

# **A critical reflection on the evolution of the South African National Waste Management Strategy**

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## **PREFACE AND ACKNOWLEDGEMENTS**

This study provides a critical evaluation of the evolution and comparative analysis of the South African National Waste Management Strategy (NWMS) over time in comparison to four other countries, namely Netherlands, Taiwan, Nigeria and Thailand.

This dissertation is dedicated to my children Neeharika and Vittesh for their loving support, patience and understanding during this journey. You have made me stronger, better and more fulfilled than I could have ever imagined. You are precious in every way, you are my world, you are my everything.

Foremost, I would like to thank God for the wisdom, the strength and courage bestowed upon me during this journey and the hardships I have faced.

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## ABSTRACT

In redressing global and local waste management challenges, many countries developed and implemented integrated waste management systems through policies, laws and strategies. The aim of this study is to evaluate the evolution of the South African National Waste Management Strategy (NWMS) from its inception in 1999 to the current 2020 NWMS.

The study also aimed to compare the evolution of the South African NWMS with international waste management policies, laws and strategies. The comparative process included two developed countries, namely the Netherlands and Taiwan, and two developing countries namely, Thailand and Nigeria.

This study made use of critical document review and analysis, supported by literature review and a comparative analysis to mainly evaluate the evolution of the following: the focus of strategic goals and objectives; the approach towards implementing the waste management hierarchy as well as the thematic content. The comparative analysis with other countries' waste management laws, policies and strategies included a review of the key principles underpinning integrated waste management, as outlined in the documents under review.

The results of the research demonstrate the progressive evolution of the South African NWMS from 1999 to 2020 compares well with the evolution of other developing and developed countries. Progressive advancements include critical aspects such as an integrated approach to pollution prevention and integrated waste management. This is underpinned by the incorporation of the waste hierarchy at its core, with the end goal to develop a circular economy.

To achieve stated goals and objectives, the policies and strategies highlight the importance of government, civil society and private business acting as a collective. In terms of its documented contents to give effect to the terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008), the South African NWMS 2020 as well as the laws, policies and strategies from other countries, are progressively moving towards “zero waste” goals and the overall improvement of integrated waste management.

**Keywords:** waste management strategy; waste management, environmental legislation; sustainable development, South Africa

## **ABBREVIATIONS AND ACRONYMS**

|          |                                                                    |
|----------|--------------------------------------------------------------------|
| CFRN:    | Constitution of the Federal Republic of Nigeria                    |
| DEAT:    | Department of Environmental Affairs and Tourism                    |
| DEFF:    | Department of Environment, Forestry and Fisheries                  |
| ECA:     | Environmental Conservation Act, Act 73 of 1989                     |
| EMA:     | Environmental Management Act                                       |
| EPA:     | Environmental Protection Agency                                    |
| EPR:     | Extended producer responsibility                                   |
| FEPA:    | Federal Environmental Protection Agency                            |
| FMEEnv:  | Federal Ministry of Environment                                    |
| FNASREC: | Faculty of Natural and Agricultural Sciences Ethics Committee      |
| IP&WM:   | White Paper on Integrated Pollution and Waste Management           |
| IWMPs:   | Integrated Waste Management Plans                                  |
| MBT:     | Mechanical-Biological Treatment                                    |
| MRF:     | Material Recovery Facilities                                       |
| MSW:     | Municipal Solid Waste                                              |
| NEMA:    | National Environmental Management Act, Act 107 of 1998             |
| NEMWA:   | National Environmental Management Waste Act, Act 59 of 2008        |
| NESREA:  | National Environmental Standards Regulatory and Enforcement Agency |
| NEQA:    | National Environmental Quality Act, A. D. 1992                     |
| NWMS:    | National Waste Management Strategy (South Africa)                  |
| NWU:     | North West University                                              |

|        |                                                   |
|--------|---------------------------------------------------|
| N&S:   | Norms and Standards                               |
| PPP:   | Polluter Pays Principal                           |
| RDF:   | Refuse-derived fuel                               |
| RRA:   | Resource Recycling Act                            |
| SAWIS: | South African Waste Management Information System |
| SDG's: | Sustainable Development Goals                     |
| UEEE:  | Used electrical and electronic equipment          |
| UN:    | United Nations                                    |
| USW:   | Urban solid waste management                      |
| WDE:   | Waste Disposal Act                                |
| WTE:   | Waste-to-energy                                   |
| 3Rs:   | Reduce, reuse and recycle                         |

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## CHAPTER 1 INTRODUCTION

### 1.1 Background

Poor waste management is one of humanity's greatest challenges of the 21st century. These challenges form the core reason it is one of the most crucial components as far as environmental management and protection of population health is concerned (Robinson, 2014; Sharma & Jain, 2020).

Society has enjoyed unprecedented economic growth in recent times but at the expense of the environment and population health (Sharma & Jain, 2020). This economic growth has seen the unrestricted generation of waste, poor waste management practices and inadequate, or unenforced laws and policy frameworks (Robinson, 2014; Singh *et al.*, 2014). According to the World Bank Group (2018) the world is on a trajectory where waste generation will overtake the population growth of more than double by 2050 (World Bank Group, 2018).

Some of the most notable environmental challenges experienced to date have been climate change, ecosystem degradation, water scarcity, and waste management (United Nations Environment Programme, 2016b). This extensive environmental degradation has led to irrevocable changes to our world, with humanity playing a pivotal role as the change agents in this new geological epoch, termed the Anthropocene (Robinson, 2012, 2014).

These negative impacts have been worsened by the historic lack of effective environmental legislation, or where such legislation exists, it being poorly being poorly regulated and fragmented (United Nations Environment Programme, 2011). Redressing this requires the political will globally to implement mitigation measures to curb detrimental effects on human health and the environment (United Nations Environment Programme, 2011; World Bank Group, 2018).

It is against this background that sustainable development is prioritised on global, national and regional levels (United Nations Environment Programme, 2016a, 2016b). At a global level, the United Nations (UN) has urged nations to develop and enforce comprehensive waste management laws, policies and practices as key components to achieving the UN's 17 Sustainable Development Goals (SDGs) (United Nations Development Programme, 2020). For this reason, sustainable waste management now underpins sustainable development initiatives, leading to a global upsurge in environmental law (World Bank Group, 2018).

Environmental law now has more focused political and legislative attention aimed at promoting sustainable development to protect the environment (Coetzee, 2016; Muzangaza, 2016; Strydom *et al.*, 2018). Internationally, regulators developed and implemented several visions, policies,

laws, strategies and plans to realise sustainable and integrated waste management, governance and practices (United Nations Environment Programme, 2013, 2016a). Many countries have also acceded to and ratified many of the international treaties, conventions, protocols or agreements, aimed to address specific global environmental challenges (United Nations Environment Programme, 2016a). These international agreements and local obligations are intended to monitor, measure and report on all aspects of environmental performance in support of the pursued objectives (United Nations Environment Programme, 2013, 2016a).

Since these agreements are legally binding, member countries have primarily promulgated numerous policies, laws and strategies to govern waste management at the national level (United Nations Environment Programme, 2013). Globally waste management systems are aimed to positively impact sustainability at a community level while addressing equitable growth and economic transformation (Seadon, 2006).

Developed countries such as Netherlands and Taiwan, through their sustainable waste management systems have already adopted a circular economy. On the contrary, developing countries such as South Africa, Thailand and Nigeria are experiencing difficulties in realising the benefits of environmental protection provided by successfully moving towards a circular economy, which is a defined systemic approach to economic development beneficial to society as a whole, the environment, and business (Wilson *et al.*, 2013).

## **1.2 Problem statement and rationale for the study**

Undoubtedly, historical poor waste management practices on a global level has resulted in widespread environmental degradation and negative impacts on human health, as evidenced by contamination of water, land, and air (World Bank Group, 2018).

In addressing waste management as an environmental concern, regulators globally have developed and implemented systems in support of sustainable development alongside equitable growth and economic transformation (Samiha & Abdessalem, 2015; Singh *et al.*, 2014). To this end, international and domestic law has constantly developed to maintain a regulatory framework that deals with the causes, effects and handling of wastes (Alberts, 2014).

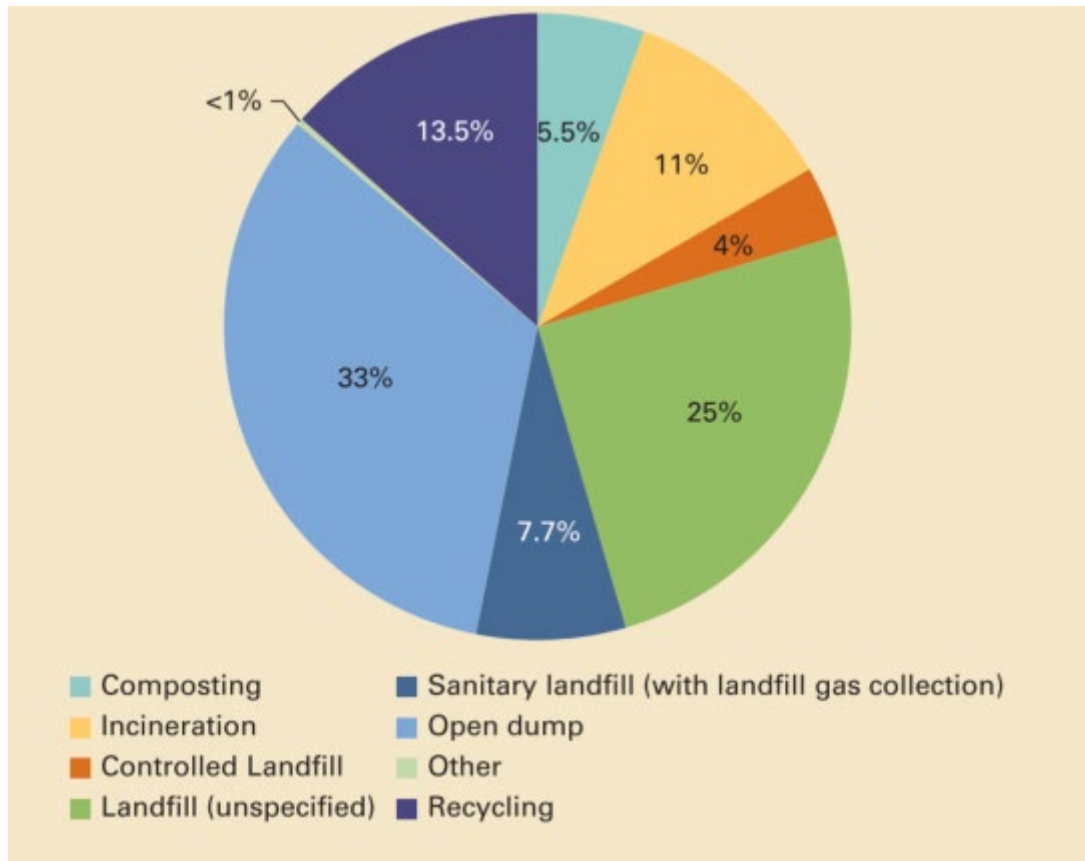


**Figure 1-1: Global waste treatment and disposal (World Bank Group, 2018)**

According to the World Bank Group (2018), global waste statistics as evidenced in Figure 1-1 demonstrates that currently 33% of waste is still openly dumped, approximately 30% of waste is still disposed of in landfill, with only 11% of waste being incinerated and only 13.5% waste recycled (World Bank Group, 2018). Notably this snapshot, is highly skewed as waste management practices vary significantly by income level, regions and per country (World Bank Group, 2018).

One of the main objectives of integrated waste management systems is to divert waste from landfills by unlocking the value of waste as a renewable resource suitable for re-use in the economy (Robinson, 2012; Wilson, 2015). This process supports the drive for a greener and cleaner economy to realise enhanced long-term benefits for human health and the environment in a truly circular economy (Ellen Macarthur Foundation, 2017).

South Africa's aims are no different and some key waste management challenges to overcome include: lack of waste information, illegal dumping, salvaging at waste disposal facilities, limited landfill airspace, inadequate waste collection services, poor waste separation, poor recycling rates, lack of awareness of waste management in the general population and lack of compliance and enforcement of legislation (Godfrey *et al.*, 2019; Muzenda, 2013; Zhakata *et al.*, 2016).

Historically, legislation governing waste in South Africa was fragmented at the national, provincial and local authority level as each tried to govern waste independently, depending on the source as well as impact (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000; Kotze, 2005). Regulations governing waste were in place for decades before the first National Waste Management Strategy (NWMS) was drafted in 1999. This was achieved mainly through the National Water Act, Act 36 of 1956 (NWA) and the Environmental Conservation Act, Act 73 of 1989 (ECA), both of which make specific provisions for pollution prevention as associated with waste management requirements (Godfrey & Oelofse, 2017). Recently, as a global partner, South Africa has become signatory to many of the global conventions and treaties relating to environmental and waste management (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2018). Legislation in this matter has become a living document which is continuously updated to underpin South Africa's commitments (Godfrey & Nahman, 2007). This enables co-ordinated change and compliance at local, provincial and national levels (Oelofse, 2010).

