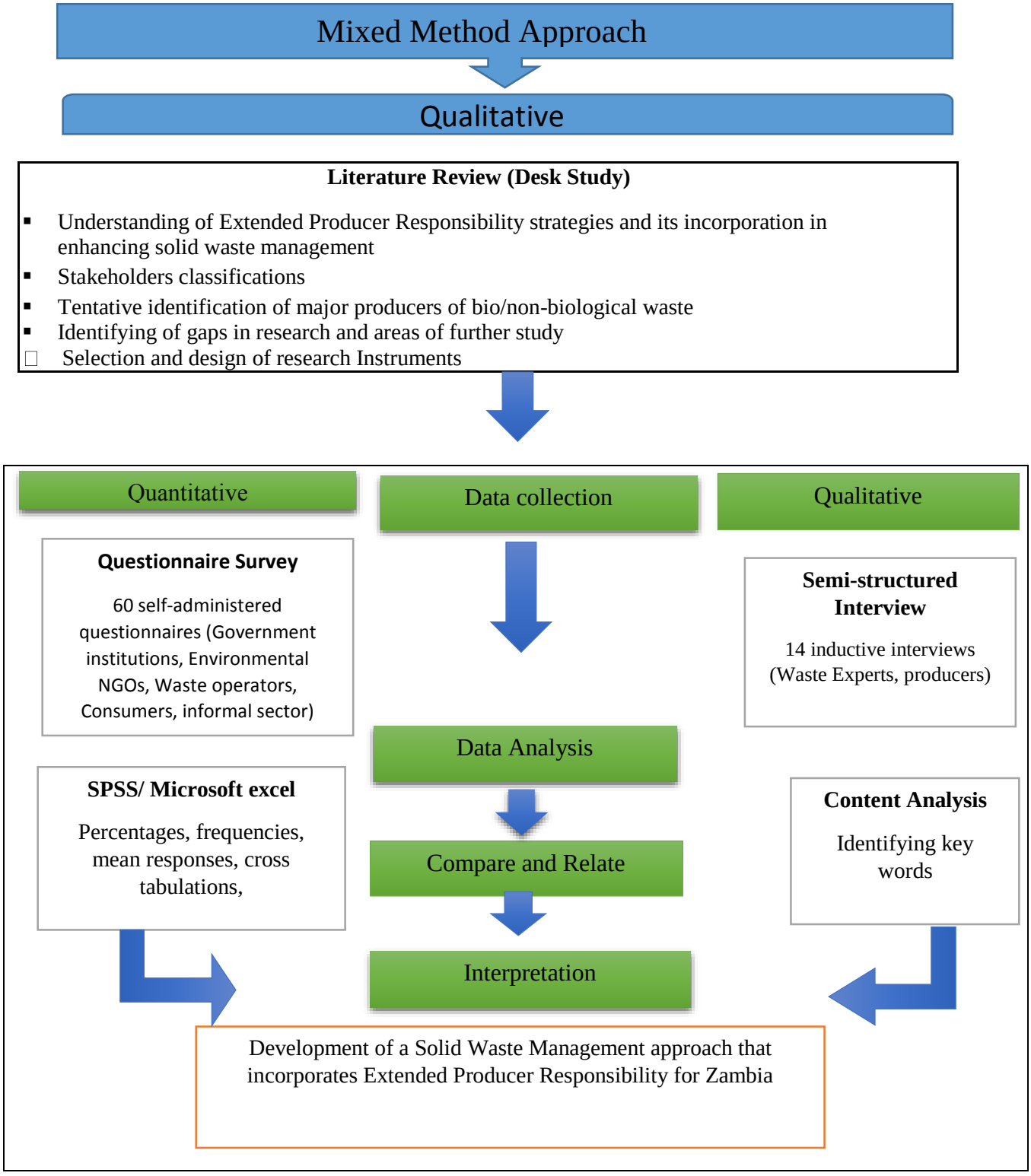


Figure 10: Summarised methodology steps

Conclusion was drawn from the theoretical framework, the analysis of various waste management experiences in developing countries as with regards to EPR implementation, interviews and questionnaire surveys to give an understanding on the role of Extended Producer Responsibility (EPR) to encourage solid waste reduction and improve biological waste conversion practices in the city of Lusaka Zambia.

Considering the analysis on stakeholder mapping and sampling (see 2.9 for more details), a purposive sampling approach was used (Bryman, 2012, p. 422), which justified directing the interviewee/questionnaire administration contacting efforts to relevant representatives of the mentioned stakeholder groups. The goal was to have a high representation of key stakeholders, less of expectant stakeholders and none of the latent stakeholders. The organizations sought to contact were those who, either were found to have the most knowledge of the impacts of EPR implementation, offered the highest representation of their stakeholder group, or were actively involved in the public discussion. The author of this research possessed a significant network in Zambia, which complemented with the contacts provided by the experts interviewed in the exploratory stage. This allowed to quickly identify and contact key representatives of determined organizations, and to experience a high rate of contact success. Out of 80 organizations contacted by email and phone calls, 14 agreed to be interviewed (17.5%) and 50 responded out of 60 self-administered questionnaires (83%). Some institutions were initially hard to reach, but were later successfully contacted after the first set of interviews by waste experts provided better quality contacts in these organizations, following a snow-balling sampling approach (Bryman, 2012, p. 424). The resulting distribution of interviews and questionnaire administration is detailed in Table 6 and largely adheres to the objectives of the purposive sampling. The sample size was 80, out of which 14 interviews and 50 questionnaires were conducted.

Table 3. 2: Questionnaire/Interview distribution by Stakeholder group (Author's Own)

Stakeholder Group	Organizations Contacted	N0. Organization interviewed	No. of questionnaires responded to
Government/municipality	3	3	10
Producers (Large)	15	6	-
Waste Operators	7	1	4
Waste Experts	2	2	-
Environment NGOs	9	1	5
Consumer Representatives	34	-	27
Informal Sector (waste pickers)	10	1	4
Total	**80**	**14**	**50**

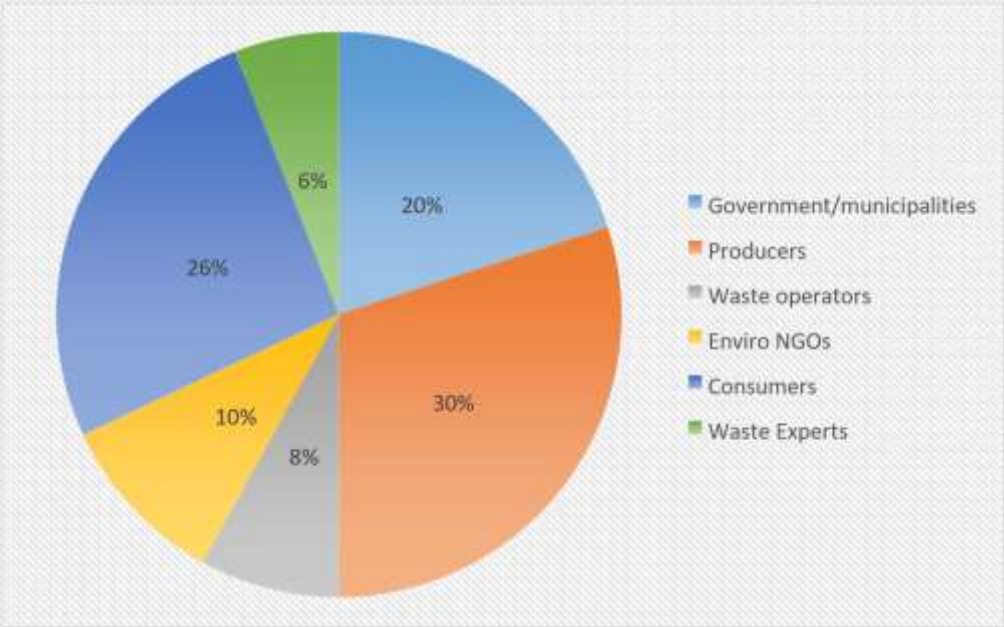


Figure 11: Stakeholder percentage distribution

When possible, organizations contacted and interviewed/questionnaire administered were associations that represented several members of a stakeholder group, which was expected to provide a better quality of data, compared to interviewing/administering questionnaire to a single player with a potentially biased opinion. This was the case for producers, waste operators, municipalities and consumers. No PROs were contacted, as there is no established PRO in Zambia to date. No stakeholder from the communities' category was contacted, as no local community has recently raised their voice related to the impacts of new waste management infrastructure.

3.4 Data Collection

Sample size computation

The following formula was used for the sample size **n** for which the population size is known:

$n = N*X / (X + N - 1)$,

where,

$X = Z\alpha/22 *p*(1-p) / MOE2$,

and $Z\alpha/2$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), MOE is the margin of error, p is the sample proportion, and N is the population size.

Variables used

Confidence level =95%

Population Size = 89

Margin of Error =5%

Z at 95% =1.96

a =0.05

p =0.5

N =89

a) Computation

$X = Z\alpha/22 *p*(1-p) / MOE2$

$X = 1.96 (0.05/2*2) * 0.58(1-0.5)/0.05*0.05)$

$X = 7.89 * 0.5(0.5)/0.25$

$X = 1.9725/2.5 *10^{-3}$

$\underline{X = 789}$

b) Computing sample size

$n = N*X / (X + N - 1)$

$n = 89 * 789/ (789 + 89 - 1)$

$n = 70,221/877$

$\underline{\text{Sample size } n = 80}$

3.5 Data collection tools

Interviews and self-administered questionnaire

Previous research on EPR schemes has used various methods for data collection. For instance, the European Commission (2014) did a multi-case study analysis of 36 selected EPR programs to identify common rules, and Kaffine and O´Reilly (2015) did a survey with 395 stakeholders to inform the update of the guiding principles of the OECD EPR manual (2001). Although these methods have been effective in the past, this research will follow a comparable approach to the one used by Kunz *et al.* (2018), which considered 27 interviews with 6 stakeholder groups of the WEEE EPR landscape in Europe to explore the support of EPR schemes towards a CE. With the objective of undertaking an inductive qualitative research, semi-structured interviews were used (Bryman, 2012, p. 212) and questionnaires self-administered for purposes of covering a wide population. These are flexible enough to provide insights on how the respondent sees the world, but structured enough to be able to compare data from the full set of interviews/questionnaires and draw relevant conclusions (Denzin and Lincoln, 2018, p. 579). The sample size was 80 out of which interviews and questionnaires were conducted. The 14 interviews and 50 self-administered questionnaires were conducted between the 11th of March and the 7th of May of 2019. Most of the interviews were done in person, 11 in total, lasting between 27 and 58 minutes. The remaining three interviews were done in writing via email, by request of the interviewees. The interview considered introductory questions on the role of the organization and its relation to the EPR law, after which came a core set of open questions about the impacts and opportunities in the implementation of the Packaging EPR law. The topics considered in this section were informed by the interviews from the exploration stage and the most relevant issues. Finally, a set of additional questions enquiring about particular topics was included. Extreme care was put to avoid bias based on the author's opinion during interviews, using neutral prompts and probes to direct the conversation to the topics of interest. The questionnaire was slightly adapted to the context of each stakeholder group. A copy of the questionnaire used for waste experts can be found in Appendix 5.

3.6 Method of Data Analysis

Content Analysis and SPSS/Excel

After each interview, recordings were turned into simple transcriptions of the core phrases of the interview in English and Nyanja. Following that, an open coding process was used to

identify core ideas and concepts (Strauss and Corbin, 1990, p.61). The initial coding process of the 14 interviews resulted in 73 observations. Through a process of constant comparison (Bryman, 2012, p. 568) and content analysis, they were iteratively refined and renamed, split and combined into categories and core categories, resulting in 36 categories. Later, the relationship between categories was explored, with a focus on the agreements or disagreements between stakeholder's groups. This analysis gave the foundations to the findings and discussion of Chapter 4. Data collected through survey questionnaire was analysed using statistical package for social sciences (SPSS) and excel.

3.7 Ethical Considerations

Before every interview or questionnaire administration, the respondent was fore informed about the research study and consent sought. In order to maintain anonymity and avoid direct or indirect identification, the names of interviewees/questionnaires and organizations were omitted, and interviews were listed by the type of stakeholder group and a number, e.g. Government 1, Producer 1 to 6, and so on.

CHAPTER FOUR: FINDINGS AND DISCUSSION

4.1 FINDINGS

This chapter presents the key findings from the data collected. The analysis suggests nine major factors in the effective implementation of the Zambian packaging EPR law:

- Citizenship awareness, participation and education of waste (educational offerings)
- Establishment of stakeholder's communication and coordination channels
- Market creation for post-consumer products recirculation
- Innovative product design (cradle –to-cradle)
- Willingness to change behaviour
- Responsible shopping & consumption practices
- Provision of waste incentives (levy, taxes etc.)
- Development of a waste sorting culture
- Strong collection & recycling system

The rest of the findings as applicable to objective one were concluded through thorough desk study or literature review of the Zambia Environmental Management Agency (ZEMA) EMA of 2011 as with regards to EPR law in Zambia.