South Africa enshrines legislative provision for environmental rights in section 24 of the Constitution, Act 108 of 1996 (Blackmore, 2018; Zhakata *et al.*, 2016). In recognising waste management as one of the critical elements of sustainable development, the stated legislation is the main driver in waste management as contemplated in the National Environmental Management Act, Act 107 of 1998 (NEMA), which is the environmental framework legislation underpinning integrated environmental management (Muzenda *et al.*, 2012; Wessels & Müller, 2012; Zhakata *et al.*, 2016).

In 2008, the National Environmental Management Waste Act, Act 59 of 2008 (NEMWA) came into effect to address the country's waste management deficits (Muzenda, 2013). NEMWA set out the process to fundamentally change the way waste is regulated in South Africa through the mandatory introduction of integrated waste management that introduced a more holistic and proactive approach specific to waste management (Hanekom, 2014; Muzenda *et al.*, 2012; Zhakata *et al.*, 2016).

A key aspect in waste management in South Africa has been the progressive development of the NWMS from its inception in 1999 through to the 2011 and 2020 revisions.

The NWMS sets out requirements for integrated waste management and planning and introduces the waste management hierarchy in support of pollution prevention and minimisation (DEA (Department of Environmental Affairs (South Africa)), 2011). The strategy aims to promote and encourage management of waste materials in order to reduce the amount of waste produced,

and to recover the maximum value from the waste materials (DEA (Department of Environmental Affairs (South Africa)), 2011).

The NWMS also identifies critical waste management challenges faced by South Africa and endeavours to align local waste management with international best practice (Muzenda, 2014). In September 2020, the Department of Environment, Forestry and Fisheries (DEFF) published the latest version of South African NWMS.

It is thus important to reflect on the evolution of the South African National Waste Management Strategy (NWMS) over time and how effectively it has adapted to the needs of the nation. In addition, it is important to reflect on international waste management systems and how they relate to the progressive development of sustainable waste management in South Africa. These critical reflections provide a starting point for identifying key gaps, opportunities and best practices; to inform immediate and long-term initiatives; to support sustainable and integrated waste management. It also provides the opportunity to identify past and present limitations and constraints for the further development of the South African NWMS for readdress.

### **1.3 Research aim and objectives**

The research aims to answer the following question: *To what extent has the South African National Waste Management Strategy evolved in comparison to international policies and strategies?*

The primary objectives of this research include the following:

- **Research objective 1:** Critically evaluate the changes in the NWMS over time; and
- **Research objective 2:** Comparatively assess the evolution of the South African NWMS with international policies and strategies.

### **1.4 Delineating the scope of the study**

The delineated scope of the study includes a critical review of the changes to the South African NWMS from inception in 1999 through the 2011 and the current 2020 version. The scope, therefore, reflects on changes over a 20-year timespan. The critical review of the evaluated changes to the strategy over time mainly focused on three aspects:

- (i) how the key goals and objectives of the strategy have changed over time;
- (ii) how the approach to waste management hierarchy has changed over time; and
- (iii) how the overall content and focus of the strategy has changed over time.

The second part of the scope provides an international dimension to the study through comparison of the evolution of the South African NWMS, with four other countries namely Netherlands, Taiwan, Thailand and Nigeria. The Netherlands and Taiwan have made great strides over the years through the effective implementation of the waste management systems and reflect the developed nations in this study. Thailand and Nigeria reflect developing countries in this study. Nigeria has been specifically selected as a comparative African country with a fast-growing economy and major pollution challenges similar to South Africa.

In the comparative review of the South African NWMS with the laws, policies and to the international case study countries, four aspects are focused on:

- (i) how the key goals and objectives of the strategy have changed over time;
- (ii) how the approach to waste management hierarchy has changed over time;
- (iii) how the overall content and focus of the strategy has changed over time; and
- (iv) what are the key underlying principles informing integrated waste management?

For the purpose of the comparative analysis, the evolution of the policies and strategies focuses on a 50-year time frame covering the periods ranging from 1972 to 2010; 2011 to 2016; and 2017 to 2020. These timeframes have been selected to draw a parallel assessment that corresponds with the South African NWMSs.

It is important to note in the critical and comparative analysis, this research has focused on documented policies, laws and strategies in the context of developing and developed case countries. The implementation of the goals, objectives and actions as outlined in the documented strategies was excluded from the scope of this research, whilst it has been used to an extent to provide context to the evolution of the strategies assessed.

## **1.5 Assumptions and limitations**

Due to the delineated scope of this research, the following limitations and assumptions of this research should be noted:

- The policies, laws, strategies and supporting legal documents included documents available in English and readily available in the public domain. This influenced the case countries selected for inclusion in the research.
- The research focused on the documented contents of the laws, policies and strategies under review. The actual implementation of these strategies and policies did not form part of the scope of this study, however, it is touched on to maintain context.

- The study focused mainly on the strategic goals and approach to the waste management hierarchy, the overall content of the South African NWMS and how this has evolved over time, in comparison to those case countries selected for the study.
- Where information was available the study included a historical dimension to waste management touching on economic, political and civil drivers dating back as early as the 1960s and 1970s in order to evaluate the evolution of and changes to the policies, laws and strategies over time.
- While a wide range of documents were available for the select countries, only a limited number, mainly focusing on waste-related policies, laws and strategies, were deemed to have had a noticeable impact and influence on the study's aims and objectives and as such were selected.

## **1.6 Structure and outline of the dissertation**

The first chapter introduces the global environmental challenges principally associated with waste management. This provides an overview of the development and evolution of global environmental management, including the legal landscape for waste management. The problem statement and rationale for the study are defined, followed by the study's aim and objectives.

The second chapter sets out the research approach, methodology, and practices employed to collect data. This is to inform the comparative and situational analysis of South African and international waste management systems. The data and information collected will provide the basis to inform chapter four, the findings of the study, and chapter five, the conclusion, and recommendations.

The third chapter sets out a comprehensive literature review of international waste management systems and trends. It will outline international practices and systems in waste management by discussing a selection of country-specific waste management legal landscapes, policies, and strategies. A comprehensive legal overview of waste management in South Africa is provided, as has guided the evolution of the South African NWMS and its implementation, is also included.

Chapter four provides a critical evaluation of the changes to the South African NWMS through inception in 1999, and 2011 and 2020 developments and include context influencing implementation in order to provide an authentic full picture. This will be followed by a comparative assessment of the evolution of the NWMS, through its waste policies, laws, strategies and plans, as compared to international laws, policies and strategies. This section will assess and compare

the progressive evaluation of the select case countries, namely the Netherlands, Taiwan, Thailand and Nigeria in context of international, local and national drivers.

Chapter five will contain the study's conclusions and recommendations.

## **1.7 Chapter summary**

This chapter summarises global waste management challenges and the importance of sustainable waste management systems. The problem statement, as it pertains to this study, outlines South Africa's waste management challenges and the importance of assessing and evaluating the evolution of the NWMS over time. Equally important is the need to compare South African strategies with the evolution of international policies, laws and strategies as adopted by developing and developed economies.

The research aim and questions informs the scope and intent of the study in assessing the evolution of the South African NWMS.

Chapter 2 describes the research methodology used for this study.

## CHAPTER 2 METHODOLOGY

### 2.1 Introduction

This chapter outlines the research methodology used to evaluate and assess the evolution of the South African NWMS as well as the waste management systems of the selection of countries, namely the Netherlands, Taiwan, Thailand and Nigeria.

It outlines the research approach, data collection, method, analysis and ethical considerations including limitations of the study.

The research made use of document analysis and evaluation, supported by literature review together with a comparative review methodology approach.

The key focus is on the evolution of the South African NWMS since inception in 1999 and iterations of 2011 and 2020. The strategies are further compared to the waste management systems in the developed and developing countries selected with the aim of understanding the developments and principles underpinning the evolution of these international waste management systems compared to the progression of the South African NWMS.

### 2.2 Research design

The research design is informed by documents from the four countries on their national strategic stance on waste management practises and outcomes in comparison to South Africa.

The two objectives of this study are:

**Research objective 1** is to critically evaluate the changes in the NWMS over time. This is primarily addressed through document review and evaluation of the three versions of the NWMS (1999, 2011 and 2020). This is further supported by review of literature, academic publications, reports, policies, laws and strategies related to integrated waste management in South Africa in its historical context; to assess how these have influenced the changes in the NWMS over time.

**Research objective 2** is to comparatively assess the evolution of the South African NWMS with foreign laws, policies and strategies. It includes a literature review component, which firstly informed the selection of the four comparative case countries. Once the four case countries were selected, the international dimension of the study, was identified and further literature review provided context to how these countries approach waste management. Relevant policies, laws, strategies, reports and articles were sourced. Finally, a critical comparative analysis was undertaken between the four international case countries with the evolution of the South African

NWMS. The study includes a parallel evaluation of the different countries' waste management policies, strategies, and legal frameworks.

The research design includes a broad-based historical dimension to the literature study that aims to compare and contextualise the development of the integrated waste management systems between the different countries with due consideration to their social, political and economic factors as outlined in Chapter three and four. A further objective of the critical review and evaluation was to assess and identify trends; to ascertain if these are as a result of local or global developments; to identify potential trends, and how these have been considered in past evolution of the NWMS, if at all, and how they can guide the future development of the NWMS.

### **2.2.1 Case country selection**

The comparative case countries selected are the Netherlands, Thailand, Taiwan, and Nigeria. Selection is based on either similarities or differences in waste management systems between industrially developed and developing countries.

#### **2.2.1.1 The Netherlands**

South Africa and the Netherlands have long-standing ties, due in part to former colonisation and emergence of the Afrikaner people and South African laws with roots in Roman-Dutch law (Lenel, 2002). Over the decades, these two countries have maintained strong relationships in many different areas including but not limited to fields such as trade, economic, science and technology, education, judicial, multilateral and culture (The Presidency (South Africa), 2015).

The Netherlands is a densely populated country, with land scarcity, poor soil conditions for landfill and no natural (fossil) based energy sources (Dijkgraaf & Vollebergh, 2004; Dijkgraaf & Gradus, 2014). For this reason, the country's waste policy regime over the years has focused primarily on incineration, in particular waste-to-energy (WTE) plants over landfilling (Dijkgraaf & Vollebergh, 2004). As a result, the electricity and heat markets have become very dependent on the waste market, with waste and electricity companies operating in similar markets with energy recovery from waste in the form of WTE playing a pivotal role (Dijkgraaf & Vollebergh, 2004).

The Netherlands has made great strides towards waste management and has managed to adopt and implement various waste management laws, strategies and policies that have been globally recognised and adopted (Peelen *et al.*, 2015).

The Netherlands and South Africa's country specific circumstances are fundamentally different in so far as economic wealth, political and social circumstances are concerned. Limited land space, lack of natural resources and high energy costs are some of the key drivers that inform waste

policy changes in the Netherlands. This would therefore compel waste policy change drivers that are not necessarily applicable to South Africa.

### **2.2.1.2 Taiwan**

Taiwan and South Africa had long standing diplomatic relationships during the pre-Apartheid era, however this relationship ended in 1998, after South Africa switched their diplomatic allegiance from Taiwan to China (Grimm *et al.*, 2014). Despite ending their diplomatic relations, Taiwan, and South Africa still maintain good trade relations (Grimm *et al.*, 2014).

As a developed country, Taiwan's dynamic economy earned its ranking as one of the wealthiest in Asia, largely driven by industrial manufacturing and the export of electronics, machinery, and petrochemicals (Central Intelligence Agency, 2020c). They are a huge importers of energy, with more than 99% of its energy consumption supplied by imported fuels (coal, natural gas and petroleum), making energy expensive (Tsai & Chou, 2006; Zhang *et al.*, 2020). For this reason energy sustainability is a fundamental factor to their social development, thus there is a huge drive to increase local energy supply and to enhance energy security (Zhang *et al.*, 2020).

In the early 1990s, the country was given the nickname "Garbage Island" (Middlehurst, 2019). Today, Taiwan has undergone a major change in its trajectory through the imposition of a well-developed and defined integrated waste management system and as such have achieved high recycling rates (Middlehurst, 2019).

Despite its economic wealth, Taiwan has limited land space, is densely populated, has no natural (fossil) based fuel resources and are huge importers of energy (Chen & Houngh, 2004; Zhang *et al.*, 2020). As a result, their waste policies had to shift away from conventional end-of-pipe treatment methods such as landfill and incineration to newer methods that support waste minimisation and optimal resource utilization (Chen & Houngh, 2004).

Taiwan as a developed country and South Africa as a developing country have specific circumstances that are fundamentally different in terms of economic wealth, political and social circumstances. Limited land space, lack of natural resources and high energy costs are some of the key drivers that inform waste policy changes in Taiwan. As a wealthy nation, Taiwan is able to afford more expensive and technologically advanced waste management options. This would therefore compel waste policy change drivers that are not necessarily applicable to South Africa, a country faced with various political, economic, social challenges.

### **2.2.1.3 Thailand**

Thailand and South Africa have long standing diplomatic and trade relations, dating back more than 25 years (South African Embassy Bangkok, 2020). However, it was only in 1993 when these two countries formally established full diplomatic relations (South African Embassy Bangkok, 2020). Today, they still maintain very good relations, with South Africa being the biggest trading partner of Thailand in the African continent (The Nation, 2020).

As a developing country Thailand has demonstrated remarkable growth in both social and economic development over a relatively short time period (Keyes, 2020). Its economy has grown sustainably and rapidly over the past years with notable reductions in poverty and unemployment rates (Central Intelligence Agency, 2020b). Today, Thailand is politically stable, despite its long history of political turmoil and military rule (Central Intelligence Agency, 2020b).

They are large producers of oil and natural gas, however due to their high fuel demand, they import hydrocarbons to sustain their demands (U.S. Energy Information Administration, 2017). They are also very rich in agriculture and the world's biggest rice exporter (Central Intelligence Agency, 2020b).

While Thailand still faces some major waste management challenges, the developing nation is able to demonstrate some major improvements in the development and implementation of integrated waste management systems (Chankaew, 2020).

With an abundance of natural gas, incineration and WTE as waste management options may possibly be poorly supported. The land is also largely required for agriculture, hence waste disposal to landfill may potentially not be encouraged and poorly supported.

Both Thailand and South Africa are developing nations, with similar backgrounds in terms of their historical political instability, economic challenges, high poverty and unemployment rates and therefore provides for an equal comparative analysis on how other developing countries have developed in sustainable and integrated waste management. A marked difference, however, is that Thailand as a developing nation has managed to overcome many of its political challenges, significantly grow its economy, and overcome its high poverty and unemployment rates and was simultaneously able to advance well with their integrated waste management systems. This demonstrates that through concerted efforts, developing countries are able to overcome many of their historical economic, political and social challenges which will also better support integrated waste management systems.

#### **2.2.1.4 Nigeria**

South Africa and Nigeria are both former British colonies and members of the Commonwealth of Nations and African Union (African Union, 2020; WorldData.info, 2020).

Nigeria and South Africa are both developing African countries who have the biggest economies on the African continent, with Nigeria having an abundance of oil and gas reserves (Central Intelligence Agency, 2020d, 2020e). Nigeria's GDP (2019: \$1.03 trillion) surpassed that of South Africa (2019: \$730.9 billion) a decade ago, and as such allows for an equal comparative analysis on how other African countries have developed in sustainable and integrated waste management (Central Intelligence Agency, 2020d, 2020e).

Both countries' economies are largely dependent on mineral resources and are notorious for their violence and vigilantism with high youth unemployment rates (Adebajo, 2019). Despite its economic wealth and growth, today Nigeria's poor waste management practices have left the country polluted and is ranked as one of the world's dirtiest and worst liveable countries (Sridhar *et al.*, 2017).

Both Nigeria and South Africa have many historical and current commonalities on social, economic, and political fronts, many of which are still prevalent today. Both countries still use waste disposal to landfill as the preferred option, largely due to high unemployment and poverty rates, as the poor population is unable to afford more expensive and technologically advanced waste treatment options. Expectedly so, many of the drivers for waste management are expected to be similar, except the fact that Nigeria has an abundance of oil and gas readily available and as such may not necessarily support WTE.

Chapter 4 provides a comparative contextualised review of the waste legislative frameworks to assess similarities, differences and aims to identify further opportunities, challenges and trends in each country. This is done with due consideration of past evolution of the South Africa model and how and if these can guide the future development of the South African NWMS.

A detailed evaluation and critical analysis is conducted on the South African legislative framework relating to waste management and the evolution of the NWMS.

### **2.3 Data collection and data analysis**

Data relating to the two research objectives was gathered by means of document review and evaluation, literature review and a critical, comparative assessment.

### **2.3.1 Document review, evaluation, and analysis**

Data collection was achieved by assessment and analysis of specific waste policies, laws, strategies and reports relating to sustainable and integrated waste management in the five countries selected for the study.

In the South African context, policies and laws selected were on the basis of influencing the development of the 1999 NWMS and subsequent updates in 2011 and 2020. Similarly, in the international context, policies and laws selected were on the basis of influencing the development of their integrated waste management systems. These were analysed to ascertain whether aims, goals and objectives were successfully achieved. In comparing the strategic goals, valuable insight was obtained on the evolution of these waste management systems as influenced not only by local policies and laws, but global initiatives as well.

Pertinent information was evaluated and extracted from various publications to enable an informed assessment of data collected and analysed for South Africa and the international case countries. An analytical framework was constructed for comparative purposes to analyse the different countries' waste management policies, laws and strategies to those of South Africa.

The critical evaluation largely focused on the evolution of the South African NWMS and how it has evolved since its initial concept in 1997, the original draft in 1999, through to amendments in the 2011 NWMS up to the latest 2020 NWMS.

### **2.3.2 Literature review purpose and aims**

The aims of the study's literature review are to

- (i) provide background and context to the research;
- (ii) to inform the selection of case countries for the comparative evaluation of the South African NWMS with other countries;
- (iii) to gather the policies, strategies and supporting legal documentation from the case countries; and
- (iv) to provide insights of published academic works on the evolution of these policies and strategies over time.

The purpose of the study's literature review is to enable realisation of the aforementioned aims.

Research is usually informed by a plethora of existing information, hence a literature review offers a platform that informs a broad summary and distillation of relevant information on a particular

topic in support of specific research questions (Rowley & Slack, 2004). It has thus been heralded as a vital component in enabling the emergence of the research community (Randolph, 2009).

According to vom Brocke *et al* (2009) “*science is a cumulative endeavour as new knowledge is often created in the process of interpreting and combining existing knowledge*” (vom Brocke *et al.*, 2009:2206). For this reason, literature review plays a pivotal role in scholarship as it aims to restructure a colossal amount of knowledge into a more refined and definitive domain (Randolph, 2009; vom Brocke *et al.*, 2009). It is against this backdrop that a literature review fundamentally embodies the first step to determine its reform into research and therefore offers valuable knowledge accumulation and understanding that allows for keeping abreast of changing and growing environments (vom Brocke *et al.*, 2009).

It also creates a stable foundation for the advancement of knowledge on a particular subject (Webster & Watson, 2002). Literature reviews are thus essential to identify what has been written on a subject or topic in order to assess possible trends, similarities and differences to determine to what extent a specific research area reveals any interpretable trends or patterns and to collect empirical findings related to the research topic (Pare & Kitsiou, 2017). These reviews are, therefore, not aimed at merely resynthesizing past research, but is typically also intended to identify knowledge gaps and highlight important phenomenon which may lead to plausible proposals and solutions to close these gaps and inform direction for future research requirements (Rowley & Slack, 2004; Webster & Watson, 2002).

According to Rowley and Slack (2004), conducting a literature review can be quite an intimidating and daunting task as information is not always readily available and searches need to be quite refined to limit the amount of “useless information” (Rowley & Slack, 2004). For this reason, a literature review should follow some basic steps, such as evaluating sources of information available, followed by searching and locating the information resources, developing conceptual frameworks and mind-mapping in order to produce a comprehensive review on a research topic (Rowley & Slack, 2004). It is, therefore, imperative for a literature review to be clear and decisive with relevant and refined searches in order to warrant a high level of rigour and precision into the research topic from reliable databases that will enable the effective use of existing knowledge and to avoid re-investigating (Paré *et al.*, 2015; Rowley & Slack, 2004).

The quality of a literature review is thus particularly determined by the literature search process (vom Brocke *et al.*, 2009). One of the key elements in conducting a literature review is the source of documentation requiring an evaluation of numerous different sources that typically includes a myriad of academic and professional journal articles, books, lectures as well as a host of web-based sources (Webster & Watson, 2002). According to Randolph (2009), a good literature review

demonstrates the knowledge about the author on a research topic that includes vocabulary, theories, history, methods, key variables methods and ideas (Randolph, 2009).

Several authors have recommended scholarly and research articles be used, as many have been peer reviewed as well as proceedings from renowned conferences (Rowley & Slack, 2004; vom Brocke *et al.*, 2009; Webster & Watson, 2002). Another plausible advantage of using scholarly and research articles is they include a bibliography, which may provide additional useful sources of information on the subject at hand (Rowley & Slack, 2004). Further valuable sources include professional or practitioner journals as these often provide more updated and recent developments and trends (vom Brocke *et al.*, 2009). Books are also credible sources of information and, furthermore, also include extensive bibliographies (Rowley & Slack, 2004; vom Brocke *et al.*, 2009). Web sources are probably the easiest and simple source of information and also provides for a medium for individuals and organisations to communicate on matters and provide up to date statistics as well (Rowley & Slack, 2004). Randolph (2009), however, stresses the importance of being able to adequately cull the collection of literature and, in so doing, discard irrelevant articles and limit the study to information relevant to the research topic (Randolph, 2009).

For the purposes of this research, the literature review component included relevant published literature such as books, scholarly articles, journal articles, country specific reviews and reports, policies and laws. Literature was gathered primarily using electronic platforms and databases, such as Google scholar, North West University Library database, Scopus, EBSCO-Host and various other sources available on the internet. For each country selected some of the keywords used during the research were; environmental law, waste management strategies, waste management, waste law, waste management policy, waste management challenges, sustainable waste management, global waste management. Further keywords were research methodology, literature review methodology and comparative research. Further research was conducted on each selected country's legal databases to identify the relevant laws and policies relating to waste management.

Country-specific websites and reviews were used, such as The World Factbook, to obtain some of the most recent and up to date country-specific data. Scholarly articles and publications from 1997 to 2020 were generally used, older publications relating to research methodologies also provided valuable insights that are still relevant and applicable. While reviewing country-by-country legislation, specific reference was made to historical laws, policies and strategies relating to integrated waste management to provide some historical context in order to evaluate the evolution thereof.

The results of this study's literature review process are documented in Chapter 3.

### **2.3.3 Comparative analysis: South African NWMS vs other countries**

Once relevant South African and case country data was obtained through the literature review process, an analytical framework was compiled to conduct a comparative analysis of the South African strategies in an attempt to dissect the evolution of the different waste management systems over time.

In order to conduct the critical analysis on the evolution of the South African NWMSs, it was prudent to provide an overview of South Africa in terms of locality, economic, social and political circumstances, both historical and current. Secondly, a synopsis was conducted to determine country specific waste management challenges and lastly how integrated waste management has evolved over the years with specific reference to policies and laws that have informed the strategies over time. Only once the first two steps were completed, a comparative evaluation was done on the evolution of the various updates of the NWMS's. This approach provided both a systematic and logical structure to develop an understanding of the country specific dynamics and circumstances that play a pivotal role in terms of its response towards any global waste management challenges and responses, including its own waste management challenges and responses. It also provided the opportunity to contextualise some of the waste management initiatives and how the country has been able to respond to this.

The purpose and intent of the comparative analysis of the various iterations of the South African NWMS was to evaluate and assess the evolution of these strategies in so far as the strategic goals and intents are concerned.

Once the comparative assessment was completed on the evolution of the South African NWMSs, the same systematic and logical approach was adopted for each of the case countries selected in order to track the parallel evolution of the waste regimes per country, both developed and developing countries. Each case country was then specifically compared to the evolution of the South African strategies with due consideration of the country's social, political and economic circumstances, including country specific drivers for the waste management options, highlighting some differences and similarities.

According to Gutteridge (1971), comparative research finds its value as an instrument that can be used for the growth and development of law and offers insight on how far and in what respects legal systems differ from each (Gutteridge, 1971). This has been described as a two-step process; firstly to collect relevant information about other legal regimes and, secondly, to apply the

experience and learning from other systems that can provide not only guidance in law reform but also to promote international uniformity in law (Gutteridge, 1971; Van Hoecke, 2015).

An important consideration of comparative law research is to consider country-specific circumstances and conditions so as to adequately contextualise the approach (Van Hoecke, 2015). It is against this backdrop legal research has also been described as a multidisciplinary process, as it has to consider and provide insight on historical, cultural, political and socio-economic environments as of legal traditions, and in so doing realising legal systems may not only converge but also diverge as rules are considered in these various different contexts (Kroeze, 2013; Reimann, 2002; Van Hoecke, 2015). Notably, this method is not an absolute and fixed methodological approach and provides the flexibility of using various approaches that can be usefully applied in the comparative study (Van Hoecke, 2015).

The comparative analysis employed for the purposes of this research focused on document review, evaluation, and analysis of the South African NWMS over time and to compare the evolution of these strategies with the evolution of policies, laws and strategies of the case countries selected.

These principles were used as the underlying approach to develop a synopsis on the different waste management principles applied in the various strategies of each country. Lastly the evolution of these principles were assessed against the South African NWMS and its alignment with these principles. The research, therefore, focuses on identifying and distilling key elements on global trends for integrated waste management policies laws and strategies and how each of the selected countries have informed the change in trajectory in principles regarding integrated waste management. Consideration of historical factors and drivers in each country was also considered be it economic, social and political influences that informed these changes.