The discussion schedule will explore the meaning and the results for each one of them. Due to the early-stage of implementation of the packaging EPR law, many details and regulations are pending to be determined, by either the forthcoming decrees or the concerned stakeholder's decisions. The analysis of the interviews allowed further identify the four most relevant aspects that remain to be defined, issues that will be explored in more detail in sections that follows. These are the definition of: Emphasis of the EPR implementation impacts varied between stakeholder groups, in accordance with their interests.

A summary of the issues that were given more importance by each group is detailed in the table below:

Table 4. 1: Issues Given importance by each stakeholder group

		Governmen	Producers	Waste Operator	Municipalitie	onmental ONG	Consumers
Extended Producer Responsibility for enhancing solid waste management	• Citizenship awareness, participation and education of waste (educational offerings)	X	X	X	X	X	X
	• Establishment of stakeholder's communication and coordination channels	X	X		X	X	X
	• Market creation for post-consumer products recirculation	X	X			X	
	• Innovative product design (cradle –to-cradle)	X	X	X	X		
	• Willingness to change behaviour	X	X			X	
	• Responsible shopping & consumption practices	X					
	• Provision of waste incentives (levy, taxes etc.)		X		X	X	
	• Development of a waste sorting culture			X			
	• Strong collection & recycling system		X		X		

When combining the results from Table 7 and the stakeholder map from section 2.9 it becomes apparent how *key stakeholders* (Government and Producers) and *dangerous stakeholders* (Waste Operators and Municipalities) are concerned by the majority of the

challenges, even though they might have different opinions on how to address them. *Dependant stakeholders* (Environmental NGO and Consumers) are worried about more specific issues.

One relevant aspect to be considered from the analysis of Table 7 and the stakeholder map is that the majority of stakeholders are located in the *urgency* circle, understanding urgency as "the degree to which stakeholder claims call for immediate attention" (Mitchell, Agle and Wood, 1997, p. 869). This implies that the confrontation of the evolution of the EPR law could be driven by narrow views focusing on short-term solutions, rather than stable long-term measures that benefit the whole system. This aspect calls for careful attention.

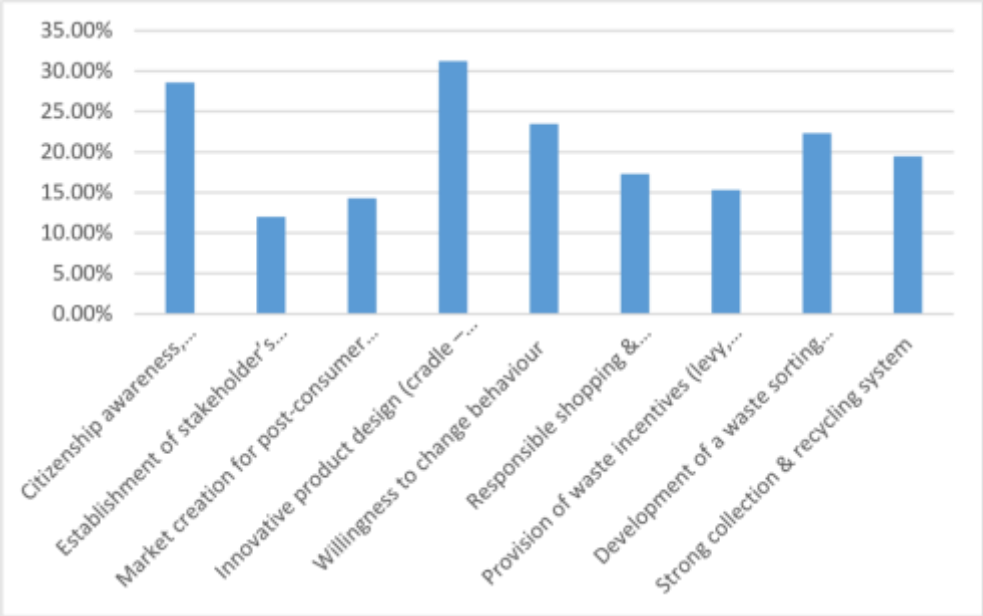


Figure 12: Key issues for EPR implementation

The key issues (See 2.10 for details) relating to EPR were identified in literature and used for data collection. These issues or factors were rated by participants from less important to extremely important. The responses were ranked from the highest percentage to the lowest. Over 80% of the all respondents agree or strongly agree on a number of issues such as importance of awareness and education on waste and its influence in behaviour change, cradle-to-cradle design, along with extended producer responsibility and collaborative consumption through a shared ownership of products.

The key issues for EPR implementation were later ranked with regards to percentage response (See figure 12 for details) and respondent key issue percentage in table 8 below:

Table 4. 2: Ranking of Key issues for EPR implementation & respondent key issue percentage

Key issue	Percentage	Rank	Environmental Org /%	Government %	Consumer%	Waste operator %	Informal sector %
Innovative product design (cradle – to-cradle)	31.23%	1	5.01%	14.2%	7.02%	2.0%	3.0%
Citizenship awareness, participation and education of waste	28.59%	2	11.5%	7%	4.09%	3.6%	2.4%
Transformative knowledge motivating (Willingness) to change behaviour	23.45%	3	10.45%	8%	1.3%	1.7%	2.1%
Development of waste sorting culture	22.00%	4	4.4%	5.0%	5.2%	4.2%	3.2%
Strong collection & recycling system	19.45%	5	3.9%	3.02%	3.04%	5.6%	3.89%
Responsible shopping & consumption practices	17.29%	6	3.45%	7.3%	3.5%	1.14%	1.9%
Provision of waste incentives	15.7%	7	4.0%	6.0%	3.0%	1.1%	1.6%
Market creation for post-consumer products recirculation	14.28%	8	2.06%	5.1%	3.2%	1.02%	2.9%
Establishment of stakeholder's communication and coordination channels	12.00%	9	4.2%	3.6%	1.1%	2.1%	1.0%

The survey findings of the participants show that innovative product design using the cradle to cradle principle was ranked as the top most issue in extended producer responsibility for effective solid waste management, followed by citizenship awareness, participation and education of waste, transformative knowledge motivating to change behaviour, development of waste sorting culture, strong collection and recycling system and so on.

Participants associated with environmental organizations had a higher percentage of agreement on the fact that lack of awareness is the key cause of creating waste problems and that creating a positive environment for behaviour change will allow the waste problem to be addressed more effectively (See results in table 7 & 8).

The participants provided a mixed response to development of a waste sorting culture. Mostly, respondents from government organizations and producers supported a market creation for post- consumer products to enhance recycling and participants from environmental organizations were supportive of creating a strong stakeholder communication and coordination and recycling. However various studies suggest that waste incentives (financial or moral) can be beneficial for motivating people to recycling waste.

Most producers were of the view that packaging material (plastic) waste menace in the municipality is closely linked with consumer behaviour. Educating the public on better handling of packaging material was a recurring theme in approaches suggested by producers. In total 52.14% of producers made recommendations directly aimed at influencing consumer behaviour rather than technological approaches.

This situation emphasizes that consumers are key in packaging material waste management. Extended Producer Responsibility seeks to assign responsibilities among various stakeholders. Aside paying taxes which all citizens are expected to do, the survey observed that consumers had no roles in packaging material waste management. Without governmental bodies institutionalising frameworks to influence consumer behaviour towards plastic waste, efforts by producers could prove ineffective.

4.2 DISCUSSION

The main aim for this research was to recommend a baseline for the foreseeable future of the impact of incorporating EPR as an approach to encourage municipal solid waste management in the city of Lusaka by promoting recovery and recycling of packaging waste materials, making conditions better for waste separation and thereby enhancing efficient biological waste conversions**.** This research found that more than 49% of solid waste in Lusaka is high in organic content (UN-Habitat 2010) and the improper separation of organic and inorganic materials from the waste streams, use of inappropriate techniques, lack of developed institutions, poor financial status are the main reasons that make it difficult to manage these wastes. The best way to handle this kind of waste to avoid its landfilling and open dumping could be biological waste conversion.

4.2.1 Major producers of bio/non-biological waste as applicable to EPR in Zambia

The first objective was to identify the major producers of bio/non-biological waste as applicable to EPR in Zambia. This objective was met through interviews with waste experts and desk studies conducted during data collection of this study. The findings are that: Major producers of biological and non-biological waste were identified as any person (company) who manufactures, retails, imports, trade or commercially distribute in Zambia domestically or imported packaging material or puts a product on the market that has the potential to become waste (The EMA act No. 12 of 2011, SI No.65 of 2018). These include:

- Manufacturers: as the producers of non-biological waste
- Retailers/Traders/Importers: as the producers of biological waste and Non biological
- Commercial distributors: as the biological and non-biological waste

Various studies have shown that it is entirely the responsibility of the consumer to adapt to good altitudes when it comes to disposal of these wastes because at the end of the day these packaging materials have short useful lifecycle and are usually discarded indiscriminately at the convenience of the consumer. Managing packaging waste material requires the involvement of both bio/non-biological producers to facilitate a system for separation of organic and inorganic materials from waste. These packaging materials have short useful lifecycle and are usually discarded indiscriminately at the convenience of the consumer (Kavaarpou 2013). This study in comparison with literature revealed that challenges in managing packaging material waste are not only linked with the inadequate and inefficient disposal capacities of duty bearers but also essential are consumption behaviour, income levels and perception of consumers (Hansen et al, 2002). It stands

to reason therefore that, without parallel efforts aimed at directly influencing producer and consumer behaviour, the adequate management of waste cannot be tackled only with technical end-of-pipe technologies (Kavaarpou, 2013).

There is need to create the link between the production and waste phases of a product (Sander, 2007). Linking the production phase and the waste phase encourages producers to engage in practices that minimize waste. Producers have the greatest possibilities to initiate sustainable waste practices through product redesign, waste minimization, promote less wasteful products and facilitate reuse of the product at the end of its life (OECD, 2001).

4.2.2 Ways of influencing Producers and consumers towards a transition to sustainable production and consumption

The second objective of this study was to assess ways of influencing producers and consumers towards a transition to sustainable production and consumption. The research revealed that educational offerings, stakeholder establishment of communication channels and waste incentive supported by literature could influence producers and consumers towards sustainable production and consumption

i) **Educational Offerings:** This include citizenship awareness, participation and education of waste by consumers and producers and tagging a cost to the price of a product (See figure 13) whose percentage was coming to 28.59% (refer to table 8). Citizenship awareness about responsible shopping and consumption and ultimate disposal of waste is often believed to motivate behaviour change in relation to pro-environmental lifestyle choice.

   (a) Citizen education and participation

Most respondents had some concern for the key role of citizens in the EPR scheme, because, independent of the method of waste collection, their awareness and willingness to cooperate holds the key to the volume and efficiency the system can achieve:

We could have a great network of recycling points, or we could have an amazing waste management system in place, but if the citizens do not respond, this will not work, we will not reach the goals". (Government 1)

There is awareness that citizens' convenience is a success factor for the system, but there are different views regarding the implementation models of the scheme. There are also discrepancies on who is responsible to educate consumers and how to do this. From this, it appeared that consumers had no

responsibility allocated to them towards EPR for solid waste management. However, Policies that influence consumer behaviour could prove to be effective in this regard.

(b) Tagging a price to the cost of a Product

This would motivate practices that reflect the real social and environmental costs of the production processes. The producers assume part of these costs and also translate part of the cost to the consumers as reflected in the price of the product, therefore, lowering the consumption patterns. An example of this EPR implementation scheme is buying a packaging material for packing goods in chain stores after shopping. In this way producers and consumers are motivated towards sustainable production and consumption.

1. **Establishment of communication channels:** 12% of respondents were of the view that there is the need to dialogue and understand producers and consumers through well-coordinated communication channels, this would later change their habits towards waste consumption and production. However, the low 12% response show that the majority of respondents are not in support of this view
2. **Waste incentives:** 15.7% of respondents were of the view that waste incentives given to producers and consumers could foster a great atmosphere for EPR implementation for effective solid waste management. However, the low percentage imply that the majority of respondents are not in support. Nevertheless, various studies have shown that such incentives could include giving the producer freedom of choice when it comes to selecting their cost –effective technology when producing their packaging materials hence motivating them to engage in sustainable production and consumption.
3. **Market mechanisms –**14.28% of respondents were of the opinion that Market creation for post-consumer products aligns with the fact that a support of market mechanism to make recycling more effective would motivate both consumers and producers towards sustainable consumption and production leading to sustainable solid waste management. The low percentage in response imply that the majority were not in support of the view.

(a) A support of market mechanism for recycling

Most respondents had some concern in regards to the support of market mechanism for recycling industry in Zambia, considering the little volume it processes compared to its potential and the lack in waste management infrastructure. They explained that some materials that could be recycled do not reach an economically viable volume (e.g. certain plastics), while for others the collecting capacity surpasses the transformation capacity (e.g. multilayer liquid containers). For those materials

where there is capacity, it seems there is a very limited number of companies in the transformation stage (e.g. glass and cardboard), exposing the fragility of the system. There is the need for creation of a market mechanism for recycling. The following quote provides good insight

"The recycling market is very dawning, very defined to a certain type of materials. Currently, engaged capacity is very limited to what the industry can deliver. There is not enough capacity developed to start receiving post-consumption material. To think about the implementation of the law, it is necessary to increase the capacity of reception and valorisation of the materials."