Case country selection was based on either similarities or differences when compared to South Africa. Netherlands and Taiwan have been selected on the basis that they are developed nations with distinctly different economic, social, political, cultural and historic backgrounds. Further to this, drivers for waste management options are different when compared to South Africa. Their wealthy economies also provide for adequate funding to realise the goals, objectives and targets of their waste policies, laws and strategies.

Thailand and Nigeria were selected as developing nations, with similar histories in so far as economic, social and political struggles are concerned and was the basis of an equal comparative assessment. Nigeria, as a rich African nation has many commonalities when compared to South Africa, however today they have made little progress in so far as sustainable development and

integrated waste management is concerned. Thailand, on the contrary has made great strides in their economic growth and has achieved low unemployment and poverty rates and achieved political stability. Through these transitions, Thailand has been able to achieve marked improvements in sustainable development and integrated waste management systems. These improvements demonstrate that developing countries are able to overcome historical challenges which may pave the way for further improvement in their integrated waste management systems.

Based on inherent differences and similarities, between countries it has been argued that one cannot assume a lift-and-shift approach when using comparative law. A rule cannot be taken out of its context and simply transplanted and applied elsewhere, as this may be seen as a *“meaningless form of words”* as the rule must surely undergo several changes when applied in a different context (Ellis, 2011; Van Hoecke, 2015). A more favoured approach is the concept of “borrowing” or “transplantation” on the basis that the value-add is in the learning from one another in various ways and being suitably able to adapt to the diversity of cultures and changing conditions by applying some general principles with due consideration of rather comparing the propensities in different countries (Ellis, 2011; Reimann, 2002).

## **2.4 Methodological considerations, assumptions, and limitations**

This study presented certain limitations that have to be considered when evaluating the results:

- Only documents, reports, and publications available electronically and in English were accessed, and deemed adequate as a basis for the research.
- While this study aims to evaluate the evolution of the South African NWMS in comparison with other countries, the comparison is limited to four selected case countries.
- Originally, more case countries were considered for comparative analysis, however, there was a general lack of publicly available material. The four case countries selected all met the documentary research parameters and have comparative contexts with South Africa.
- The country selection for comparative purposes was limited to two developing countries and two developed countries which have some historical or current ties with South Africa. The sample size was deemed sufficient to address the current scope and aims of the study.
- The Netherlands, Taiwan and Thailand websites did not have all the supporting laws, policies and strategies available in English to conduct a direct comparison with South African documents. Policies, laws and strategies for Nigeria was not publicly available.

However, in these instances other available research articles and documents were used as a basis upon which to draw conclusions and interpretations of other authors, through scholarly articles and reports. The absence of supporting documents online did not influence the achievement of the research objectives.

- Peer-reviewed, academic publications referenced in research mostly represented the views and opinions of other authors and deemed sufficient to achieve the objectives of the study.
- Updated country specific statistics on socio, political and economic status were obtained from the online World Factbook and International Monetary Fund.
- There is no publicly available status quo assessment report available for the South African 1999 NWMS. However, a draft status quo assessment report for the 2011 NWMS was published in 2019. It was, however, not the main aim of the research to consider the implementation of the documented arrangements outlined in the NWMS.

## **2.5 Ethical considerations**

Based on the review by the North West University, Faculty of Natural and Agricultural Sciences Ethics Committee (FNASREC), the Committee cleared this study as having no ethical risk. FNASREC granted permission to initiate this study under ethics number NWU-01189-20-A9.

## **2.6 Chapter summary**

This chapter demonstrates that literature review is an essential part of a research project as it provides a detailed evaluation of literature available on the subject matter.

An extensive selection of sources of information, ranging from books, journals, scholarly articles, conference proceedings, electronic and other available sources, were used. The literature review assessed what has been previously published on the subject and evaluated historic and current thinking and trends on the subject. It also provided an opportunity to identify gaps and, moreover, avoided duplication.

The research entailed a comparative research methodology to evaluate and distil historical and current global trends on integrated waste management policies, laws, and strategies. This was achieved through a comparative assessment between the developed and developing countries selected for the study. This comparative investigation was a valuable tool to inform growth and development of legal systems with due consideration for country specific circumstances and

conditions. It also presented some useful learnings on global trends and possible new opportunities to promote future global harmonisation.

This study focused on a selection of country-specific policies, laws and strategies that formed a pivotal part of comparing and integrating the information obtained and critically reflected in the evolution of the NWMS of South Africa.

Chapter 3 provides the literature review chapter of this dissertation.

## **CHAPTER 3 LITERATURE REVIEW**

### **3.1 Introduction**

The purpose and aims of the literature review is to provide context to historical negative social and environmental impacts of poor waste management practices. It provides country specific reviews on waste management challenges, mitigation measures in terms of policies, laws and strategies that have been developed and implemented to address local and international waste management challenges.

Further information relates to global waste management challenges and how the policies, laws and strategies in both developed and developing countries selected relate to the evolution of the South African NWMS.

### **3.2 Background**

Waste generation is inevitable during the production and consumption of resources (Das, 2016; Singh *et al.*, 2014). Globally, both the volumes and complexity of wastes being generated are increasing due to rapid industrialisation (Das, 2016; Nkosi *et al.*, 2013; United Nations Environment Programme, 2013). Moreover, waste material takes on many different forms, from gases, liquid and solid wastes causing pollution to air, land and water resources (Singh *et al.*, 2014).

According to Oelofse (2009), it is an imperative for governments to define what constitutes waste in order to deal with the mounting problems associated with waste generation (Oelofse, 2009). In so doing this provides a basis to adequately regulate waste management, identify risks associated with waste and select appropriate waste management options to control the potential impacts of waste on the environment and human health (Oelofse, 2009; Seadon, 2006). Moreover, the conceptual approach to waste management is supported by the waste hierarchy that includes waste prevention, reuse, recycling, composting, energy recovery and final disposal, that is informed by the definition of waste (Institute for Prospective Technological Studies, 1997; Nkosi *et al.*, 2013; Oelofse, 2009). It is also important to note that implementing the waste hierarchy is not a simple process as it requires changes in the way products are designed and manufactured to promote its re-use and recycling (Nkosi *et al.*, 2013)

Since the 1970s, communities have become more aware of the interdependence of the environment, society, and the economy and this has resulted in the emergence of the concept of sustainable development (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2006). Correspondingly, there has been a worldwide upsurge in the promulgation of

environmental law (Glazewski, 2000; World Bank Group, 2018). Political leaders globally have increasingly come to recognise waste as a problem (Singh *et al.*, 2014).

In addition, waste management has been found to have strong linkages to a host of other challenges such as health, climate change, poverty reduction, food and resource security, sustainable production, and consumption (Singh *et al.*, 2014; Wilson, 2015; Wilson *et al.*, 2013). As a result, sustainable waste management now underpins many sustainable development initiatives, and is a vital element to the achievement of the United Nations (UN) Sustainable Development Goals (SDGs) (United Nations Development Programme, 2020; Wilson, 2015). One of the outcomes of the UN Conference on Sustainable Development (Rio+20) of June 2012 was the recommendation that all countries develop comprehensive national waste management strategies to address waste management challenges (United Nations Environment Programme, 2013). Additionally, Nkosi *et al.* (2013) argues that if adequate waste management policies and practices are not employed globally this may lead to detrimental impacts on human health and the environment that will negatively affect quality of life (Nkosi *et al.*, 2013).

The UN has further sanctioned as imperative for all cities to bring waste under control and harness the opportunities of waste as a resource to ensure sustainable growth by developing strengthened policies, monitoring and enforcement, with implementation of appropriate services and technologies (United Nations Environment Programme, 2018).

### **3.3 The role of policy and strategy in integrated waste management**

Policy and strategy development are crucial components in sustainable waste management, identifying and acknowledging the problems and sets out a structured process in terms of mitigation measures. These developments set goals and target and provide guidance on how these will be achieved. Such strategies also provide direction and aims to present a more integrated and holistic approach to waste management and assist in developing a consensus on the need for any further actions required. For this reason, strategies should be a collective approach and include all stakeholders to enable better coherence and co-operation for effective implementation.

### **3.4 Global evolution of sustainable waste management**

The following sections provide country specific overviews, waste management challenges, evolution of waste management policies, laws and strategies for South Africa, the Netherlands, Taiwan, Thailand and Nigeria to demonstrate the evolution and progression of global sustainable waste management systems.

### **3.4.1 Evolution of waste management in South Africa**

The sub-sections provide an overview of the progression of waste management in South Africa over time.

#### **3.4.1.1 Country overview: South Africa**

South Africa is situated at the southernmost tip of the African continent and spans a total area of 1 219 090 km<sup>2</sup> with a population of 56.5 million people (Central Intelligence Agency, 2020d). South Africa's population growth rate is 0.97% p.a., with an urban population of 67.4%, that is on an incline rate of 1.97% annually (Central Intelligence Agency, 2020d).

South Africa's unemployment, poverty and inequality rates are amongst the highest in the world, with an unemployment rate of 27% while 16.6% of its population living below the poverty line (Central Intelligence Agency, 2020d)

South Africa is an economically well developed country in sub-Saharan Africa and has the largest stock market on the continent, with an estimated GDP of \$730.9 billion in 2019 (Central Intelligence Agency, 2020d; Karani & Jewasikewitz, 2007). It enjoys an abundance of natural resources such as gold, chromium, antimony, coal, iron ore, manganese, nickel, phosphates, tin, rare earth elements, uranium, gems, diamonds, platinum, copper, vanadium, salt and natural gas (Central Intelligence Agency, 2020d).

Exploitation of these natural resources has led to the generation of varied and complex waste streams, further exacerbated by the poor solid waste management in urban townships and rural areas, which can be largely attributed to the oppressive and disenfranchising policies of Apartheid that led to an unequal and unjust socio-political past (Coetzee, 2016). Notably, as a country pre-1994, minority rule was ostracised by the international community, politically isolated and subject to sanctions all designed to be inhibiting factors in its economic advancement and environmental protection (Coetzee, 2016). Post 1994, South Africa was able to extricate from its Apartheid restraints and was able to reintegrate into the international arena that inadvertently led to increased economic development and has made notable improvements towards improving the well-being of its citizens (Coetzee, 2016).

While South Africa has been progressing economically since 1994, its industrial growth has inevitably worsened environmental problems in the areas of polluted rivers from agricultural run-off and urban discharge, air quality degradation resulting in acid rain, solid waste pollution, land degeneration and disruption of ecosystems (Central Intelligence Agency, 2020d; Coetzee, 2016). According to Mngoma *et al.* (2011), South Africa was and is still not possible to divorce

developmental issues from issues of governance and civil society (Mngoma *et al.*, 2011). Today, the country still faces many of the socio-economic challenges, such as political instability, high unemployment rates, poverty and inequality (Central Intelligence Agency, 2020d; Coetzee, 2016).

Historically, the South African legal and governance landscape for integrated waste management has been fragmented, not only within local authorities but also as each economic sector tried to independently manage waste streams (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000; Kotze, 2005). According to Mngoma *et al.*, the 1990s presented an era that introduced the concept of sound environmental governance, that presented the opportunity for improved waste legal landscape and implementation of waste policies and strategies (Mngoma *et al.*, 2011).

It should be noted with developing countries in Africa, today's sub-Saharan country borders were decided by former colonial powers and do not consider the diversity of cultures. The number official languages alone stand at 13, demonstrating the country's cultural diversity (Central Intelligence Agency, 2020d). Until 1994, 92.2% of this culturally diverse population were oppressed and disenfranchised from participating in any mainstream activities which were occurring elsewhere in the developed/developing world, where countries tended to be united by a single culture and/or language (Human Rights Committee, 1998). This means the diverse population of South Africa is playing catch-up when compared to other cultures and civil societies outside of sub-Saharan Africa.

Whilst this holds true, the government is determined to learn and update legislation in line with international peers with a view to enabling sustainable environmental practices and adopting the waste hierarchy progress towards a circular economy. The emergence of the National Waste Management Strategy (NWMS) of 1999, 2011 and 2020 clearly demonstrate intent.

#### **3.4.1.2 Waste management challenges in South Africa**

As a developing country, South Africa has several challenges with regards to waste management. These can be largely attributed to population growth and urbanisation leading to increased waste production and greater complexity of waste streams, compounded by the mixing of hazardous and general wastes (Muzenda, 2014). The resultant effects have led to mounting pressure on the country's waste management resources (DEA (Department of Environmental Affairs (South Africa)), 2011; Taiwo *et al.*, 2008).

Several authors have asserted that municipal solid waste is one of the most crucial challenges, notwithstanding the poor state of repair of landfill sites, many of which are unlicensed (Muzenda, 2014; Muzenda *et al.*, 2011; Oelofse, 2011; Taiwo *et al.*, 2008). Additionally, illegal dumping

practices is costing the South African economy over R460-million per annum, notwithstanding the negative social and environmental impacts largely due to poor waste collection services (Godfrey & Oelofse, 2017; Oelofse, 2018).