(Producer3)

The producer was further concerned with the lack of a solid waste management infrastructure in Zambia, posing a challenge to the law. As a producer explains:

"In other countries, the EPR law is implemented when there is already an established waste management system that considers the provision of a market system for recycling. For us, in Zambia, it is the other way round. We do not yet have a general waste law and we are correcting this lack by means of the implementation of the EPR law". (Producer 3-

See appendix 3 for extract of interview with producer 3)

Gaps in EPR Stakeholder involvement

v) Economical- It was observed that it is not motivating for producers to collect littered packaging material along the streets if the law was to be implemented.

vi) Cultural factors-cultural habits of waste disposal and generation of waste at first place. Without government institutionalizing frameworks to influence consumer behaviour towards packaging material waste, producer's efforts could prove ineffective.

4.2.3 Motivation for Producers to engage in waste recycling practices

The third objective was to assess the Motivation for Producers to engage in waste recycling practices

1. **Provision of incentives-** 15.7% of respondents were of the view that incentives could motivate producers to engage in waste recycling practices. Nevertheless, the low 15.7% show that the majority of respondents were not in support. Several Studies in EPR has however pointed that such incentives include; imposing possibilities of sanctions for non-compliance and freedom given to producers to find cost-effective ways to meet the goals has previously motivated producers to engage in recycling activities.
2. **Educational programs (28.59%) -** Education programs that incorporate environmental considerations in the design of producers' products. If the producer is fully aware of the environmental implications of his production process, he is able to engage measures that minimize waste, incorporate eco-design methods and reduce waste going to the landfill and also reduce on his input material in the production process.
3. **Development of a waste sorting culture and a strong collection/recycling system especially at source (22% respondents).** The 22% percentage response show that most respondents are not in support. However, studies have shown that this can foster a market for recyclable materials encouraging producers to engage in waste recycling practices implying that producers would be motivated to recycle waste and use as much as possible recyclable materials for their products, therefore avoiding to some extent, the overconsumption of natural resources and energy in the production processes.

Considering that the producer is given the suitable conditions (provided he is motivated) for EPR implementation and sustainability towards engaging into recycling practices, the following proposed state-run recovery programme could facilitate a well-coordinated recycling and recovery system.

4.2.4 Proposed EPR State Run Recovery Programme

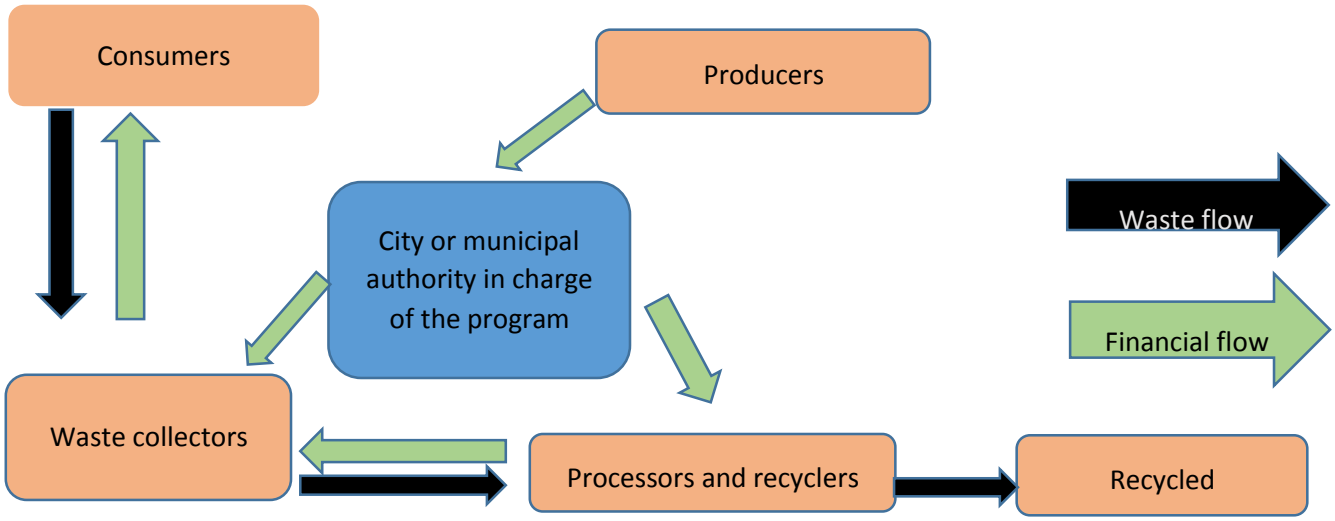


Figure 13: Proposed state-run recovery programme through EPR (Source: Modified from Danquah et al, 2015)

As shown in Figure 11, the municipal or state is the main body of public investment in the establishment of waste recovery and recycling programs. The state or municipal authorities will have the physical responsibility of collecting the packaging material waste while the producers will be financially responsible for the programme and also providing incentives to consumers to encourage return of packaging material waste to vantage points or collections points provided by the municipal authorities. This can also be done for other useful waste streams.

Waste Flow- Consumers (including households and businesses) bring post-use plastic products to collection points or to waste collectors (formal or informal), who then transport it to processors or recycling firms. The collections can be coordinated by the authorities, producers or a body in charge of the program for maximum efficiency, and this can be done by integrating and improving on the already existing informal recovery systems.

Financial Flows- Each producer pays a financial contribution to the collection scheme. The amount paid, for instance, can depend on the amount of production of each producer. These payments are then disbursed by the authority in charge of the scheme to the actors in the collection process. The authority pays each collector based on a unit rate per weight that they handle, as already existing in the informal sector, or the collectors can sell their products to the recycling companies. Instead of them ending up at landfill sites or being disposed of improperly.

4.2.5 Stakeholders and Roles of Institutions in fostering EPR

The fourth objective of this research was to Identify stakeholders and Roles of Institutions in fostering EPR for effective solid waste management.

The stakeholders were identified during data collection conducted in this study and their roles mapped as supported by literature. Stakeholders in the EPR arena encompasses the Government, the producers, PROs, municipalities, waste operators, environmental NGOs, consumers, communities and the informal sectors. These are embedded in an institutional system that can play a vital role in the application of EPR to waste management and are as follows:

Producers

These are the main stakeholders that have the financial and physical responsibility towards packaging material waste management. Producers can decide to be physically involved in the end-of-life stage of their product or financially involved. Mandating producers to pay for the lifecycle environmental cost of their products provides economic incentives to implement green production and disposal processes. During the product development phase producers may thus be concerned with improving product design in terms of material and energy usage and pollution prevention. Other environmental considerations at product design phase include waste minimization, reuse or recyclability, material conservation, pollution reduction, lower toxicity and "eco-design" (Walls, 2006). Efforts of producers resulting from EPR can be summed up as geared towards not only reducing the waste disposal burden on the environment but also ensure that resources are efficiently utilized in satisfying human needs.

Government: The Zambia Environmental Management Agency (ZEMA) is the national authority that leads to the establishment of the legal EPR framework. They will further provide information and registration service that supports the system.

Environmental NGOs: Institutions whose role is to represent the interests of the natural environment. The law considers their participation in the consultation process.

Consumers: Generators of the waste after the use-phase and are required to take back waste into the system

Municipalities: Local government play a crucial role. They currently manage household waste streams.

Waste Operators: They collect, consolidate, transport and manage the recycling of waste for PROs.

Producer Responsible Organization (PROs) - Intermediaries that facilitate the fulfilment of producer's targets, subscribing contracts with waste operators and municipalities. They charge fees to the producer they represent in order to cover their costs. There is no established PRO in Zambia to date.

Informal sector: Zambian law considers the inclusion of informal collection/recycling sector mainly waste pickers, as accredited waste operators once recommended and acquire business levy from the local council.

The coordination among stakeholders is crucial to the success of EPR schemes. Government, local authorities, NGOs, CBOs, the formal and informal sectors and consumers are embedded in this institutional system. The study revealed that Zambian EPR encompasses the government, the producers, NGOs and consumers as its main actors and are embedded in an institutional system that have the power to motivate multinational owned companies to implement EPR as a tool for packaging material waste management. The solid waste management relationship approach is presented in the figure 14:

Solid Waste Management approach that links stakeholders and assigns them appropriate responsibilities. Green arrows represent resource flows and the orange arrows symbolize financial flows

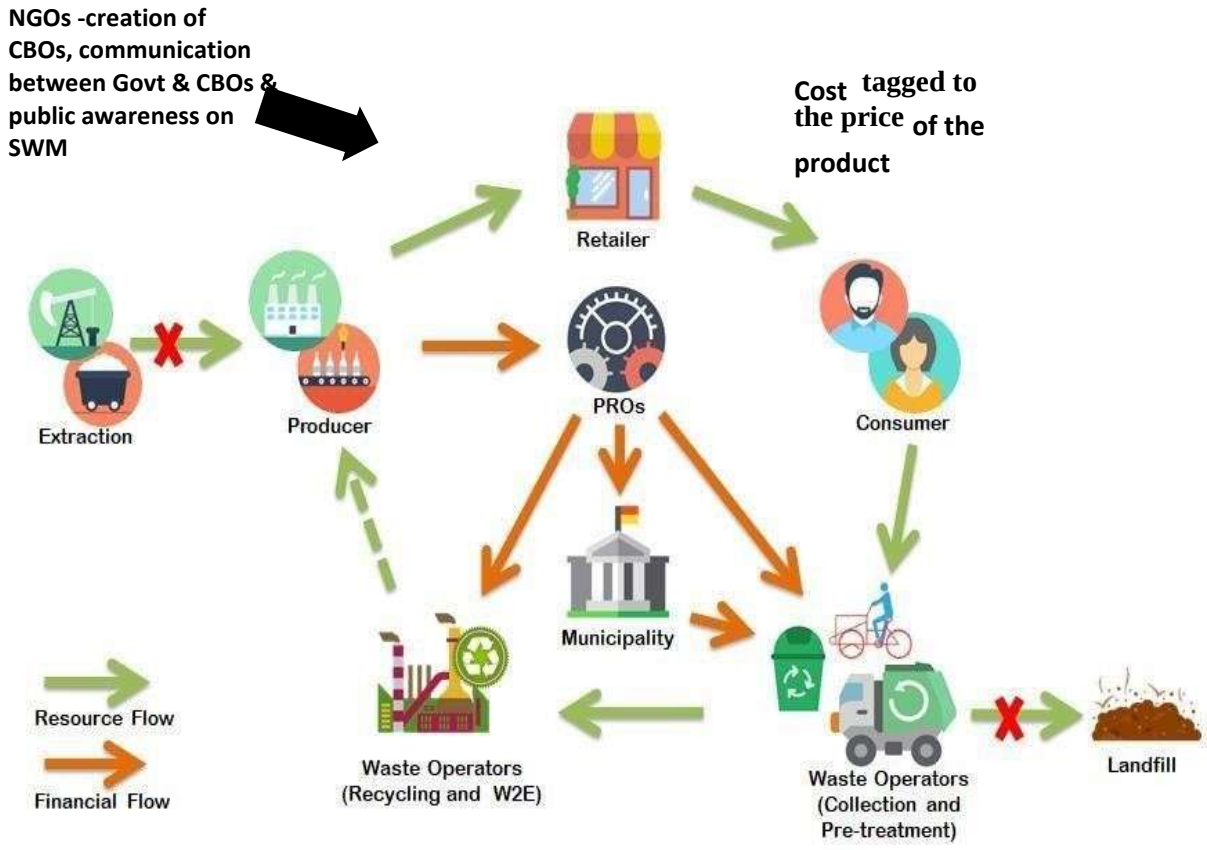


Figure 14: Simplified structure of Zambian packaging EPR scheme (Author's own; Modified from Tomas, 2018)

The simplified structure of Zambian packaging EPR scheme corroborates the critical relevance of the stage of development of the recycling industry. The relationships scheme allows exploring the responsibility of each stakeholder in the waste management system as with regards to EPR law implementation. It is a tool that can aid stakeholders in the present stage of discussion of the packaging regulatory decrees in Zambia, and can also guide the construction of EPR relationship scheme for each of the other priority products or for the EPR schemes of other countries. A key feature of the scheme is that it is an exercise to adopt a systemic approach, recommended in the definition of policies that impact a diverse group of stakeholders as in the case of EPR legislations, especially in the analysis of sustainability-related regulations (Espinosa and Walker, 2011). Based on the OECD experience, the cost of the EPR system is allocated in the following way: PROs services account for 5 to 10%, collection and sorting an estimated 60 to 80% and recovery and disposal the remaining 10 to 40% (OECD, 2016b, p. 103).

(a) Roles of Institutions.

Under the fourth objective second part was to identify roles of institution and are as follows: (i) stakeholder coordination and (ii) communication was identified as key roles of institutions:

(i) Stakeholders' coordination and communication

The majority of respondents considered stakeholder's coordination and communication a very relevant issue, some even stating it as the most complex and relevant of all. As explained by interviewees, this is challenging because the scheme demands coordination between organizations with very different interests that regularly do not communicate -particularly private and public organizations. Demanding the "*overcoming of certain mistrusts"* (Municipality), the adaptation to new waste management models and the creation of needed partnerships. The alternatives of the best environmental and economically efficient models need to be discussed and refined, and it is through stakeholder coordination that the scheme will start to work in the practice, not only by the publication of the pending regulatory decrees. These aspects demand high levels of communication and participation of the main players of the system, including the competition, a sensitive topic in Zambia, as the next quote describes:

> *"Producers will have to sit down with their competitors. At the moment you declare the materials you put on the market, you declare your production, your sales…In Zambia there are much mistrusts, where the issue of collusion is right under the skin... people do not know how to meet with the competition to put together the management systems, without being told they are being colluded".*

(Producer 1)

4.3 Literature Findings and discussion: An analysis of experiences of EPR in Developing Countries

The main aim for this research was to recommend a baseline for the foreseeable future of the impact of incorporating EPR as an approach to encourage municipal solid waste management in the city of Lusaka by promoting recovery and recycling of packaging waste materials, making conditions better for waste separation and thereby enhancing efficient biological waste conversions. It should be noted that this research was carried out at the early-implementation stage of EPR in the country i.e. before targets concerning the recollection and recycling aspects could be defined by the government and stakeholder consultation is still going on and thus it is necessary to look at experiences of EPR in developing countries, looking at each case one by one and drawing conclusions from it to see the possibility of its implementation in Zambia.

4.3.1 EPR to enhance solid waste reduction

EPR experiences are increasing and have been applied in some developing Asian countries to wastes of different kinds of like electronics and electrical equipment (like the case of china and Thailand) and packaging waste, and the establishing of recycling systems based on EPR is a practice running during the last years (Kojima et al., 2009)

Vietnam amended its Environmental Protection Law in 2005, and under the general provision on waste management section, makes the waste-generators to be responsible for the expired and discarded products, and aiming to reduce, recycle and reuse waste material in order to minimise the quantity of waste discarded. Among the products covered by this legislation are accumulators, medicines for human use and tires (Vietnam, 2006). In spite of the interesting scope of the law, it lacks detailed regulation and consequently it has been difficult to implement (Kojima etal., 2009).

Malaysia performed a Solid Waste and Public Cleansing Management Act in 2007 under the ‘reduction and recovery of controlled solid waste ‘section, which gives power to the minister to demand that any solid waste generator mitigates the generation of solid waste in any method for the purpose of reducing, reusing and recycling of solid waste. The Act goes further stating that ‘take back systems’ can be established, requiring that specified products after use be taken by the manufacturer, assembler (or importer) and they shall be obliged on their own account and cost to recycle or dispose those products in a specified manner. This requires a fixed deposit-refund system, the labelling of the products and a feeling of obligation from the dealers of the products (Malaysia, 2007). This motivating legislation still needs supplementary

specifications that would be prepared by the Department of Solid Waste Management (Kojima etal., 2009).

The law on Rubbish Management in Indonesia states clearly that producers have to manage the resulting waste from packaging of their products, and other part of the products that are difficult to disintegrate by natural processes. Commercial and Industrial areas and also public facility are obliged to provide a rubbish sorting facility (Indonesia, 2008 et al., 2009).

Experience in the Latin American countries is very similar. Governments are concerned by enacting regulations to manage certain kind of wastes, as shown by the Argentinean case, where a ban has been placed on compact fluorescent lamps by the Municipal Waste Management Law in the City of Buenos Aires (Lindhqvist et al., 2008) note the Argentinean authority willingness to establish legislation in the collection and post-consumer management of municipal waste, and some other hazardous waste like batteries as the case of the 'Zero Waste Law' in the city of Buenos Aires depicts.

Uruguay went for more specific legislation called the 'Law of Use of Non-Returnable Packs' in 2004, which was later amended in 2007. The law makes clear details on the responsibilities of brand owners regarding the handling of all packaging materials (Plastics, cardboard, metals or glass), including the packs of tobacco and cigarettes, whether they are manufactured in the country or imported from abroad (Aldaz, 2007). It is within the scope of this law to enhance the reuse and recycling culture, thereby preventing the packaging materials from forming household waste. The legislation is very encouraging and clear in its objectives by including all the actors like distributors, manufacturers and importers of products, both on large and small scales. With type of arrangement, the law ensures effectiveness, compliance and prevents evasion (Aldaz, 2007). Voluntary agreements and deposit-refund schemes that would enable the consumers to return the packaging materials are expected to be part of the features, just like the already established scheme for soft drinks and water packaging materials.

Mexico also has a 'General Law' on the Prevention and Management of Waste that was enacted in 2003 and amended in 2007. The law obliges the producers, importers, exporters and distributors to execute management plans to deal with the remaining hazardous waste, once their products are discarded. Among others, used oil, accumulators, batteries, fluorescent lamps, medicines and pesticides are covered by this law. Just like other legislations, this one also aims to prevent and minimise the generation of waste, its releases to the environment, as well as its integrated management (Estados Unidos mexicanos, 2007)

Researching into the experience in Africa, a very interesting case was found in South Africa that is directly related to packaging waste. Conscious of the problem generated by this kind of waste, South African government has given space to EPR in a series of laws (The National Environmental Management Act 107 of 1998, the National Waste Management Strategy, the National Integrated Waste Management Bill, the National Waste Management Bill and the Waste Act) (Nahman, 2010). Detailed cases of plastic bags, glass, steel, beverage cans and PET (a type of plastic) are explained by Nahman (2010), which are summarised as follows: The overconsumption and littering of plastic bags due to its free distribution led to the enactment of a legislation aimed at increasing reuse and recycling, decreasing collection, processing costs and dumping. By promoting recycling, the government encourages the industry to generate employment, and of course, alleviate the burden of this waste in the streets and the environment. The establishment of a a levy for each plastic bag bought by the consumer enabled the creation of funds aimed at boosting the return and collection of plastic bags, thereby, stimulating their recycling. However, the national tax system blocked, somehow, the transfer of funds to the company in charge of those tasks, and the levy decreased product consumption in such a way that there were no plastic bags to be recycled. The waste was reduced as well as the employment in the plastic industry.

The case of steel cans is quite different. Based on a complete voluntary initiative, two major companies in South Africa joined efforts to create a non-profit organization called "Collect – a-Can)'that stimulates the collection and recycling of steel cans. Run in an effective self-regulated way, the program pays the collectors and consumers for each can they return, thereby increasing the supply of recycling material and its market. The recycling levels have increased from 18% to 67.5% during one and a half decade, there has been an increase in the level of income for the people involved in the collection process. The funding provided by the companies and the revenues from the process have assured sustainability for the program. The government, avoiding the use of legislation as in the plastic bag case, motivated the companies in the glass industry to join efforts to stimulate glass recycling. With a levy on the sales of glass, a non-profit organization called Glass Recycling Company (GRC)'was created in 2006, whose main task was the collection of glass for recycling, and not the recycling process itself. This initiative included the major glass producers and most of the filler companies. By paying the collectors and setting up of banks along the cities where the consumers can put the used glass, GRC ensures a cost-effective supply of material that is then sold back to the producers (at the

same price of virgin material which makes the prize of the recycled glass very stable) that recycle the glass in their own facilities. The recycling rate has increased and is now above 26%.
A type of plastic resin called PET, used to pack food and beverages, was targeted by the companies in this industry as a potential recyclable material. After some negotiations among brand-owners, resin producers, converters and fillers, the non-profit organization 'South African Polyester Recyclers 'was created in 2000 (renamed as PETCO in 2004) as a voluntary initiative. PETCO, which is only in charge of the collection process, functions on the levy system that is paid by converters, which allows payment to the collectors. This system absorbs the fluctuations of the price of PET due to market variables, by ensuring its constant supply. Despite lack of adequate technology to recycle PET in a bottle-to-bottle way, there are many ways to use post-consumed PET, therefore, maintaining the recycling market and the creation of employment.
After presenting the various approaches to the implementation of EPR, with an emphasis on its efficacy as a strategy to arouse recycling of all kinds of packaging materials at the end of their useful life in South Africa, the results show that voluntary agreements between government and the industries could be more effective than forced regulations in the framework of a developing country, when EPR is used as a waste management tool (Nahman, 2010). Provision of adequate incentives may be an important ingredient to the implementation of effective EPR in the developing countries. Although for effectiveness, sanctioning power may be vital norms and rules (Scott, 2001).
The cases in Asia, Latin America and South Africa show the different approaches and the instruments to apply EPR. Each country has its own context, which is determined by, among others, legal frame, market and local culture, even if all of them are categorised as developing countries. A factor that is common to almost all the cases (except steel recycling in South Africa) is the presence of government. It was mentioned in chapter two that developing countries depend on foreign investment from developed countries to foster their economic development, and this leaves them with little choices that make it difficult for them not to support the production process that are motivated by capitalist practices. This situation usually stops the countries from enacting environmental legislation that could somehow prevent the attraction of such investments into the developing countries. In the cases where the legislation exists, it is not amended or reorganized to meet needs and the ongoing situation (Visvanathan, 2007).

An important aspect that requires a mention is the economic motivation for the companies in the area of EPR implementation. Analysis of the interview with producer 4 shows that the company would like to implement EPR because it would project them as a good company helping to solve the waste problem in the country. The manager also makes it clear that their main motive of doing it would be to sell more products because applying EPR could boost their sales in the city. Besides the 'good will' companies by definition are created to make money and keep the costs of production as low as possible. One of the ideas of EPR is the internalization of social and environmental costs on the products, however, if such costs are extremely high, multinational companies will not have the initiative to implement EPR, and much less the small producers which can barely fight against the fluctuations of the market and the demand (Kojima etal., 2009). However, the South African case showed that increasing the level of cooperation among companies could allow the sharing of the economic burden when implementing EPR programs and therefore facilitating the process. On the other hand, the existence of a recycling market that gives value to the post-consumer products or the possibility of creating one, as well as the available of technology to perform the recycling would be crucial to the success of EPR implementation in the developing countries.

The analysis of the EPR experiences shows two major identified difficulties to its smooth operation in the developing countries. The first identified problem is the difficulties in identifying producers of some products in the situation that they are imitations or/and smuggled into a developing country. The second difficulty is the lack of a system that provides incentives for the implementation of EPR (Kojima etal., 2009). The availability of information is also crucial in the implementation of EPR since it requires a high level of cooperation among stakeholders, as demonstrated in the case of glass and PET material in South Africa.

The cases cited and other studies research (Lindhqvist, 2000; Kojima 2009: Nahman, 2010: Visvanathan etal 2007; Wilson etal., 2006) have shown that the overall goals of EPR as a policy tool is to promote cleaner production processes, the use of safe and recyclable material, and a reduction of solid waste management problems in developing countries. Consequently, the studies show that the implementation of EPR would help in promoting sustainable solid waste management in the developing countries by offering the following services:

- Would motivate the producers to use as much as possible recyclable materials for their products, therefore, avoiding to some extent, the overconsumption of natural resources and energy in the production processes.

- Would motivate practices that reflect the real social and environmental costs of the production processes. The producers assume part of these costs and also translate part of the cost to the consumers (reflected in the price of the product), therefore, lowering the consumption patterns.
- Would reduce the costs of waste management for the municipalities, for instance, in reducing the need for landfilling space and operational costs.
- Would decrease unemployment rates for the poor and strengthen the informal recycling sector by giving subsidies through the recycling fund. The improvement of the recycling conditions, which at the end will bring better working conditions for recyclers (informal sector, scavengers), is an important part in the recycling chain in developing countries.
- Would generate cooperation along the production chain by integrating the upstream environment impacts (type of materials from the source and production processes) and the downstream impacts (associated impacts to the product use, recycle and final disposal) while implementing EPR programs and designing a new product.
- Would promote the culture of sorting of among the population and also raise the awareness of the need to prevent the usual indiscriminate dumping of used products on the streets and natural ecosystems.
- Would help relieve the pressure on landfills and the economic, social and environmental costs associated with such practices.

The benefits of EPR policy tool seem very promising. The majority of the inorganic waste in most developing countries including Zambia is paper and plastic (which mostly represent packaging material), which constitutes a burden in the municipal solid waste management. It is true that much of the legislation regarding EPR in developing countries intend to manage 'problematic waste stream' which basically consist of hazardous substances. However, there are problematic waste in the waste stream, that come from common products being consumed by the population in developing countries on daily basis. Such materials end up in the streets and ecosystems where the culture is just 'dump it anywhere'. In that sense, EPR could play a significant role in achieving solid waste reduction when addressed toward the majority of inorganic waste. The identification of the sources (producers) of such materials is crucial to EPR for a substantial solid waste reduction to be achieved in the city.

4.3.2 EPR as an aid to effective biological waste conversion

The waste composition description made in chapter two showed that solid waste in Lusaka city of Zambia is made up of over 50% of organic materials (UN-habitat 2010) and also showed that biological waste conversion would be the most appropriate practice for managing the high percentage of organic waste in developing countries (Airan and Bell, 1980). Airan. and Bell (1980) also suggest that a major challenge to effectiveness of composting in developing countries is the mixture of organic and non-organic waste fractions. Furedy etal (1997) have shown that source separation of inorganic waste from organic wastes is vital to successful composting of municipal solid waste (in developing Asian countries). The authors further stressed the importance of household cooperation with source separation by citing the failure of pilot source separation schemes in Asia, which happened as a result of lack of household cooperation.