Due to historical fragmented policies, waste collection remains highly skewed in favour of affluent areas with an underwhelming 61% of the population receiving kerbside collection services (Zhakata *et al.*, 2016). Municipalities struggle on financial, manpower, ethical and material fronts, compounded by inadequate budgeting for waste collection, maintenance and investment in new technologies (Oelofse, 2018). Further challenges include lack of political and social commitment, lack of funding, implementation, compliance, and enforcement leading to air, land and water pollution as well as a loss of biodiversity (Muzenda, 2014). Today, we must add rampant corruption over the last decade to that list (State Capture Commission, 2020). While these are some of the major challenges experienced in South Africa, waste disposal to landfill is still extensively used and remains the dominant technology of choice due to its inherent low costs and absence of alternative technologies (DEA (Department of Environmental Affairs (South Africa)), 2011; Godfrey & Oelofse, 2017).

### **3.4.1.3 Waste management in South Africa**

Over the past 30 years South Africa's approach to waste management has shifted considerably towards more sustainable waste management practices; guided by international trends and social discourse in an attempt to handle waste in a more integrated, economically, environmentally and socially acceptable manner (Taiwo *et al.*, 2008).

Godfrey and Oelofse (2017) has categorised the evolution of South Africa's waste management system into five distinct phases: the age of landfilling, the emergence of recycling, the flood of regulation, the drive for extended producer responsibility and the circular economy (Godfrey & Oelofse, 2017).

Government has promulgated a number of policies and implemented laws and strategies which inform waste management as outlined below.

The South African Constitution (Act 108 of 1996) is the cornerstone of environmental protection and Section 24, in the Bill of Rights, further sets out the right to environmental protection and to live in an environment not harmful to health or well-being (Mngoma *et al.*, 2011).

The National Water Act, Act 54 of 1956 (NWA) as amended, is based on the notion of water protection, conservation, control and use of water (Nealer & Raga, 2008). The NWA aims to control the use of water and the treatment and disposal of effluent (Van Wyk *et al.*, 2002). In so

doing, water users are required to return water to the water body from which the water was originally abstracted, making it obligatory for the effluent to be treated to acceptable standards before being returned to the watercourse (Mema, 2010; Van Wyk *et al.*, 2002). The NWA can, therefore, be considered as impact management and remediation of pollution (Taiwo *et al.*, 2008). It also provides for the direct prevention and control of the impact of waste practices on water resources under Section 19 Pollution Prevention Regulations (Department of Water and Sanitation (South Africa), 1998). The then Department of Water Affairs and Forestry (DWAF) was the lead agency in the permitting of waste disposal sites, even with the promulgation of the Environmental Conservation Act (Act 73 of 1989) (ECA), because the primary detrimental impact of waste management is a water resource pollution risk.

The ECA as amended, with its enactment was the primary law governing protection and control of the environment and to regulate waste management (Zhakata *et al.*, 2016). The intent of the ECA was to control, regulate and reduce negative environmental impacts associated with poorly managed and operated landfill sites (Godfrey & Oelofse, 2017). It primarily regulated the licensing, control and management of waste disposal sites and introduced in South Africa the first legal definition of waste (Godfrey & Oelofse, 2017; Taljaard, 2011). In 1994, the Minimum Requirements document series was published by the DWAF in 1994 and updated in 1998 to provide technical guidance on the handling, classification and disposal of waste (DWAF (Department of Water Affairs and Forestry (South Africa)), 1998; Godfrey & Oelofse, 2017). The Minimum Requirements have subsequently been replaced by the National Norms and Standards for the Assessment of Waste for Landfill Disposal and the National Normal Norms and Standards for Disposal of Waste to Landfill (Godfrey & Oelofse, 2017).

Despite the good intent of the ECA, its rulings on waste disposal to landfill and burning of waste led to negative environmental, social and economic impacts, and lacked inclusion of all other related waste management aspects (Taljaard, 2011).

The National Environmental Management Act, Act 107 of 1998 (NEMA), has replaced and repealed most parts of the ECA and is currently the overarching environmental framework legislation in South Africa that aims to give effect to Section 24 of South Africa's Constitution and provides for integrated environmental management (Coetzee, 2016; Kotze, 2005; Nel & du Plessis, 2001). According to Coetzee (2016), NEMA advocates sustainable development, and therefore connects social, economic and environmental factors to the developmental needs of present and future generations (Coetzee, 2016). Some of the key principles in NEMA specifically relating to waste management are the polluter pay principle, precautionary care principle, duty of care principle, cradle to grave principle and promotes implementing the best practicable environmental option (Butler & Hallows, 2002; Zhakata *et al.*, 2016). NEMA has also placed an

obligation on all three tiers of government, national, provincial and local to be the drivers of environmental management and sets out their mandate, powers and duties, and the requirement on authorities to develop, implement, guide and enforce environmental protection (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 1999). It further imposes a duty on any person who causes, has caused or may cause significant pollution or degradation to take reasonable measures to prevent, minimise and rectify significant pollution and environmental degradation (Nel & du Plessis, 2001; Zhakata *et al.*, 2016).

The National Environmental Management Waste Act, Act 59 of 2008 (NEMWA), as amended is the main statutory provision regulating waste in South Africa (Zhakata *et al.*, 2016). It is the first comprehensive act intended to provide a proactive and holistic approach devoted exclusively to waste management (Godfrey & Oelofse, 2017; Hanekom, 2014).

NEMWA aims to inculcate integrated waste management in support of sustainable development and NEMA S2 principles (Zhakata *et al.*, 2016). It sets out objectives to *“protect health and environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development”* in an attempt to change the way waste is regulated in South Africa (Hanekom, 2014).

NEMWA has formally adopted the internationally recognised waste management hierarchy that strives to move waste away from landfill disposal towards reuse, recycling and recovery (Godfrey & Oelofse, 2017). The waste hierarchy now underpins integrated waste management in South Africa and, among others, provides for the establishment of the NWMS to address key waste management challenges and should give effect to South Africa's international obligations in terms of waste management (DEA (Department of Environmental Affairs (South Africa)), 2009). NEMWA aims to regulate every aspect of waste and secondary resources and to this end provides the requirements for storage, collection and transportation of waste and treatment, processing, and disposal of waste (Godfrey & Oelofse, 2017).

NEMWA also provides for Norms and Standards for waste management and service delivery, waste information systems, waste management licencing, implementation of extended producer responsibility, implementation of integrated waste management plans, and economic instruments to implement the strategy (Mokoena, 2019). It also sets out the requirement to identify the status and risk of contaminated sites and provides a legal mechanism for remediation activities to be instigated and controlled (Matete & Trois, 2008).

The NEMWA, as amended, also defines *waste* as: *“any substance, material or object that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be*

*discarded or disposed of, by the holder of the substance material or object, whether or not such substance material or object can be re-used, recycled or recovered and include all waste as defined in Schedule 3 of this Act”* (Department of Environmental Affairs (South Africa), 2009).

#### **3.4.1.3.1 National Waste Management Strategy 1999**

In 1999, the then Department of Environmental Affairs and Tourism (DEAT) published the first NWMS in response to the mounting waste problems, and to remedy the historical fragmented and uncoordinated ways in which waste was dealt with in South Africa (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000; Zhakata *et al.*, 2016). This consequently led to the development and publication of the White Paper on Integrated Pollution and Waste Management (IP&WM) in 2000 (Oelofse & Godfrey, 2008).

This strategy marked a major change in trajectory for waste management in South Africa, from the traditional “end-of-pipe” towards a more holistic approach inclusive of pollution prevention and integrated pollution and waste management systems in line with international and national objectives (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000; Muzenda, 2014). The IP&WM set out the regulatory framework for integrated pollution control and waste management in South Africa that for the first time introduced the waste management hierarchy (Muzenda, 2014; Muzenda *et al.*, 2011).

In recognising the country’s waste management challenges, the IP&WM and NWMS set out the need to move up the waste hierarchy in an effort to divert waste from landfill disposal and increase recycling rates (Godfrey & Oelofse, 2017; Makgae, 2011; Nahman & Godfrey, 2010). The NWMS also invokes the polluter pays principle, which implies that all waste generators are responsible to pay the cost associated with the waste they generate (Makgae, 2011; Nahman & Godfrey, 2010).

The Polokwane Declaration of 2002, was the outcome of the first National Waste Summit in South Africa that marked an important milestone in the country’s waste management roadmap to address waste management challenges (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2005). The summit confirmed waste management as a priority and the need for urgent action to be taken to ensure a clean and healthy environment (Taiwo *et al.*, 2008). The vision of the summit was *“to implement a waste management system which contributes to sustainable development and a measurable improvement in the quality of life, by harnessing the energy and commitment of all South Africans for the effective reduction of waste”* (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2005).

#### **3.4.1.3.2 National Waste Management Strategy 2011**

The NWMS of 2011 was a legislative requirement of the NEMWA and was intended to provide the detailed process required to achieve the NEMWA objectives (DEA (Department of Environmental Affairs (South Africa)), 2011).

In recognising some of the key waste management challenges, the updated NWMS provided several actions intended to address the challenges timeously and effectively by all tiers of government (DEA (Department of Environmental Affairs (South Africa)), 2009).

The updated strategy was intended as an enabler and recognised the importance of moving up the waste hierarchy with a major focus on waste avoidance, minimisation and recycling; to reduce impacts further downstream with treatment and disposal as the last option, and also makes provision for the remediation of contaminated land (Muzenda, 2014; Nahman & Godfrey, 2010).

This 2011 strategy also used various instruments to promote and implement the goals of the NWMS, such as the waste classification and management system, norms and standards, licensing of waste management activities, industry waste management plans, extended producer responsibility, waste information system, priority wastes and economic instruments (Mokoena, 2019).

#### **3.4.1.3.3 National Waste Management Strategy (NWMS) 2020**

The latest update of the NWMS was published on 13 September 2020 and aims to build on earlier successes and on the previous 2011, version marking a major change in trajectory in South African waste management systems in support of a circular economy (DEFF (Department of Environment Forestry and Fisheries (South Africa)), 2020b). Diverting waste from landfill is at the core of the updated NWMS, with due consideration for alternative waste treatment options. The waste hierarchy has been updated by DEFF in support of the key principles of the 2020 NWMS, namely waste minimisation, waste prevention and waste as a resource in support of a circular economy (DEFF (Department of Environment Forestry and Fisheries (South Africa)), 2020b).

Some of the key priorities for the latest NWMS are: waste prevention and waste resource management as waste minimisation strategies to implement the circular economy; industrial symbiosis and extended producer responsibility; separation at source; awareness and enforcement to build a culture of compliance and innovation (DEFF (Department of Environment Forestry and Fisheries (South Africa)), 2020b; Magomola, 2019).

In a circular economy, products are designed for a cycle of disassembly and reuse (Directions in Urban Development Series, 2019). Notably, the concept continues to gain traction in South Africa,

spurred on by rising prices to consumers, waste management costs and the general mobilisation through legislation to address climate change (Magomola, 2019).

### **3.4.2 Evolution of waste management in the Netherlands**

The sub-sections provide an overview of the evolution of waste management in the Netherlands.

#### **3.4.2.1 Country overview: the Netherlands**

The Netherlands is a country located in western Europe bordering the North Sea and surrounded by the highly industrialised, densely populated Rhine-Ruhr region of Germany to the east and Belgium to the west (Jeroen, 2018). The country spans a total area of 41 528 km<sup>2</sup> of which 18.41% is water, with a population of 17.2 million (Central Intelligence Agency, 2020a). It is the most densely populated country in the European Union, with a density of 488 people per km<sup>2</sup> it is also one the most densely populated countries in the world (Central Intelligence Agency, 2020a). Their natural resources include natural gas, petroleum, peat, limestone, salt, sand and gravel (Central Intelligence Agency, 2020a). Whilst the Netherlands is one of the major natural gas suppliers in Europe, the country is now faced are now faced with future energy security challenges as their major gas field, Groningen faces closure by 2022 (International Energy Agency, 2020).

According to the International Monetary Fund (IMF) the Netherlands has one of the most internationally integrated economies and has the sixth largest economy in the European Union (IMF, 2020). They have performed well in recent years with steady and robust economic growth estimated at 2.6 % in 2018 (IMF, 2020). With a GDP of \$986.8 billion in 2019, its recognition as a global economic leader has been driven largely by a healthy banking sector, its growth in domestic demand, strong fiscal position, robust net exports at over 60 % of GDP in 2018, low unemployment rates of 3.8 % in 2018 with only 8.8 of its population living below the poverty line (IMF, 2020). According to 2020 statistics, the Netherlands has an urban population of 92.2% (Central Intelligence Agency, 2020a). It also has a singular language and culture stretching back centuries (Central Intelligence Agency, 2020a).