Ekelund et al. (2007) conducted a research on composting of municipal waste in South Africa and they explain that the presence of contaminants like glass, plastic and particulate metal would greatly affect composting in a negative way. It is explained in the research report that the presence of these contaminants in the organic waste stream would not help the marketability of compost, because the contaminants would change the appearance of the compost. A research was carried out between the year 1995 and 2001 to find out the role of composting to an effective and sustainable integrated waste management in Southern developing European Countries and the Eastern Transitional European countries. It is written in the research report that source separation of waste by the waste generator is not only environmentally better but also technically advisable and can be very effective if the people are well educated on which materials need to be separated, how to separate them and where to deposit the wastes (Dulac, 2001).

To cite experience in the America, research evidence has shown that source sorting of municipal waste is vital if the goal is to achieve a successful composting of municipal solid waste. A survey was conducted in the US with the aim of finding out if municipal solid waste composting makes economic sense, and the survey shows that plastics are one of the major challenges of municipal waste composting in seven out of the nineteen facilities that were contacted (Renkow and Rubin, 1998).

There are numerous other study cases that show the interference of inorganic materials with the effectiveness of biological waste conversion practices, but for the sake of brevity, this argument would be based on the already mentioned cases. Therefore, EPR could make a huge

contribution in the separation of inorganic waste (such as glass, metal and packaging) from organic waste by encouraging the separation of inorganic wastes for collection and recycling, instead of ending up in the same waste stream with organic waste. By so doing, one of the major challenges to composting in developing countries and can be effectively reduced through this waste sorting process, instead of the usual way of sending both organic and inorganic waste into waste stream and would motivate producers to recycle their materials thereby fostering sustainable production.

4.3.3 The roles of institutions in fostering EPR for effective waste management

The idea of a politicized environment suggests that environmental problems and solutions are contextualized in a large and global arena Bryant and Bailey, 1997) where institutions carry out a 'battle of powers'. There has been a long struggle to achieve sustainable waste management systems in the cities of developing countries but this quest has not been realized. Hence, for the purposes of this report, it is vital to look into the roles that institutions could play to enhance EPR for effective management systems in a developing country context. Before the analysis, it is important to explain what an institution is and mention the components of an institutional system.

Institution has been defined as 'a relatively enduring collection of rules and organized practices, embedded in structures of meaning and resources that are relatively invariant in the face of turnover of individuals and relatively resilient to the idiosyncratic preferences and expectations on individuals and changing external circumstances' (March et al., 2006 p.3). Campbell (2004) believes that institutions are the building blocks of social life and also explains that the possession of formal and informal rules, monitoring and enforcement mechanism make them systems that convey the frame within which human beings operate and communicate with one another. Other definitions have been given to institutions, and one of which is 'institutions are the rules of the game in a society' (North, 2009p.3). He explains further that institutions constrain, control, support and enable social behaviour; thus, affecting and determining the extent to which individuals, groups and organizations would obey rules and norms.

Scott (2001) shows three major analytical and important components that build institutions that are each independent, but can also work together as a combination. These components are regulative, normative and cultural-cognitive systems. To put them in a short and clearer perspective, the following features can characterise institutions:

- The regulative pillar (how the society must behave: laws and rules, supported by sanctions)
- The normative pillar (how the society ought to behave: values, norms, desirable goals, etc.)
- The cultural-cognitive pillar (how the society usually behaves: institutions regulate behaviour according to shared conceptions of social reality, nature, frames through which meaning is made).

A clear picture of the modus operandi of institutional systems would give understanding of how institutional arrangements could function in the establishment of EPR a s a policy principle to tackle solid waste management issues in developing countries. From the definition, it can be inferred that institutions are embedded in a social, economic and cultural context that share certain characteristics in developing countries, which are at the same time, immersed in a global scenario. As stated in chapter two, the political arena where the environmental problems are contextualized is the place where those institutions have their power struggles. Moved by their economic situation, governments in developing countries accept the conditions of the developed countries and try to catch up by replicating their production patterns or simply allowing the investors (from these developed countries) to exploit their resources. There is no way to internalize the costs of such practices, unless, there will be no short- term economic growth for the developing countries. Consequently, environmental legislation is not fully enforced, revised or adjusted to the specific situation.

For instance, it is difficult for the government to ask the producers, who are mostly multinational companies, to reduce (regulative pillar) their revenue margins to apply EPR practices, since they are the ones that generate money, pay taxes, employ the population and so on (other reasons, like lac of economic resources to enforce environmental legislation and lack of a transparent government aggravate the situation). The situation gets worse when the government try to apply a solid waste management policy and find out that it is a very common practice (cultural- cognitive pillar) for people to dispose their waste openly or in an abandoned site (Visvanathan and Glawe,2006). However, the level of consciousness of the government towards the environment increases every day, a situation that has led it to act intelligently. One of the findings of the research in the EPR experiences in South Africa explains the role of the government in voluntary agreements by giving the producers incentives, which include the possibilities of sanctions for non- compliance, and also gives freedom to the producers to find a cost-- effective way to meet the goals that they both agreed upon. At the end is not a threat

but cooperation. In line with Scott (2001) normative pillar of institutions, which explains how the society ought to behave (values, norms, desirable goals, etc.), the individuals themselves are picking up interest in the environmental issues and are getting together to join forces. Many non-governmental organizations (NGO) have been actively involved in solid waste reduction practices. Visvanathan and Glawe (2006) stress the importance of NGOs in boosting the competence of the local communities to create an awareness of waste management problems, to contribute to the organizational capacity and help in the creation of community based organizations (CBO), to offer communication between the government and the CBOs, to grant support to the informal sector by providing assistance and organization (Wilson et al., 2006) and, to transfer technical knowledge to active CBOs.

Visvanathan and Glawe (2006) also provide examples of such activities in developing countries, as the case of clear participation of different NGOs to increase public awareness in waste reduction, waste segregation and recycling in Sri Lanka, or the NGOs in Nepal 'Zero Waste Nepal' and the 'Women's Environment Preservation Committee' that help the community with concrete activities to foster waste reduction and waste sorting. Bangladesh and Pakistan are also examples where NGOs participate actively with the community to reduce solid waste management problems. Visvanathan and Glawe (2006) continue to explain that in developing Asian countries, women play a very important role in the CBOs. As a responsibility for their immediate environment, they have been increasing their participation, not only in waste sorting, recycling and sometimes composting, but also in educational programs and workshops beyond their communities. Examples in Bangladesh and Sri Lanka are provided and the findings in data collection of this research for the Zambia Lusaka case study supports educational programs to foster EPR and motivate producers to its implementation.

Medina (2000) makes an analysis of the waste picker cooperatives in Asian and Latin American countries, where NGOs have played an important role helping with the logistics. The cases have evolved in such a way that, for instance, policies now support and encourage the creation of these cooperatives in Indonesia, contracts for collection of recyclables have been assigned to Colombian waste picker cooperatives and, in Brazil, the development of public- private initiatives are promoted by local authorities.

A specific literature that links the NGOs and CBOs with EPR programs has not been found. However, some inferences can be made from the cases of EPR practices cited in this report. Using the South Africa case, almost all the EPR initiatives (except plastic bags) require a collection system that is performed by a non- profit organization (Nahman, 2010). This entity

is in charge to manage the methods to stimulate the collection of the post- consumer products (that later enters the recycling facilities). Such task demands efforts, time and money, much more in the scenario where a sorting culture does not exist and when collection rates are low. Now, the increasing potential of the NGOs and CBOs to develop such a waste sorting culture, and to organize to certain extent the informal sector into cooperatives that are in charge of the collection, can facilitate the task for the producers to organize an EPR program, which would lead to the saving of efforts, time and money. Besides, a sorting culture and a strong informal collection can foster a market for recyclable materials, which is also a motivation for the producers to establish EPR programs; this is supported by 22% respondents in this research.

The Mexican regulation 'General Law to the Prevention and Management of Waste' (Estados Unidos Mexicanos, 2007) is a good example where the government is interested in supporting and encouraging the creation and consolidation of groups that participate in the design of preventive waste policies, and calling NGOs to generate necessary information to nourish solid waste management programs. This kind of initiatives aim to increase the communication and networking among NGOs and CBOs (Visvanathan et al., 2007) to augment the likelihood of EPR implementation.

The coordination among stakeholders is crucial to the success of EPR programs. International associations, the national and local authorities, producers, NGOs and CBOs, the formal and informal sector and the consumers are embedded in the institutional system, though resilient, (March and Olsen, 2006) has seen changes through the last decades when the solid waste problems have become more acute, thereby enhancing cooperation to some extent. There are lots of changes underway that would take place within and beyond national borders where power struggles are always present. From the foregoing, it is evident that institutions would be a key player towards ensuring a concrete institutionalization and successful implementation of EPR in developing countries.

Extended producer responsibility (EPR) ensures that the producers extend their responsibility to the entire lifecycles of their products. Institutions are the building blocks of social life, armed with formal and informal rules, monitoring and enforcement mechanism to shape the behaviour of the society. With the possession of an enormous power over the society, institutions would play vital roles in enhancing EPR for effective waste management systems in the developing countries. Institutions have the power of motivating the multinationals to implement EPR in the developing countries, and also help to prevent 'the free- rider problem' by helping to form

an association of the producers, or a common fund (as the case in South Africa) where different companies with different economic activities in the production chain of a specific material can work together to establish EPR programs, thereby taking away the problem of identifying the producers whose products constitute problems to municipal solid waste management in the developing countries. This would contribute to reducing the municipal solid waste and also, to solving one of the major challenges to composting in a developing country like Zambia.

4.3.4 Challenges for EPR Implementation

The study analysis allowed to identify five challenges that need to be addressed, but were given less emphasis or were only addressed by a particular group:

- How to improve waste management in the municipality with little financial resources, particularly as most municipalities in Zambia do not charge citizens for waste management
- Sending waste to landfill is still very cheap in Zambia, making more environmentally friendly alternatives unattractive
- Lack of harmonization between regulations of different governmental bodies (e.g. Environmental Health regulations that inhibit the opening of new collection centres)
- Ineffective incentives to waste prevention and eco-design
- The need and how to design the system as to avoid bad practices seen in the past in the municipal waste management environment.

4.3.5 Future challenges

This research has the distinctive feature of being focused in the early-stage implementation of an EPR law, an aspect that allows it to be informed by a distinctive perspective and to contribute to closing identified gaps in existing EPR literature. In Zambia, the regulatory decrees have not yet been defined and published, giving stakeholders a chance to express their opinions and potentially influence the design of the EPR law. This aspect also implies some limitations on data comparison, as section 5.3 will explore. As mentioned in section 2.3, EPR implementation has three stages, being the final one the execution of the scheme into a working system. The final stage is characterized by the strong interaction of relevant stakeholders, whose actions help to shape the actual practice of waste collection and treatment (Gui *et al.*, 2013, p. 2).

Having highlighted this, the research proposes a list of the most probable challenges that the Zambian packaging EPR landscape will face in their final stages of implementation. The list aims to prepare stakeholders for the upcoming challenges, and it illustrates the dynamic nature of the challenges' relevance over time:

- **Free-riding**: This aspect has been explored in the literature as a large challenge in the final stage of implementation (See Table 1 in Section 2.3), as it might impact PROs' costs and producers' fees. Strong monitoring and enforcement are recommended, as well as transparency of information (OECD, 2014; Kaffine and O'Reilly, 2015).
- **Weak monitoring and enforcement**: As the law is not in place, this has not been an issue to date in Zambia. However, it is mentioned as one of the critical issues to assure target compliance, prevent free-riders and assure recycling standards quality. The active participation and coordination of stakeholders in the early-stage implementation and the inclusion of their opinion in the practical design of the system is recommended to have an efficient system that requires little central government monitoring and where PROs, producers and local government perform a natural monitoring role (European Commission, 2014; Kunz, Mayers and Van Wassenhove, 2018).
    - **Design for Environment (DfE)**: It is too soon to evaluate the impact of DfE of the Zambian EPR law, though this topic will probably be of interest in the coming stages. It is one of the main goals of EPR schemes, but the impact on DfE has been less than expected in OECD countries (Lifset, Atasu and Tojo, 2013; OECD, 2016b; Kunz, Mayers and Van Wassenhove, 2018). PROs' fees based on materials weight or product characteristics, as recyclability, have been more effective than fees based on unit put on the market (. i.e., Market Share) (Kaffine and O'Reilly, 2015, p. 4).

4.3.6 Key features to be defined.

The research also identified the most relevant key features that remain to be defined, given the implications to the EPR landscape stakeholders.

Separation at source is an aspect mentioned in the waste management literature as an effective way to increase the recycling volumes, successful in developed countries. However, it requires the existence of a civic environmental awareness culture and publicly tested opportunity structures for participation to succeed, two factors not necessarily found in developing economies (Charuvichaipong and Sajor, 2006, p. 2), thus requiring assessment and

ponderation. Separation at source is not an explicit requirement of effective EPR schemes in the EPR literature. Instead, the theory rather leaves the collecting and sorting model selection up to the coordination of PROs, local governments, producers and waste operators (OECD, 2001, 2016b).