The Netherlands is globally renowned for their great success in their waste management system through the effective development and implementation of their integrated waste management policies, laws and strategies. The country has limited landfill space, poor soil conditions for landfill and no natural (fossil) based energy sources (Dijkgraaf & Vollebergh, 2004). For this reason, their waste regime has focused primarily on incineration, in particular WTE plants over landfilling (Dijkgraaf & Vollebergh, 2004). As a result, the electricity and heat markets have become very dependent on the waste market, with the waste and electricity companies operating in similar markets with energy recovery from waste in the form of WTE playing a pivotal role (Dijkgraaf &

Vollebergh, 2004). This large interdependency between the waste and energy sectors resulted in an increase in WTE plants and associated capital investments to support these markets (de Jong & Wolsink, 1997).

Limited landfill space and lack of natural resources are most certainly key drivers that would support waste policy changes. The country is faced with energy supply challenges that will strongly support WTE initiatives that is made possible by the country's strong fiscal position. This will certainly compel waste policy change drivers not necessarily applicable to South Africa.

#### **3.4.2.2 Waste management challenges in Netherlands**

The Netherlands has a history of uncontrolled waste management emanating from poorly managed and uncontrolled landfill practices and poorly designed thermal treatment incinerators (Kemp, 2007a). The use of waste to fill swamps and large ditches to create new land for settlement stemmed from an historical culture to get rid of waste via land reclamation with few environmental considerations at the time (Kemp, 2007a).

Lack of landfill space, limited natural resources, insufficient thermal treatment capacity for the incineration of waste and increased global awareness of environmental challenges led to a change in trajectory in the 1970s when the government began implementing measures to enhance waste management practices (Dijkgraaf & Gradus, 2014).

In recognising global and local waste management challenges early on, the Netherlands has been a global frontrunner in successful development and implementation of waste management laws and policies (Goorhuis *et al.*, 2012). Energy security, lack of landfill space are two major drivers for investigating alternatives to landfill and moving up the waste hierarchy.

#### **3.4.2.3 Waste management in Netherlands**

It was already in the 1970s when more integrated and well defined waste management governance, laws and practices were implemented in the Netherlands (Loorbach *et al.*, 2003). The Netherlands has developed a plethora of legislation and policies relating to air, water and waste management and nature conservation (Huisman, 2018).

In 1978, it was among the first countries to adopt a waste hierarchy as a fundamental principle in waste management policy, with the seven levels of management, namely: prevention, product reuse, material reuse, beneficial use, disposal with energy recovery, disposal other than landfill, and landfill disposal (Lazarevic *et al.*, 2010). It is also reputed to have been the first country in Western Europe to introduce separate waste collection systems (Oldenziel & Veenis, 2013).

It is through these types of advancements, that the country has undergone a major transformation in waste management from uncontrolled landfilling to not only controlled landfilling, but to an effective and efficient system of recycling, incineration with energy-reuse (Kemp, 2007a). For this reason, the integrated waste management system in the Netherlands is considered to be one of the most advanced waste management systems globally (Goorhuis *et al.*, 2012).

Transitions in the waste regulatory framework were first introduced in 1976 through the Hazardous Waste Act, followed by the Waste Act in 1977 to govern wastes (Kemp, 2007a). The Environmental Management Act (EMA) first promulgated in June 1979, as amended provides the legal framework for an integrated approach to environmental management that governs the country's waste management policy (Kotze, 2005; Wong, 2014). The EMA further also introduced duty of care principle (Peelen *et al.*, 2015). Since 1994, the Netherlands formally introduced a waste hierarchy model that was incorporated into legislation, and also imposed mandatory collection of organic waste separately (Loorbach *et al.*, 2003). In 1995, the simultaneous introduction of a landfill tax and a ban on 35 specific wastes, including combustible and recyclable waste, resulted in more than a 50% reduction in waste being landfilled during the period 1995 to 2003 (Kemp *et al.*, 2007b).

The Netherlands has subsequently developed, implemented and enforced strict waste management standards, waste charging schemes for households and extended producer responsibilities (Kemp, 2007a). Rijkswaterstaat, which is part of the Netherlands Ministry of Infrastructure and Water Management is responsible for the design, construction, management and maintenance of the main infrastructure facilities and the executor of the National Waste Policies in the Netherlands (Jeroen, 2018).

The first National Waste Management Plan (LAP) (2002-2013), which came into effect in 2003, set out the control of waste policies on a national level (Milios, 2013). In support of the waste management hierarchy, LAP imposed a ban on the disposal of mixed municipal waste to landfill and set out increased recycling targets from 81% in 2000 to 86% by 2012 (Legislative Council Secretariat (Netherlands), 2016; Milios, 2013).

When LAP2, the second National Waste Management Plan (2009 – 2015), came into effect it set out objectives to limit the growth in waste generation, to reduce the environmental impact of waste, to minister the environmental impact from product chains and further set increased recycling targets whilst improving waste recovery and reuse, with a view to 2021 (Huisman, 2018; Legislative Council Secretariat (Netherlands), 2016; Milios, 2013).

LAP3, the third National Waste management Plan (2017-2027), largely supports and promotes moving from a linear to a circular economy (Jeroen, 2018). Some of the main drivers for this transition are environmental protection, natural capital, secure resources, economy competitiveness, green growth and employment (Jeroen, 2018).

In support of LAP3, the Netherlands has developed a pan-government document named, A circular economy in Netherlands by 2050, which clearly sets out the visions, objectives and goals for the transition to a circular economy by 2050 and how this will be achieved (Netherlands Ministry of Infrastructure and the Environment, 2016). The overall intent is to convert the economy into a sustainably driven circular economy. Its primary objective is to use 50% less primary raw materials (minerals, fossil and metals) by 2030 (Jeroen, 2018; Netherlands Ministry of Infrastructure and the Environment, 2016).

A circular economy in Netherlands by 2050 is based on the premise that too much limited raw materials and fossil fuels are still used to produce disposable products cheaply (Netherlands Ministry of Infrastructure and the Environment, 2016). The move towards a circular economy will provide opportunities to use and consume as little as possible and maximise the use of raw materials (Netherlands Ministry of Infrastructure and the Environment, 2016).

The Netherlands has made great strides towards implementing sustainable integrated waste management measures over the years, to the extent these efforts are globally recognised. The Netherlands has successfully managed to reduce disposal to landfill and made remarkable progress in support of the waste management hierarchy; and have been consistent in updating policies and measuring performance against set targets.

### **3.4.3 Evolution of waste management in Taiwan**

The sub-sections provide an overview of the evolution of waste management in Taiwan.

#### **3.4.3.1 Country overview: Taiwan**

Taiwan constitutes a number of islands in Eastern Asia, bordering the East China Sea, Philippine Sea, South China Sea, and Taiwan strait, north of the Philippines, off the south eastern coast of China and spans a total area of 35 980 km<sup>2</sup> with a total land area of 32 260 km<sup>2</sup> and water that occupies 3 720 km<sup>2</sup> (Central Intelligence Agency, 2020c). It has an estimated population of 23.6 million (2020 est.) and is the second-most densely populated country in the world, with an urban population of 78.9% (2020 est.) and a low unemployment rate of 3.8% (Central Intelligence Agency, 2020c).

Taiwan has a dynamic capitalist economy with marked industrial growth that has been driven largely by its huge industrial manufacturing sector and a prolific export market and as a result has the world's fifth largest foreign reserves with a GDP of \$1.14 trillion in 2019 (Central Intelligence Agency, 2020c). In 2019, Taiwan was ranked as the 17<sup>th</sup> richest country in the world based on per capita income and adjusted for purchasing power.

The island has limited land space with limited deposits of coal, natural gas, limestone, marble, asbestos, arable land, with a small agriculture market that only contributes 2% to its GDP. This is why Taiwan is largely driven by the industrial manufacturing of electronics, communications and information technology products, petroleum refining, chemicals, textiles, iron and steel, machinery, cement, food processing, vehicles, consumer products, and pharmaceuticals (Central Intelligence Agency, 2020d).

Taiwan has a singular culture and language since its inception in 1948 through decades of martial law until political change and the first democratic legislative elections in 1992, the first in over forty years, and subsequently its first direct presidential election in 1996 (Central Intelligence Agency, 2020c). Since then, the country and its civil systems have prospered and Taiwan is now one of the biggest investors in China (Central Intelligence Agency, 2020c).

Taiwan, as a very populous, highly industrialised and wealthy nation, unfortunately has a lack of fossil fuel reserves and limited space for landfill, that presents a heavy environmental burden (Chen & Houn, 2004). For this reason, its waste disposal policies had to shift away from conventional end-of-pipe treatment methods such as landfill and incineration to newer methods that support waste minimisation and optimal resource utilization (Chen & Houn, 2004). As a wealthy nation, they are able to pay for more expensive and technologically advanced waste management solutions.

As a developed country, Taiwan has made notable progress in waste management and is progressively improving with years of efforts through the establishment of rules and regulations in support of integrated waste management, notwithstanding great technological advancements for waste treatment (Houn, 2003). Some of the major drivers informing their waste policies and diversion of waste from landfill is land scarcity and lack of fossil fuel reserves.

#### **3.4.3.2 Waste management challenges in Taiwan**

Taiwan is faced with a number of prominent environmental challenges as a result of rapid economic growth (Lu *et al.*, 2006; Wichai-utcha & Chavalparit, 2019; Wong, 2017). These include air and water pollution from industrial emissions, raw sewage; contamination of drinking water;

trade in endangered species; and low-level radioactive waste disposal (Central Intelligence Agency, 2020c).

Historically most wastes were disposed of in poorly designed landfill sites or on open ground as streets were sprawled and clogged with waste and infested with rats and insects, with no environmental or health considerations (Houng, 2003; Kaosol, 2009; Middlehurst, 2019). These poor waste management practices led to the island being nicknamed “Garbage Island” (Middlehurst, 2019).

Over the past few decades, due to concerted efforts by government and civil society, new stringent waste regulations and policies have been implemented, and Taiwan now enjoys great success with integrated waste management systems (Houng, 2003; Wong, 2017). For this reason, Taiwan now has one of the world’s highest recycling rates of 55%, which is highly commendable considering the historical poor waste management and the fact it is so densely populated with a highly industrialised urban population with no energy reserves nor do they have space for landfill sites (Chen & Houng, 2004; Middlehurst, 2019).

#### **3.4.3.3 Waste management in Taiwan**

In 1974, Taiwan promulgated its first Waste Disposal Act (WDA), which has undergone several amendments remains the fundamental law for solid waste management (Houng, 2003; Su, 2018). The WDA was followed by strict guidelines and regulations promoting recycling and a circular economy (Lin *et al.*, 2006; Su, 2018). Efforts in promoting a circular economy focused mainly on increasing resource efficiency and reducing environmental impact at every stage of the product lifecycle, which is mainly due to the fact that the island has very few resources (Su, 2018). Since 2003, Taiwan has implemented zero waste policies and strategies in support of a green economy, waste minimisation, recycling, and reuse and recovery to further promote effective utilisation of resources (Wong, 2017).

An amendment to the WDA in 1988 brought a major shift in the trajectory of waste management when the government introduced the extended producer principle (Houng, 2003). This placed an obligation on manufacturers to pay for the disposal of products and packaging after being used by consumers (Chen & Houng, 2004). This also brought about the opportunity for manufacturers in the same industries to enter into joint projects for recycling and to implement improved waste management practices that consequently resulted in a rapid increase in recycling rates (Lu *et al.*, 2006).

In 1984, “*The Guideline to the Disposal of Urban Garbage*” introduced a six-year plan for disposal of garbage offering subsidy incentives to local government to build garbage disposal facilities.

This resulted in 179 landfills being built, resulting in a profound increase of the garbage disposal rate from 24% to 56% of the plan period (Chen & Houn, 2004; Houn, 2003). This success was short-lived as these landfills consumed much of the limited land space in Taiwan (Houn, 2003). Further attempts to address the problem led to the promulgation of the “*Guideline to Garbage Disposal*” in 1999, which set out directions for incineration as a first disposal option with landfill as an alternative (Houn, 2003). Subsequently, the government invested in 21 public-owned incineration plants, that resulted in an increase in garbage disposal rate from 60% in 1987 to 93% in 2001 (Houn, 2003) .

To further enhance on the extended producer responsibility, the 4-in-1 recycling programme was initiated by the Environmental Protection Administration (EPA) and implemented in 1997 in an attempt to co-ordinate recycling efforts among community residents, municipalities and recycling companies (Yang & Innes, 2007). This increased recycling rates from 5.78% in 1998 to 12.72% by 2001 (Houn, 2003; Young *et al.*, 2009).

Some further enhancements in waste governance, regulation, and policy-setting included the 2001 “*Pay-as-you-throw*” regulations, which forced residents to pay for garbage collection based on the amount of waste thrown away (Chen & Houn, 2004). During the same year the EPA began promoting the separation of food waste (Middlehurst, 2019).