End-of-waste criteria: The criterion that defines when waste becomes a valuable resource draws a line between collection and valorisation. It determines if the pre-treatment stage affects the compliance of collection or valorisation targets, facilitating the possibility to add pre-treated exported waste to the valorisation targets. It also gives an indication for the design of municipalities and PROs biddings, and if they bid collection and pre-treatment together or not, affecting the competitiveness of only-pre-treatment companies. The government representative informed that this issue would initially be solved case by case, although the development of a national end-of-waste framework is programmed. End-of-waste criteria has not been explored in EPR literature as a key feature of the law that needs to be defined. However, as explored in the Zambian case, it does generate significant implications to target compliance and waste operation competition. Nonetheless, end-of-waste criteria are described in the wider literature as a useful tool for sustainable waste management and to promote recycling and the circular economy (Zorpas, 2016).

Information management: This study together with extant literatures raised concerns regarding information management. The concern over the quality of the information to be used to define the targets. The general opinion of producers, waste operators and municipalities is that there is only a partial knowledge of the capacities of the system, the actual volumes it manages, the origin, destinies and configuration of waste, as also on the behaviour of consumers and the costs to be incurred under the different implementation models of the law. Secondly, how to make better use of the information systems already in place, such as customs and the national tax service, which can provide valuable information on the baseline and the identification of free-riders.

Social inclusion The effective inclusion of the currently illegal recycling sector is a concern, particularly for Producers and Municipalities. There is consideration for waste pickers as an alternative collection system, particularly for house-to-house collection, but the informality and low association makes this a challenge. As a producer explains:

> *"Waste pickers are a function that emerges with underdevelopment, found at low socioeconomic sectors, with a natural tendency to*

informality there are very few who associate and seek to work cooperatively"

(Producer 1)

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The main aim for this research was to recommend an approach to integrate EPR in the municipal solid waste management of Lusaka Zambia, by promoting recovery and recycling of packaging waste materials, making conditions better for waste separation and thereby enhancing efficient biological waste conversions**.**

More than 49% of solid waste in Lusaka is high in organic content. and the improper separation of organic and inorganic materials from the waste streams, use of inappropriate techniques, lack of developed institutions, poor financial status are the main reasons that make it difficult to manage these wastes. The best way to handle this kind of waste to avoid its landfilling and open dumping could be biological waste conversion. Gauging from the examples cited in developing countries, other kinds of inorganic wastes have been targeted through EPR programs which include batteries, accumulators, used oil, fluorescent lamps, e-waste n general and discarded medicines to manage post-consumer products, but not with the bulk of the waste consisting of paper, plastic, metal and glass that are represented mostly by packaging waste. Therefore, the intention is to extend the responsibility of the producers to this bulk of wastes coming from packaging materials in the country. In that way EPR programs would encourage waste reduction and recycling, because when packaging materials are returned to the producers without sending them to the waste stream, the effect would be that the overall volume of waste generated is lowered, and the recovered materials can be recycled into new products.

The findings as with regards to objective two through desk study revealed major producers of biological and non-biological waste and identified them as any person (company) who manufactures, retails, imports, trade or commercially distribute in Zambia domestically or imported packaging material or puts a product on the market that has the potential to become waste (The EMA act No. 12 of 2011, SI No.65 of 2018). These include:

- Manufacturers: as the producers of non-biological waste
- Retailers/Traders/Importers: as the producers of biological waste and Non biological
- Commercial distributors: as the biological and non-biological waste

The second objective was to assess possible ways of influencing producers and consumers towards sustainable production and consumption. The research discovered that the menace caused by packaging material (plastic) waste requires a re-examination of current methods to its efficient management and possible new ways to enhance the effectiveness of already existing management practices. There is the need to exploit possibilities of influencing/motivating producer and consumer

behaviour towards sustainable production and consumption. Educational offerings to consumers and producers, waste incentives and/or a support of market mechanisms to make recycling more effective. These efforts will result in reducing among others quantities of packaging material waste being land filled and improve environmental quality. Recycled materials could serve as inputs for further production thus minimising the need for virgin materials.

The third objective was to assess ways of motivating producers to engage in recycling practices. The study found that the producers could be motivated by the provision of incentives, educational programs and a development of a waste sorting culture and strong collection/recycling system especially at the source. Producers in Lusaka will appreciate the presence of a waste sorting culture and an organized formal and/or informal sector of waste collection that would save efforts, time and money when returning their post-consumer products. Such waste sorting culture and organized informal sector are enhanced by active NGOs and CBOs that use educational programs, provide technical and managerial assistance and a channel of communication with the government. Therefore, the active work of such organizations would be of high importance to motivate the producers to establish EPR programs. Also the motivation of the producers towards sustainable production and being influenced to recycle are the presence of a recycling market and the availability of cost-effective recycling technology. This research supported by literature has shown that voluntary agreements are more effective when engaging producers in EPR schemes. One of the findings of the research in EPR experiences in developing countries; South Africa explains the role of the government in voluntary agreements by giving the producers incentives, which include the possibilities of sanctions for non-compliance, and also gives freedom to the producers to find a cost-effective way to meet the goals that they both agreed upon. At the end is not a threat, but cooperation.

This research with regards to objective four revealed that EPR arena encompasses stakeholders ranging from government, NGO's, producers and consumers as its main actors followed by municipality, informal waste pickers, waste operators and PROs. These stakeholders are linked in an institutional system that constrains, supports, controls and enable the collective sets of efforts and behaviours of consumers and producers for carrying out the EPR programs in the country. Cooperation is a very important factor to implementing EPR programs. Government is mandated to regulate EPR policies while NGOs boosts the competence of the local communities to create awareness of waste management problems. Producers have the financial and physical responsibility of their products which includes packaging materials (plastics) and are willing to embark on sustainable production towards product design they however, linked the problems associated with plastic waste management in the city to consumer behaviour. This study discovered that the

consumer had no significant allocated responsibility it can therefore, be said that there is room for consumer behaviour to be influenced towards sustainable consumption once EPR policy will gradually start to come into effect, as the specific regulations and targets are defined and published in the present and future. It is expected that EPR would be a useful tool that would help in reducing the volume of waste and encourage biological waste conversions.

The extended producer responsibility in which ever form it is implemented could leverage the huge burden of municipality in the country while influencing sustainable practices among stakeholders along the packaging material production chain in the municipality. The OECD, 2001 points out that EPR addresses what many regard as the weakest link in the product responsibility chain; the final disposal of products after their purchase and use by consumers. This research demonstrated that producers are willing and trying to contribute in waste management efforts. The same cannot be said about consumers who do not only have no responsibilities in packaging material waste management but also weaken the efforts of producers by random littering of the packaging material waste. Policies that influence consumer behaviour could prove to be effective in this regard. Involving in all stakeholders connected to the lifecycle of packaging material would lessen the burden on few duty bearers while optimising any benefits that would accrue from the implementation of EPR.

The presented evidence in this report shows that it is possible and feasible to implement EPR programs in Zambia, thereby, enhancing the achievement of waste reduction, better sorting conditions, more effective biological waste conversion and higher recycling rate. However, it is very difficult to foresee how long it will take to fully implement these programs to address the fraction of the wastes representing the packaging material in Lusaka city. Its implementation will depend on the conclusions made after stakeholder consultations are made and targets set.

5.2 Recommendations for future research

In order to complement the research findings and contribute to the EPR and waste management literature, future research could continue the case-study of the packaging material Zambia EPR law through the next stages of implementation and development, exploring the environmental and economic efficiency and contrasting them with the EPR literature. Of particular interest would be to further compare it with other developing countries other than the ones compared in this research, as to better understand how to adapt EPR and waste management policies to local contexts. The need to perform more practical case-study research is emphasized, as the EPR literature is still heavily tilted towards theory. More research is further needed on finding ways to integrate the informal sector and waste pickers, on policies and practices to increase citizens' environmental awareness and willingness to participate in recycling activities, and on promoting efficient coordination and

communication between public and private sector. Institutionalizing frameworks to influence consumer behaviour towards packaging material waste should be considered by the government. Finally, within the EPR arena, there should be a **c**reation of a waste sorting culture and an organized formal and/or informal waste collection that would save efforts, time and money when producers are returning their post-consumer products to be run by Lusaka City Council through NGOs and CBOs. This will act as a motivation for producers to implement EPR policies as it will be economically viable.

5.3 Study limitations

The findings of this research need to be carefully transferred to other priority products and to other countries, as it reflects the particularities of the packaging landscape in Zambia. Furthermore, an additional limitation of the study was the limited number of interviews performed and questionnaire low response rate, due to time constraints and ineffective contact with the waste pickers. It would have allowed better representation to have additional interviews with environmental NGOs, Government, Municipalities and Consumers, though the used sample is aligned with the stakeholder mapping performed. Interviews represent self-reported data, which implies potential biases, in this case, relevant bias are selective memory, invested interests, attribution or exaggeration (Brutus *et al.*, 2013).

Another aspect that represents a limitation, is that data collection through interviews and questionnaires were done in the early-stage implementation of the EPR law in the country, before stakeholders could potentially experience some of the effects of EPR implementation in solid waste management mentioned in literature, which mostly refers to EPR systems that are already in place. This limits the comparison of EPR implementation possibilities between the Zambia case and the literature, and it also suggests that findings might be biased by stakeholders' assumptions and expectations, rather than objective facts in the case where interviews were used. Lastly, lack of rigorous research on implementation of the Zambian packaging Extended Producer Responsibility law this made EPR information to be scarce.

6.0 REFERENCES

Adebayo Olalekan, Camilo Lancheros, James Ezinma, Salan Nurmdeen, 2011, Solid Waste Management in the cities of developing countries; A semester research project submitted. Aalborg University, Denmark.

Akenji, L. *et al.* (2011) 'EPR policies for electronics in developing Asia: An adapted phase-in approach', *Waste Management and Research*, 29(9), pp. 919–930

Aryl, D., Jacobs, L., A, R. & Sorensen, C., 2009. Introduction to Research in Education. 9th ed. CA, USA: Wadsworth Publishing Company.

Atiq Uz Zaman ,2017 'A Strategic Framework for Working Toward Zero Waste Societies Based on Perceptions Surveys' School of Built Environment, Curtin University, Bentley, Perth, WA 6102, Australia;

Bergman, M. M., 2008. Advances in Mixed Methods Research: Theories and Applications. London: Sage Publications.

Blight, G and C Mbande 1998. 'Waste Management problems in developing Countries in Solid Waste Management': Initial issues for developing countries, edited bty E. Thomas- Hope ,26. Kingston, Jamaica; Canoe press.

Brutus, Stéphane *et al.* (2013) 'Self-Reported Limitations and Future Directions in Scholarly Reports: Analysis and Recommendations'*, Journal of Management,* 39, pp. 48-75.

Bryman, A. (2012) Social research methods. Fourth Edi. Oxford: Oxford University Press.

Camilo Lancheros, Adebayo Olalekan, James Ezinma, Salan Nurmdeen, 2011, Solid Waste Management in the cities of developing countries; A semester research project submitted. Aalborg University, Denmark.

Central Statistics Office, 2012. 2010 Census of Population and Housing: Population Summary Report, Lusaka: CSO.

Central Statistics Office, 2013. 2010 Census of Population and Housing: Population and Demographic Projections 2011 - 2035, Lusaka: CSO

Cointreau S. 1982. Environmental Management of Urban Solid Wastes in Developing countries Project Guide. Washington DC Urban Development Department

Creswell, J., Planko Clark, V. & Garret, A., 2008. Methodical Issues in Conducting Mixed Methods Research Designs. In: Advances in Mixed Methods Research. M Bergman ed. London: Sage Publications Ltd, pp. 66-84.

Creswell, J. W., 2003. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. London: Sage.

Ellen MacArthur Foundation (2018) Circular Economy Overview) [Online] [Accessed 24 August 2018] Available from: https://www.ellenmacarthurfoundation.org/circulareconomy/overview/concept

Environmental Management Act No.12 of 2011, Statutory Instrument No.65 of 2018, The Environmental Management (Extended Producer Responsibility) Regulations, 2018.

Esposito, M., Tse, T. and Soufani, K. (2018) 'Introducing a Circular Economy: New Thinking with New Managerial and Policy Implications', California Management Review, 60(3), pp. 5–19.

Extended Producer Responsibility: A Guidance Manual for Governments. France: OECD, 2016b Publishing.

Garfi, M.S Yondelli and A. Bonoli 2009, Multi-Criteria decision analysis foe waste management in Saharawi refugee camps. 'Waste Management 29(10): 2729-2739.

Geissdoerfer, M. et al. (2018) 'Business models and supply chains for the circular economy', Journal of Cleaner Production, 190, pp. 712–721.

Glaser, B. G. and Strauss, A. L. (1967) Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago: Aldine.

Godwin Kavaarpuo and Joseph K. Wulifan, Journal of Sustainable Development in Africa (Volume 15, No.7, 2013) ISSN: 1520-5509 Clarion University of Pennsylvania, Clarion, Pennsylvania.

Griddings, L. S. & Grant, B. M., 2006. Mixed Methods Research for the Novice Researcher. Contemporary Nurse, 23(1), pp. 3-11.

Gui, L. et al. (2013) 'Implementing Extended Producer Responsibility Legislation', Journal of Industrial Ecology, 17(2), pp. 262–276.

Guerrero, L. A., Maas, G. and Hogland, W. (2012). Solid Waste Management Challenges for Cities in Developing Countries. Waste Management, 33(1), 220–232

Hansen, W., Christopher, M. and Verbuecheln, M. (2002). EU Waste Policy and Challenges for Regional and Local Authorities-Background Paper for the Seminar on Household Waste Management "Capacity Building on European Community's Environmental Policy". Ecologic, Institute for International and European Environmental Policy, Berlin.

Hoornweg, D. and Bhada-Tata, P. (2012). What a Waste: a Global Review of Solid Waste Management. Urban Development Series, Knowledge Papers, (15).

Hoornweg D.L Thomas and Lotten 1999. 'Composting and Its applicability in Developing Countries.' Urban Water Management, working paper series 8 management, Washington DC, World Bank.

Kaffine, D. and O'Reilly, P. (2015) 'What Have We Learned About Extended Producer Responsibility in the Past Decade? A Survey of the Recent EPR Economic Literature', Oecd.

Kumbamu. A 2006 "Ecological Modernization and the Gene Revolution. The case study of Bt Cotton in India.'' Capitalism Nature in Socialism 17 (4):7-31

Kunz, N., Mayers, K. and Van Wassenhove, L. N. (2018) 'Stakeholder Views on Extended Producer Responsibility and the Circular Economy', California Management Review, 60(3), pp. 45–70.

Lindhqvist, T.P (2000). Extended Producer Responsibility in Cleaner Production: Policy Principle to Promote Environmental Improvements of Product Systems. IIIEE, Lund University.

Lindhqvist, T.P Manomaivibool and N. Tojo 2008: Extended Producer Responsibility in Latin America context; The management of waste Electrical and Electronic Equipment in Argentina. Lund Sweden; Lund University.

Martinez-Alier J 2002. 'The Environmentalism of the Poor' A Report for UNRISD for the WSSD, University of Witswaterand, 30th August.

Medina 2010, 'Solid Waste, poverty and the environment in development countries cities. Challenges and opportunities,' United Nations university, world institute for developing economies. Research working paper No.2010/23.

Milanez, B 2006. 'Friend of Foe? Ecological Modernization in Brazil. PhD diss, Lincoln University.

Mitchell, R. K., Agle, B. R. and Wood, D. J. (1997) 'Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts', Academy of Management Review, 22(4), pp. 853–886

Moonga M.S. B Chileshe, (2017) Alternatives for Dumpsite Scavenging: The Case of Waste Pickers at Lusaka's Chunga Landfill International Journal of Humanities Social Sciences and Education (IJHSSE) Volume 4, Issue 6, June 2017, PP 40-51 ISSN 23490373 (Print) www.arcjournals.org

Nahman. A 2010 'Extended Producer Responsibility for packaging waste in South Africa Current Approaches and lessons learnt: 'Resources, Conservation and Recycling 5413).155-162.

Nicol, S. and Thompson, S. (2007). Policy Options to Reduce Consumer Waste to Zero: Comparing Product Stewardship and Extended Producer Responsibility for Refrigerator Waste. Waste Management and Research, 25(3), 227-233.

OECD (2001) 'Extended Producer Responsibility: A Guidance Manual For Governments'.

OECD (2014) 'The State of Play on Extended Producer Responsibility (EPR): Opportunities and Challenges', Global Forum on Environment: Promoting Sustainable Materials Management through Extended Producer Responsibility (EPR), (June), p. 17.

Orsato. Raul S Clegg 2005. "Radical Reformation. Towards Critical Ecological Modernization."

Sustainable Development 13(4): 253-267.

Un-habitat 2010, Solid Waste Management in the World's Cities: water and sanitation in the world cities 2010, London UK, Earth Scan.

UNEP 2005b. Solid Waste Management, volume 11: Regional Overview and information Sources, Osaka, japan United Nations Publications.

Parizeau k.V Macharen and L. Chanthy 2008, Budget sheets and buy in financing commonly-based Waste Management in Sien Reap Cambodia. 'Environment and Urbanization 20 (2) 44 5-463.

Park, J., Diaz-Posada, N. and Meija-Dugand, S. (2018) 'Challenges in implementing the extended producer responsibility in an emerging economy: The end-of-life tire management in Colombia', Journal of Cleaner Production, 189, pp. 754–762.

Patton, M. Q., 2002. Qualitative Research & Evaluation Methods. California: Sage Publications.

Rossman, G. B. & Wilson, B., 1991. Numbers and Words Revisited: Being Shamelessly Eclectic. Evaluation Review, 9(5), pp. 627-643.

Stahel, W.R. (2014) Reuse Is the Key to the Circular Economy. [Online] [Accessed 24 August 2018] Available from: https://ec.europa.eu/environment/ecoap/about-eco-innovation/expertsinterviews/reuse-is-the-key-to-the-circular-economy_en

Tchobanoglous, G., Theisen, H. and Vigil, S.A. (1993) Integrated Solid Waste Management: Engineering Principle and Management Issue. McGraw Hill Inc., New York.

Tomas Santa Maria Gonzalez (2018). Challenges in the implementation of Extended Producer Responsibility policies: The case of Packaging in Chile A research project presented for the degree of MSc Sustainability and Business University of Leeds, School of Earth & Environment.

Tunnicliffe, S. & Moussouri, T., 2003. Methods for Assessing out of School Science Learning Experiences. The Netherlands, European Science Education Research Association Conference.

Vietnam, The President of the Socialist Republic of. 2006. Law on environmental protection No. 52/2005/QH11. Official gazette: Vietnam Law & Legal Forum.

Visvanathan, C and U, Glawe, 2006. 'Domestic Solid Waste Management in South Asian countries: A comparative Analysis.' Paper presented at 3R South Asia Expert Workshop, kathmadu, Nepal 30th August- September.

Voegeli Y. and C. Zurbrugg, 2008 'Decentralised anaerobic digestion of kitchen and market Waste in developing countries: 'state of the art in South India'. Paper presented at the Second International Symposium on Energy from Biomass and Waste, Venice Italy, November.

Walls M. (2006). Extended Producer Responsibility and Product Design: Economic Theory and Selected Case Studies.

World Bank, What a Waste: A Global review of Solid Waste management, 2012.

Zorpas, A. A. (2016) 'Sustainable waste management through end-of-waste criteria development', Environmental Science and Pollution Research, 23(8), pp. 737

APPENDICES

Appendix 1: EPR policy instruments

Combined and adapted from (OECD, 2014, pp. 6–7, 2016b, pp. 16–17; Kaffine and O'Reilly, 2015, p. 9)

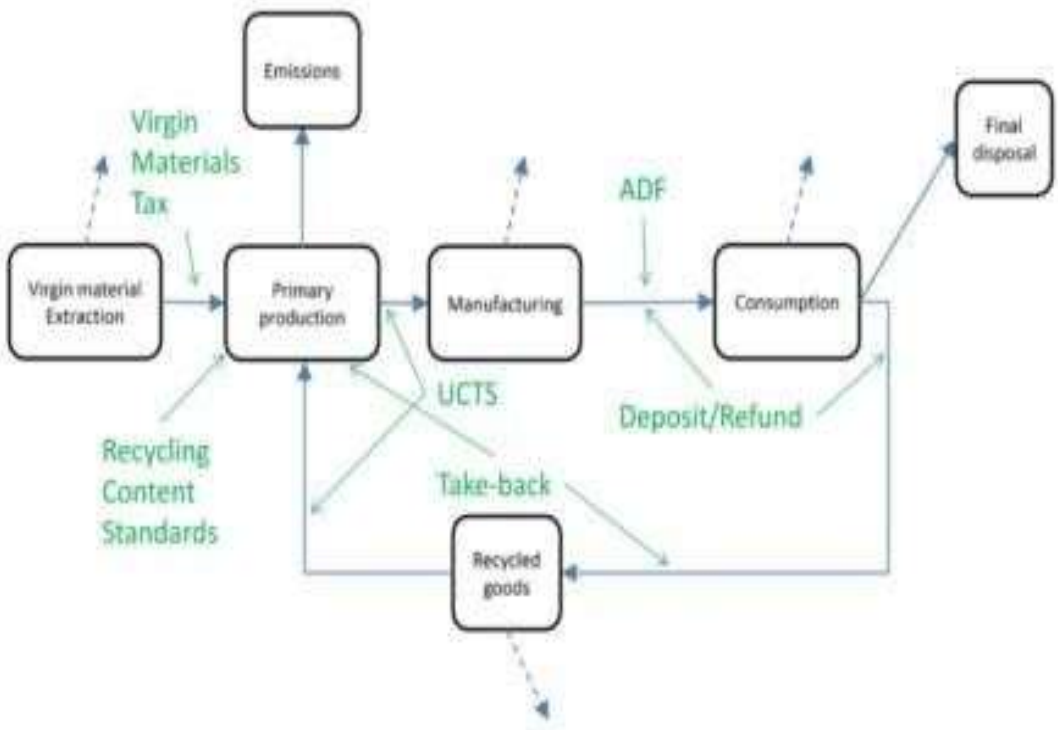
There are four broad categories of EPR instruments, which are typically used in combinations (See Figure 10):

A. Product take-back requirements: This tool involves assigning responsibility to "producers" to take back products they introduce on the market at the end-of-life, and are usually accompanied with collection and recycling targets. This policy can take many forms.

B. Economic and market-based instruments:

a) Deposit-Refund: An initial payment (deposit) is charged at the pot of sale, and refund totally or partially when the product is returned at a collection point for reuse or recycle.

b) Advance Disposal Fees (ADF): A fee is charged by private or public organizations at the purchase of the product, to cover the costs of collection and treatment.



EPR policy instruments (OECD, 2016b, p. 17)

a) **Material Taxes:** These instruments involve a tax on virgin materials (or materials that are

difficult to recycle, that contain certain toxics, etc.) To incentivize the use of secondary (recycled) or less toxic materials. This policy is implemented upstream in the production process.

b) **Upstream combination tax/subsidy (UCTS):** A tax paid by producers that is used to subsidize waste treatment (collection and treatment). **C. Regulations and performance standards:**

Instruments to encourage eco-design and recycling, such as a minimum recycled content standard. They are powerful tools when used in combinations with other instruments.

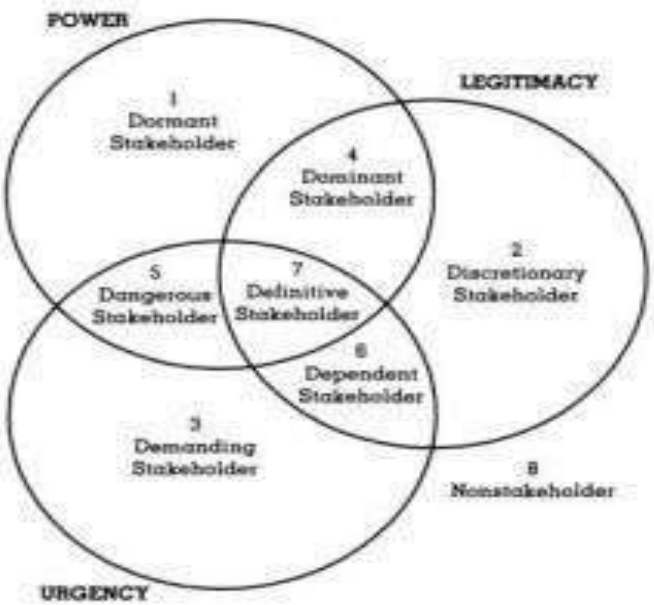
D. Information based instruments: Tools that aim to directly support EPR programs by raising public awareness. They include instruments as reporting requirements, labelling of products and components, communication to consumers about producer responsibility and waste separations, and informing recycles about materials used in products.

Appendix 2: Mitchell, Agle and Wood (1997) framework

Mitchell, Agle and Wood (1997) proposed a stakeholder mapping framework that helps to categorize and prioritize stakeholders according to the possession of 3 attributes, defined as follows:

- Power: "A relationship among social actors in which one social actor, A, can get another social actor, B, to do something that B would not have otherwise done" (Pfeiffer, 1981, p.3). Power can be Coercive (i.e. force, threat), Utilitarian (i.e. material / incentives) or Normative (i.e. symbolic influences) (E-zine, 1964)
- Legitimacy: "A generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman 1995, p. 574)
- Urgency: "The degree to which stakeholder claims call for immediate attention" (Mitchell, Agle and Wood, 1997, p. 869). Urgency exist "(1) when a relationship or claim is of time-sensitive nature and (2) when the relationship or claim is important or critical to the stakeholder" (Mitchell, Agle and Wood, 1997, p. 867)

Depending on their attributes they would fall into one of the categories presented in Figure 11. The more attributes, the higher the salience of the group and the attention is recommended to them. "Key stakeholders" present the three attributes, "Expectant stakeholders" present two and "Latent stakeholders" only one of them.



Categories of stakeholders according to their attributes (Mitchell, Agle and Wood, 1997)

Appendix 3: Model of expert questionnaire

THE UNIVERSITY OF ZAMBIA SCHOOL OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CEE 5881 QUESTIONNAIRE FOR UNZA STUDENT

TOPIC: ENHANCING SOLID WASTE MANAGEMENT THROUGH INCORPORATING EXTENDED PRODUCER RESPONSIBILTY IN LUSAKA ZAMBIA.