In 2002, the Resource Recycling Act (RRA) came into effect focused on upstream waste management and resource recycling to comply with international trends towards sustainable development. Taiwan has subsequently introduced restrictions on the use of plastic shopping bags and plastic dishes resulting in a 20% decrease in plastic bag use (Chen & Houn, 2004) .

The once nicknamed the “*Garbage Island*”, Taiwan now boasts a successful, effective, and efficient implementation of integrated waste management laws, regulations, and policies (Middlehurst, 2019). Some of this success can be attributed to Taiwan’s separation-at-source policy, investment in collection, transportation, and treatment infrastructure, notwithstanding community involvement and growing environmental awareness (Lu *et al.*, 2006). Most waste collected is being incinerated for energy recovery; biowaste now finds secondary use in the agricultural sector; raw waste is composted to create fertiliser, while cooked waste is used as livestock feed in order to minimise waste disposal to landfill (Houn, 2003; Middlehurst, 2019).

Taiwan has also promoted a circular economy focused on increasing resource efficiency and reducing environmental impact at every stage of the product or service lifecycle (Su, 2018).

Taiwan’s waste management policy is based on the notion of a cradle-to-cradle approach in support of zero waste (Su, 2018; Wong, 2017). It contains five major components: sustainable

consumption and production, increased resource efficiency, promoted consumer benefits, sustainable management of materials, and waste to energy generation (Su, 2018). Additional waste management measures implemented over the past 10 years, such as reduced use of plastics, plastic recycling, and municipal solid waste incineration, e-waste recycling, and waste to energy projects, have positively contributed to successful waste management (Su, 2018; Wong, 2017).

The Taiwanese government also emphasised urban population planning to reduce the population density which is beneficial to prevent excess waste generation. The country's waste management systems recycle almost 55% of wastes (Middlehurst, 2019)

Taiwan has introduced comprehensive and stringent waste policies to ensure waste management practices are agile and responsive in support of a circular economy.

#### **3.4.4 Evolution of waste management in Nigeria**

The sub-sections provide an overview of the evolution of waste management in Nigeria.

##### **3.4.4.1 Country overview: Nigeria**

Nigeria is a West African country located on the Gulf of Guinea (IMF, 2019). The country shares borders with Niger in the North, The Republic of Benin in the West, Chad and Cameroon in the East and a coastline to the South (Central Intelligence Agency, 2020e). It has an estimated population of 214 028 million making it the most populous country in Africa and the 6th most populous in the world, with an urban population of 52% (Central Intelligence Agency, 2020e) Nigeria is also a major producer of crude oil, with a GDP of \$1.03 trillion in 2019, and as such has the wealthiest economy in sub-Saharan Africa. (Central Intelligence Agency, 2020e).

Nigeria, a former British colony, gained independence in 1960 and has a history of civil strife, political instability, corruption, inadequate infrastructure and poor economic management (CountryWatch Incorporated, 2020). Some of the country's most volatile conflicts have been linked to ethnic, regional, and religious divides (CountryWatch Incorporated, 2020). Despite the wealth of crude oil production and reserves, 62% of the country's population still live in poverty, with an unemployment rate of 16.5% with little effort made to improve living conditions (Ike *et al.*, 2018).

Like South Africa, Nigeria has a great diversity of ethnic groups with very different languages and traditions and as a nation its borders are the result of colonial imposition (Central Intelligence Agency, 2020e). The Nigerian Civil War (1967-1970) was sparked by the attempted secessionist state of Biafra (CountryWatch Incorporated, 2020). Politics were marked by coups, military rule,

until the death of the military head of state in 1998, then in 1999, a new constitution was adopted and a peaceful transition to civilian government was completed (CountryWatch Incorporated, 2020). The country remains beset with corruption and civil strife and remains largely underdeveloped despite its reserves of crude oil. (Central Intelligence Agency, 2020e; CountryWatch Incorporated, 2020).

#### **3.4.4.2 Waste management challenges in Nigeria**

Nigeria is a severely polluted country, facing significant waste management challenges (Babayemi & Dauda, 2009; Onu *et al.*, 2012; Owolabi, 2003; Uwagbale, 2016). Its rapid population growth and urbanisation has led to an unprecedented growth in the economy, resulting in a detrimental effects on human health and the environment (Onu *et al.*, 2012).

Poor waste management practices have reached dismal heights as residents and visitors alike are confronted with a combination of hazardous and general waste heaps in the streets and indiscriminately dumped in waterways and on most vacant lands (Ezechi *et al.*, 2017; Owolabi, 2003). Major crude oil spill incidents, pipeline leakages and the illegal import and dumping of toxic wastes in the country have exacerbated the environmental damage (Ike *et al.*, 2018; Sridhar *et al.*, 2017). Additionally, most of Nigeria's cities do not have proper sewage systems and discharge sewage and grey water directly into open drains leading directly to rivers, streams and the sea (Sridhar *et al.*, 2017). For this reason, many of the country's cities have been ranked among the world's dirtiest and worst cities in which to live (Ike *et al.*, 2018).

These poor waste management practices are not only aesthetically displeasing but presents deplorable and unsanitary health and environmental threats (Ike *et al.*, 2018; Yusuf *et al.*, 2008). In addition, many industries discharge their solid and liquid wastes, oils and chemicals irresponsibly into waterways and on lands (Sridhar *et al.*, 2017).

Further waste management challenges include poor collection and disposal of wastes, poorly constructed and maintained landfill sites, lack of financial and technical support, lack of compliance and enforcement of existing laws, lack of waste data, lack of private sector participation, poor remuneration and lack of competent staff in the waste sector (Afun, 2009; Ike *et al.*, 2018). To this add extreme poverty, lack of education and training and awareness, political instability and corruption (Afun, 2009; Babayemi & Dauda, 2009; Ike *et al.*, 2018; Ogwueleka, 2009; Yusuf *et al.*, 2008). In 2019, Nigeria's solid waste collection was only 10% with its recycling industry primarily dependent on waste pickers (Urban Development Series, 2018).

Nigeria is also a huge importer of used electrical and electronic equipment (UEEE) from developed countries, compounded by the fact that there are no collection centres, nor do they

have the necessary infrastructure in place to treat or recycle this waste (Nnorom & Odeyingbo, 2020). Much of this imported UEEE have reduced lifespans or are non-functional and, consequently, Nigeria was an international dumping ground for electronic waste (Nnorom & Odeyingbo, 2020; Uwagbale, 2016). To stem this problem, the Nigerian government passed the National Environmental Regulations in 2011, which bans the import of e-waste and provides guidelines on e-waste management (Izoukumor, 2019; Uwagbale, 2016).

Despite its economic wealth, Nigeria, today still faces significant waste management challenges and has not evolved a viable environmental policy nor strong legal framework for the protection of the environment.

#### **3.4.4.3 Waste management in Nigeria**

Waste management challenges in Nigeria are not necessarily attributed to the absence of legislation, as there exists a plethora of policies, legislation and strategies in support of environmental protection, inclusive of waste management (Uwadiogwu & Chukwu, 2013; Uwagbale, 2016).

With the rise in population, urbanisation, and industrialisation alongside globalisation, the challenge of urban solid waste management has escalated with its attendant human health and environmental problems (Egberase, 2016). Nigeria is signatory to many international environmental and waste treaties and conventions and most of Nigeria's environmental laws are based on norms and principles of international law (Nwufo, 2010; Uwagbale, 2016). While waste regulation and policy in the country exists, and may be well defined, execution and enforcement is hugely lacking (Uwagbale, 2016).

Historically various legislation has been enacted to safeguard public health and the environmental sanitation of the towns, mainly through the Public Health Act of 1958, as amended in 1978 to make provision for solid waste management (Sridhar *et al.*, 2017). Following Nigeria's independence in 1960, waste management experienced many challenges, such as maladministration, inadequate infrastructure, local government inability to bear the cost of waste management, the reliance upon central state funding and lack of public agencies, such as police, for local enforcement of laws and by-laws on waste disposal (Sridhar *et al.*, 2017). Nigeria's Third Development Plan (1975-1980) was a milestone in terms of policy setting for environmental protection. However, at the time there were no laws to support the policy objectives (Owolabi, 2003). That was until the unfortunate incident of dumping of toxic waste from Italy at Koko port in the then Bendel state in the 1988 (Nwufo, 2010).

Since the late 1980s there have been some efforts to propel Nigeria to positive environmental protection management and regulation footing and towards a regime of sustainable development (Sridhar et al., 2017). This aspiration culminated in the establishment of the Federal Environmental Protection Agency (FEPA) and its inspectorate and enforcement department in 1991, which provided an institutional framework, both legal and administrative, for the enforcement and execution of environmental policies and legislations (Adelegan, 2002; Sridhar et al., 2017; Uwagbale, 2016).

Article 24 of the African Charter of 1982 marked the infancy of environmental protection in Nigeria with the declaration all citizens have the right to a satisfactory environment favourable for their development (Izoukumor, 2019). However, it was only with the introduction of the Decree 58 of 1988, the Federal Environmental Protection Agency (FEPA) was established, marking the country's first attempt at sound environmental management (Akamabe & Kpae, 2017; Sridhar et al., 2017; Uwagbale, 2016). Since then the FEPA has promulgated several regulations and policies relating to pollution control and waste management (Adelegan, 2002; Owolabi, 2003).

One of the more notable advancements in support of sustainable development was the 1989 National Policy on the Environment, which was followed by several other regulations, such as the National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulation 1991, Harmful Wastes (Special Criminal Provisions) Act 1990 and various other initiatives to specifically address waste management challenges in support of environmental protection (Sridhar et al., 2017).

In 1999, the Constitution of the Federal Republic of Nigeria (CFRN) included in section 20 an obligation on the government “to protect and improve” the environment (Izoukumor, 2019). During the same year, the Federal Ministry of Environment (FMEnv) was established to ensure effective co-ordination of all environmental matters in the country (Onu et al., 2012). Then in 2007, the National Environmental Standards Regulatory and Enforcement Agency (NESREA) was established as the main enforcement body (Onu et al., 2012; Uwagbale, 2016).

Some of the latest advancements made in terms of waste management include a review of the National Policy on the Environment established, which introduced economic instruments relating to waste management, such as a polluter pays principle and user pays principle (Onu et al., 2012; Uwagbale, 2016).

Nigeria does not lack waste management laws and policies, however, its waste management initiatives have failed (Afun, 2009). One of the inherent impediments hindering effective implementation of environmental protection laws and policies is the lack of basic facilities and

funds and lack of political will (Owolabi, 2003; Uwagbale, 2016). According to Uwagbale (2016), effective implementation of the environmental protection laws in Nigeria is *“due to lack of political will, political interplay and the mentality of primitive accumulation of wealth by various corrupt government officials and public office holders”* (Uwagbale, 2016).

### **3.4.5 Evolution of waste management in Thailand**

The sub-sections provide an overview of the evolution of waste management in Thailand.

#### **3.4.5.1 Country overview: Thailand**

Thailand is situated centrally in the Southeast Asian Indochinese Peninsula (IMF, 2019), bordering the East China Sea, Philippine Sea, South China Sea and Taiwan Strait, North of the Philippines (Central Intelligence Agency, 2020b). The country spans a total area of 513 120 km<sup>2</sup>, with an estimated population of 66 million (Central Intelligence Agency, 2020b). Thailand is the 50<sup>th</sup> largest country in the world by land area, and 88<sup>th</sup> in the world in terms of population density with 132.1 people per km<sup>2</sup> (Central Intelligence Agency, 2020b).

Thailand is the only Southeast Asian country that managed to escape colonial rule by a European power (Central Intelligence Agency, 2020b). Historically, the country has suffered gravely from political turmoil, and has been under military rule for most parts since 1947, notwithstanding a number of military coups and other political insurgencies (Central Intelligence Agency, 2020b). Today they are politically stable and strategically positioned in the Asian market with well-developed infrastructure (Keyes, 2020).

Thailand was first among the Southeast Asian nations to introduce industrialisation policies in support of foreign investment (Environment Agency, 1999). This has subsequently led to remarkable progress in socio-economic development, moving the country from a low-income to an upper-income country in less than a generation with a GDP of \$1.28 trillion in 2019 (Central Intelligence Agency, 2020b). Thailand has been heralded as having one of the fastest growing economies, displaying sustainable growth (Keyes, 2020). The country has well-developed infrastructure and is highly reliant on exports of goods such as electronics, agricultural commodities, automobiles and parts, and processed foods that accounts for 90% of its GDP, whilst agriculture accounts for 10% of its GDP, but employs one-third of the labour force (Central Intelligence Agency, 2020b).

Thailand is very rich in agriculture with an estimated 41.2% of the land used for agriculture and is the world biggest rice exporter (Central Intelligence Agency, 2020b), notwithstanding a vast amount of natural resources including tin, rubber, natural gas, tungsten, tantalum, timber, lead,

fish, gypsum, lignite, fluorite and arable land (Central Intelligence Agency, 2020b). Thailand is a large producer of natural gas, with reserves of at least 7 trillion cubic feet (U.S. Energy Information Administration, 2017). They are also huge producers of oil and petroleum products, however they are heavily reliant on hydrocarbon imports to sustain their rising fuel demand (U.S. Energy Information Administration, 2017).