Dear Respondent,

I am a postgraduate student at the University of Zambia in the school of Engineering undertaking a Masters in Environmental Engineering Research Project in the Department of Civil and Environmental Engineering. I am conducting a research on the subject "Enhancing Solid Waste Management through incorporating Extended Producer Responsibility in Lusaka Zambia."

With reference to the above subject, you have been selected to participate in this research. Please note that your views will also represent those that have not been selected in this study. Rest assured that the data being solicited will be purely for academic purposes and will be treated with maximum confidentiality. Your cooperation will be highly appreciated.

INSTRUCTIONS FOR RESPONDENTS

1. Please try as much as possible to answer all the questions that apply to you

QUESTIONAIRE FOR EXPERTS AND OFFICIALS

Part 1 GENERAL INFORMATION

1. Designation of Expert granting interview:

2. Experience:

Part 2: WASTE PROFILE

Can you estimate the following on an average in your municipal limits? (tick yes or no and if yes enter the value)

Variable	Yes	No	Value Estimated
a. Composition of Municipal Waste(Biodegradable: Non-biodegradable)			
b. Moisture Content of Municipal Waste			
c. Calorific Value of Municipal Waste			
d. Ratio of Domestic Waste to Total Waste in Municipality			
e. Total Quantity of Waste in Municipality (Daily Generation)			
f. Per capita Waste Output in the Municipality			
g. Yearly rate of Increase in Waste output			

Part3: Knowledge and experiences - Extended Producer Responsibility (EPR)

1. Do you know about Extended Producer Responsibility (EPR) strategies?
( ) Yes ( ) No
2.If your answer is **Yes above**; How long have you known about Extended Producer Responsibility(EPR)?

( ) Less than one year ( ) Less than 3 years ( ) Less than 10 years

( ) 10 years or more

3. Regarding your knowledge about EPR, which of the following sentences best applies to you?

( ) I can intensively discuss EPR with stakeholders familiar with EPR.

( ) I can state my opinions about EPR.

( ) I am not knowledgeable enough to state any personal opinions about EPR

4. Do you think producers e.g. plastic packaging material waste should be responsible for the end life cycle/disposal

   a.Yes [ ]

   b.No [ ]

5. Do you think EPR programs will increase recycling rates?

   a.Yes [ ]

   b.No [ ]

6. Do you think EPR programs will motivate producers i.e. manufacturers, traders, distributors towards sustainable Production?

   a. Yes [ ] b

   .No [ ]

7. Do you think EPR programs will motivate consumers towards sustainable consumption?

   a. Yes [ ]

   b. No [ ]

8. Do you think the Lusaka City Council is collaborating with waste collection companies?

   a. Yes [ ]

   b. No [ ]

9. Do you think the Lusaka City Council is collaborating with recycling companies?

   a. Yes [ ]

   b. No [ ]

10. Do you think Institutions have roles to play in fostering EPR programs?

    a. Yes [ ]

    b. No [ ]

11. If your answer is **Yes above**, what roles do you think institutions play in fostering EPR programs?

Table 2. Issues and factors relevant to existing Waste Management System.

Do you agree with the following statements in terms of enhancing solid waste management in Lusaka city? (tick on the box applicable to your option)

Issues and factors of Waste Management	**Likert scales**				
	Strongly Disagree	***Disagree***	***Neither Agree Nor Agree***	***Agree***	***Strongly Agree***
Importance of awareness and education of waste					
Proper education and environment for the behaviour change					
Importance of innovative cradleto-cradle product design					
Extended producer responsibility (take-back scheme)					
Effective policy on responsible shopping and consumption practices					
Collaborative consumption or shared ownership of products					
Product redesigning strategyreducing packaging waste					
Importance of market creation for post-consumer products recirculation					
Higher incentives for container deposit legislation					
Restriction on incineration					
High landfill tax and ban on waste to landfill					
Effectiveness of waste management programmes	***Not effective***	***Slightly effective***	***Moderately effective***	***Very effective***	***Extremely effective***
Training on correct recycling					

Individual bins system (organic, recycling, hazardous, etc.)					
Door-to-door waste collection					
Community recycling centre					
Priority of issues	***No priority***	***Low priority***	***Moderate priority***	***High priority***	***Extreme priority***
Enabling social technology through community participation					
Effectiveness to improve efficiency through pay-as-you throw systems					
Environmentally friendly treatment technology					
Research on material flows and waste performance					
Priority of data availability and reliability					
Priority of composting					
Priority of anaerobic digestion					
Priority of waste-to-energy technology					
Priority of landfill					

Part4; Waste treatment technologies

*(Please rate according to their environmentally friendly waste treatment technology**)***

Technology	Percentage (%)
Priority of composting	
Priority of anaerobic digestion	
Priority of waste-to-energy technology/incineration	
Priority of landfill	

Part 5: AIMS OF Extended Producer Responsibility

5. What, in general, should be achieved by applying EPR? Please indicate the importance of the following objectives.

	Very Important for EPR	Important	Some what Important	Not important at all	Unachievable by applying EPR
To shift responsibility of waste management from municipality to producers					
To improve waste treatment					
To promote recycling/recovery					
To promote reuse					
To increase collection of waste products or used products					
To reduce the amount of waste					
To promote reuse					
To reduce toxic substances used for a product					
To increase disassemblability and/or recyclability of a product					
To disseminate information to end-of-life management en tities					

To reduce environmental impacts from a product system					
To increase durability and/or maintainability of a product					
To reduce costs of waste management					
To stimulate innovation in waste management					
To promote new business models					
To internalize external costs					
To create a level playing field in the market (a producer who takes environmental actions should not be disfavoured .)					

Thank you for your Cooperation!!!

Appendix 4: Extract from Interview with Producer 3

Question: Actually I went through your CSR report 2014 and we found out that you have a Strong commitment to make an impact in society in terms of environmental issues but I didn't find the concept of EPR there. So I would like to know if you are acquainted with the concept?

Answer: No, we don't use that concept, we focus on waste as you see I think in the report but We focus on reducing waste in general and more recycling and it's from the EU waste strategy. They have this waste hierarchy, and that is what we have been looking into, where we like to Go from the bottom and to the top, where the top is waste prevention that's number one, and Then reuse, recycling, energy recovery, disposal. So in our new environmental strategy to be Launched here in start of August I think, we will focus on what we call zero waste and that is to Say we will stop the disposal, we will stop the waste going to landfill and also in some years we Will stop the incineration of the waste even though it's with energy recovery because all our Waste should be at least recycled. So that's our target and I don't know how it's matched this EPR. We haven't looked into that by now but maybe because it's new strategy and maybe that Could be a kind of standard systematic way of doing it. But at this moment we don't use it as a guideline.

Question: From the CSR report I saw that you recycle most in your production facilities, like You recycle waste water, and other kind of products to put it back in the production chain or Just use it for other things, but I am like kind of interested in the end of life products, we Mean like what happens when the customer consumes the product, what do the customer do With that waste?"

Answer: And by waste you mean?

Question: the packaging material waste

Answer: it's the packaging, it's not food waste?"

Question: Yes “packaging"

Answer: And we will start to focus in that, it has not been in our focus until now but in our

New strategy from now we will focus on this. One of our targets...this is a bit confidential until

It will be launched but just to inform you if you don’t use it exactly but you can use the expression.

Maybe it’s not in this paper, no. But one of our targets is to reduce waste with the consumers and when we say in future we say zero waste it shows that all our products also the packaging materials should be reused in future. And how we are going to work it, we can prepare it to be reused but we can’t force the consumer to reuse it. It’s the re\users own decisions but we can prepare, in our packaging development, we can prepare so it’s the right materials to be reused or that can be kind of way getting the packaging. So we will focus in that and we mean this about zero waste, all should be recycled. So it will be preparing to be recycled by materials or by a way to getting it back. And also it will be information or dialogue with the consumers because some of the consumers are going to change their habits because in Zambia we are used to throw everything indiscriminately and it goes to the landfill or gets in the drainages thereby clogging and causing health problems. But in future the consumer has to do something else with the packaging put it together with something of the same material to be collected. So, also, there we need a different infrastructure in Zambia, so we are going to work with the waste collection companies to get another infrastructure. So it’s also a political issue. And this strategy is for 2025 so because you don’t change that immediately. You have to work in some steps and with long horizon.

Question: What are the motivations to start this program now, why wasn’t this previously implemented in the past, why now?"

Answers: It’s because it has been a long way. We started, the environmental" era and the CSR era is

Increasing all the time and by now it’s increasing very much by now but five years ago when we

Started making environmental strategy we were focused on what was important by then, it

Still is but this was the only thing that was important, it was the environment on the diary to the effluent and the smoke and so on, so we started to get that right. And from there we have

Question: So in general we can say that it's a voluntary initiative within the company, the

Government doesn't have anything to do with this like with regulations or something, and just

This idea of EPR was born within the company, and will be applied like a voluntary strategy.

Is that right?

Answer: Of course there are some regulations on the waste and how to collect waste and so

On and if your infrastructure is based on splitting all the materials then as a consumer you have to sort it and we as a company we can use all materials we want but we have to use materials that can be recycled maybe, that's some regulation. But we want to go further than that to say then we would have no recycling. This is about no recycling, it's not a regulation. That is one of our main targets to say as a responsible company, we want to go that way. Because in general this new strategy it is based on not producing any waste, everything should be reused in one\way; the "packaging materials, the energy, the food waste and so on. The whole idea of recycling is in this strategy. So it's in general an idea of how to manage these things.

Question: I would like to ask about your opinion regarding you as a company taking responsibility

Of the end of life management of your product in Lusaka. To what extent do you

Think in your opinion that it can be useful to apply this strategy in Lusaka and other provinces where you have businesses?

Answer: That is a difficult question because what can we do, I think it's going more and more

That way, I think in the start this is nine or ten years' strategy and I think in the beginning we

Will focus on preparing all our products, all our materials to be reusable that we give the

Possibility but I think when it comes some years into strategy we will think this is not enough

we'll have to go in dialogue in the different markets and different places to find out how can

we help, we can work together with some local organizations or someone like them to take care

of the waste. That's if you asked of my opinion, this is not written down in strategy. But I think it could be the way because that is what I have experienced working in this area. Now we are prepared to zero waste but things aren't going the right way can we go out and have the dialogue with some local organizations to help them with our knowledge may be go together with some other companies in those markets to create possibilities to collect the waste, find the way of managing it. If this is an important question and I think it is because we are talking about resources. The waste shouldn't be waste it should be resources,

Question: Like to summarize a little bit, so far you are just starting this kind of a strategy you Are not actually very clear in what you want to do but at least you have this wish to go first Through the reuse of products and then possibly to help in reality to take care of the waste," That is like line of reasoning?

Answer: It could be a possibility if you ask for my opinion. What we are doing by now, it is we

Are looking into the possibilities to change the materials in our packaging materials to get it More reusable. That's what we are doing by now. We are focusing on this. We have the data, We collect the data from all our product size where we collect the different kind of waste data," And we also have some data from packaging materials and so on. So we know the amount of it

And we also know the materials so that is what we get start with by now to focus on what is Important and what is less important to change. But we have developed at tool to focus on the Packaging material, what is the best packaging material to use for specific kind of things from Carbon footprint perspective or for recycling perspective and so on. So we have this tool and Working with it. So what we are going to do is the consumer focus we are going to develop. And that's a new path.

Question: You said in your CSR report that you pay a lot of attention to customer's opinion, is there like some kind of request or enquiry of the customer about the packaging

of the products, I mean the waste that results from the packaging have they showed any interest in that?

Answer: Yes I'm sure. It will be very much on market, when we are talking about the customers. It is very mostly the retailers that are pushing us and they started all about the carbon footprint and they have pushed on the companies to have more focus on that. And also they have focused on the packaging material. I'm sure. I can't tell you exactly

What way but try to look into maybe, company X they have what

They call plan A and they say because there is no plan B, it's a kind of environmental strategy

Too and where they tell to their suppliers you have to do this and you have to do that with

Energy and so on. And you could look into it to see if there is something about the waste, I'm"

Sure they have a focus on waste too. There maybe you can find something. But I know in the

Zambian market we have worked very much to reuse materials...the milk is sold in plastic bottles

And there we have worked a lot last few years to reuse more reused plastics in the

Plastic bottles and plastic sachets and also we have reduced the weight of the packaging material used for one bottle. So that has been the focus and that's my conclusion, that must be because the retailers think this is important, so we can tell them, now we have new bottle/plastic sachet with more recyclable materials so you should buy this. So it's in their focus I'm sure. But again the government need to create a market for recyclable products to boost the recycling industry.

Question: Regarding the design for reuse of your product, is there any mechanism like

Incentives for customers that will make it work included in the strategy, for example when I

Buy a product that is recyclable like the bottles?"

Answer: Not decided, no that's not the point where we have decided what to do. Compared

To the bottles we get back because there's some money on it, and also there are some

Restrictions of how much and what kind of recyclable material we can use because it's food.

So There are some restrictions of it,"