Thailand has made significant progress towards poverty reduction, that declined from 65.2% in 1988 to 9.85% in 2018, with an unemployment rate of only 0.99% reported in 2019 (Central Intelligence Agency, 2020b). They also have an urban population of 51.4%, with only 7.2% of the population living below the poverty line (Central Intelligence Agency, 2020a). Thailand enjoys a singular uniting language (90.7% Thai), ethnic group (97.5% Thai), and majority Buddhist religion (94.6%) (Central Intelligence Agency, 2020b).

Whilst Thailand is now a socially and politically stable country, with great economic wealth, it has a large focus on agriculture, hence waste disposal to landfill would not be a favorable waste management option, even though they have an abundance of land available. Additionally, they have an abundance of natural gas, however due to their high electricity demand, they are importing electricity. WTE would therefore be advantageous either, considering its high energy demand. For these reasons, their waste policy drivers would not necessarily be applicable to South Africa.

#### **3.4.5.2 Waste management challenges in Thailand**

Thailand's rapid economic growth coupled with urbanisation, industrialisation and heavy agricultural production over the past three decades has led to significant environmental challenges (Environment Agency, 1999; Kamuang & Siriratpiriya, 2017; Nik, 2010). There has been a marked increase in volumes and complexity of waste generation from domestic and industrial sectors, resulting in increased degradation of natural resources (Wichai-utcha & Chavalparit, 2019). Further negative effects include poor air quality, polluted water bodies due to industrial and domestic discharge, water scarcity, natural resources exploited by land conversions, slash and burn agriculture leading to deforestation and soil erosion, and a notable decline in wildlife populations (Nik, 2010).

Some of the most significant waste management challenges in the country include open-air city centre dumps, low waste collection coverage, lack of available waste transport services, illegal waste dumping, open burning of waste, lack of treatment and disposal facilities, inadequate waste segregation, poor recycling facilities, rampant overuse of plastic grocery bags, marine pollution with plastics, improper waste disposal, illegal trafficking and dumping of industrial hazardous

waste, illegal import of hazardous waste and e-wastes, and a marked increase in imports of plastic waste since the China ban on waste imports in 2017 (Kaosol, 2009; Pollution Control Department (Thailand), 2019; Wangwongwatana). Thailand is not only among the largest plastic manufactures in Asia, but also a major importer of plastic waste both legal and illegal (Ocean Conservancy, 2017). The result is the country is regarded as one the top marine polluters globally (Pollution Control Department (Thailand), 2018). Not only does plastic kill marine life and choke seabirds, but toxic fragments from plastic can end up in seafood intended for human consumption. It also requires decades to break down in the environment (Ocean Conservancy, 2017).

According to Simachaya (2017), waste management challenges in Thailand can be attributed to a number of factors, such as change in government leading to a change in waste management policy, lack of support on the political front, struggles within local authorities, difficulties in changing human consumption behaviour and too many waste management laws; and even the constant striving for greater technological advancements may not necessarily provide the solution to the countries waste management challenges (Simachaya, 2017).

While major advancements have been made in integrated waste management law and policy setting, aligned and in support of global trends, Thailand is still faced with major waste challenges. As noted above, some of these have been attributed to change in government, lack of political will and conflicts between local authorities, and the difficulty of changing human behaviour (Kamuang & Siriratpiriya, 2018).

### **3.4.5.3 Waste management in Thailand**

In recognising the environmental and waste challenges, Thailand has progressively implemented several policies, laws, strategies and plans relating specifically to waste management and pollution control. These include provisions in the 2007 Constitution of the Kingdom of Thailand for environmental protection and waste prevention (PCD, 2020).

Thailand's first attempt at addressing its environmental challenges at a national level was through the enactment of The National Environmental Quality Act of 1975 and the subsequent Industrial Estate Act of 1979 that includes specific waste regulations aimed to govern hazardous waste practices within industrial estates (Environment Agency, 1999; Nik, 2010).

However, it was only in 1981, when the government announced the National Environmental policy, that a more integrated approach towards sustainable development was introduced, aimed at preserving nature and natural resources and harmonising social and enhancement of the environment. (Environment Agency, 1999) Despite its good intent, this failed to meets its

objectives due to rapid industrialisation in the late 1980s, which further increased environmental pollution (Environment Agency, 1999).

With the mounting local and global waste challenges, Thailand had an upsurge in policies and regulations governing waste in the 1990s. This led to the inclusion of 'a better quality of life and environment' in the 7<sup>th</sup> National Economic and Social Development Plan (1991-1996) and reinforced a government commitment to environmental conservation (Environment Agency, 1999).

In 1992, the Factory Act gave effect to specifically regulate factory operations and set out compliance requirements for factories, such as handling and disposal of hazardous wastes and issuing of permits through its hazardous waste regulations. Historical environmental regulations were repealed and replaced with the Enhancement and Conservation of National Environmental Quality Act of 1992, which became the country's only environmental law (Environment Agency, 1999; Nik, 2010). This Act was specifically to promote environmental protection through prevention, remediation and mitigation of pollution control via the polluter pays principle (Nik, 2010). It also introduced pollution control areas, identified as areas with serious pollution problems in need of redress (Environment Agency, 1999). These areas were also entitled to receive funding from government or loans for implementing waste and pollution mitigation measures. Incentives were introduced to promote private sector environmental management such as tax measures and environmental lending funds (Nik, 2010).

In 1996, the National Environmental Basic Plan was introduced, and by 2003 criteria for the characterisation of waste came into effect (Kaosol, 2009). Thailand has further progressed and developed regulations in support of the waste management hierarchy and developed waste management plans. These include the 2014 Roadmap On Waste and Hazardous Waste Management, the National Solid Waste Management Master Plan (2016-2021) and the 2016 Action Plan Thailand zero waste (Funatsu, 2019; Simachaya, 2020).

The National Solid Waste Management Master Plan (2016 - 2021) is underpinned by the concept of 3R (reduce, reuse and recycle) (Simachaya, 2017). The plan aims to encourage both the private sector and civil society including children, to reduce waste at source by following the 3R principles (Kerdsuwan, 2017; Sasaki, 2020). It further seeks to establish proper disposal methods for all waste streams with an emphasis on waste to energy methods, and the inclusion of all sectors to participate in proper waste management practices (Kerdsuwan, 2017; Pollution Control Department (Thailand), 2018; Simachaya, 2017).

The National Solid Waste and Hazardous Waste Management Master Plan specifically defines goals and strategies for solid waste management (Simachaya, 2017, 2020). Some of the key elements of the plan include review and analyse the existing waste management systems and programmes to address key waste issues, assess future needs, to identify new waste management trends, costs and approaches, and, lastly, it sets out to explore options and opportunities to boost and strengthen the 3R principles (Kamuang & Siriratpiriya, 2017). The current plan also has several goals to support waste management throughout its lifecycle by focusing on the local community to achieve utilisation of more than 75% of municipal solid waste by the end of 2021 (Funatsu, 2019).

The National 3R principles were introduced to promote environmental conservation, to reduce the quantity of waste by applying a more integrated waste management approach in support of the 3R as a strategy (Kamuang & Siriratpiriya, 2017). Its primary focus is to promote the concept of the 3R (reduce, reuse and recycle) in an effort to achieve effective use of resources (Kamuang & Siriratpiriya, 2017). The 3R strategy includes market-based approaches such as waste banks to enhance collection of waste (Wichai-utcha & Chavalparit, 2019). Material Recovery Facilities (MRF) and Mechanical-Biological Treatment (MBT) are examples of designated waste separation facilities that have been implemented (Yukalang *et al.*, 2018). Recycling facilities such as refuse derived fuels (RDR) and industrial scale incinerators have also been introduced (Yukalang *et al.*, 2017). Incinerators have offered not only the advantage of resolving geographical constraints, but is also a more hygienic waste disposal method with added value as a viable source of both heating and energy (Simachaya, 2017; Yukalang *et al.*, 2017). According to Kamuang and Siriratpiriya (2018), the country currently boasts eight small-scale incinerators, two with pollution control systems in place and one with WTE capability. In addition, they have 12 integrated systems using a combination of biological treatment and recycling (Kamuang & Siriratpiriya, 2018).

Thailand introduced the 2016 Action Plan, Thailand Zero Waste (2016 – 2017) and 2017 Action Plan, Clean Province plan that strive to unlock, promote and support waste utilisation in support of the 3R Policy (Simachaya, 2020). These plans specifically focus on minimising waste through separation at source initiatives, establishing an effective waste management database, implementing measures to deal with improper waste disposal methods by communities and management measures for industrial and infectious wastes (Pollution Control Department (Thailand), 2018). The Thailand Zero Waste Action Plan is also intended to establish proper disposal methods for municipal solid waste and household hazardous waste by using centralised facilities for clusters of municipalities, emphasising waste utilisation and waste-to-energy methods (Simachaya, 2017). As with the National Solid Waste Management Master Plan (2016 - 2021), it also encourages citizens and the private sector to reduce waste at the source by following the

3Rs concept. One of the primary focus areas to attain this is through waste separation at source supported by the updated Maintenance of Public Sanitary and Order Act (no.2) B.E. 2560 (2017) (Kamuang & Siriratpiriya, 2018).

In July 2017, when China banned imports of many recyclable wastes, countries started diverting their e-waste and plastic waste to Thailand, resulting in huge influx of these wastes into the country (Sasaki, 2019). In response to the plastic waste challenges, the Roadmap on Plastic Waste Management (2018-2030) was introduced (Ullrich, 2020).

In June of 2018, Thailand's issued a prohibition on further imports of electronic and plastic waste with immediately effect and put forward the current National Economic and Social Development Plan (2016 - 2021) (Simachaya, 2020). In addition, Thailand introduced the 20-Year Pollution Management Strategy with three main strategic goals namely; waste prevention and reduction at source; increasing efficiency in waste treatment and pollution control at source; and development of a waste management system (Pollution Control Department (Thailand), 2018). This strategy is based on the principles of an integrated waste management framework inclusive of the 3R Policy, a circular economy and the PPP (Pollution Control Department (Thailand), 2019).

As a developing country, faced with many of the socio, economic and political challenges faced by many developing countries, Thailand has made great progress with its sustainable and integrated waste management system through its polices, laws, strategies and plans.

### **3.5 Chapter summary**

The chapter above provides an overview of waste management challenges and waste management laws, policies and strategies implemented over the years in the countries selected in response to global and local waste management challenges.

Both developed and developing countries have historically had poor waste management practices. Rapid urbanisation and industrialisation have worsened these problems due to more complex wastes being generated, resulting in both environmental degradation and threat to human health.

In response to these global and local waste management challenges, numerous policies, laws, and strategies, relating to integrated waste management have been generated in both developed and developing countries. These have all evolved over the years in response to the growing international waste management initiatives, treaties, conventions, and accords.

In principle, these initiatives are well grounded and formulated, at least on paper. Implementation, monitoring and enforcement in developed countries have confirmed that great success can be

achieved, as is evident from statistics in support of these targets and initiatives. Developing countries on the contrary still struggle tremendously with effective implementation as they display some common circumstances such as political instability, poor societies, with high unemployment rates, lack of compliance and enforcement, corruption, lack of funds, technology, infrastructure, skills, education and awareness, as well as lack of basic waste collection services to mention a few.

## CHAPTER 4 RESULTS AND DISCUSSION

### 4.1 Introduction

Chapter 4 provides the results and discussions related to the two research objectives:

- **Research objective 1:** Critically evaluate the changes in the National Waste Management Strategy (NWMS) over time; and
- **Research objective 2:** Comparatively assess the evolution of the South African NWMS with international policies and strategies.

Results related to the literature review, which formed part of the methodological scope of this study, are outlined in Chapter 3.

### 4.2 Results related to RO1: Critical evaluation of the changes in the South African NWMS over time

The evolution of the South African NWMS has been informed by the progressive development of the strategic goals as reflected in Table 4-1 below. The South African waste legislation has been influenced and informed by the key elements of the waste hierarchy, which dictates the overall strategic approach for waste management. Integrated waste management and planning in South Africa has been primarily guided by the NWMS and regulated by the National Environmental Management: Waste Act (NEMWA). The NWMS and similarly the NEMWA through its various amendments, has evolved over time driven by local needs and international responses to integrated waste management and planning.

Table 4-1 summarises the evolution of the strategic goals of the South African NWMS since its inception in 1999 to its 2011 and the latest iteration of November 2020.

**Table 4-1: Strategic goals of the 1999, 2011 and 2020 NWMS**

| 1999 NWMS                                                                                                                                               | 2011 NWMS                                                                                                            | 2020 NWMS                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Effective Institutional Framework and Legislation</li><li>• Pollution prevention, waste minimisation,</li></ul> | <ul style="list-style-type: none"><li>• Promote waste minimisation, reuse, recycling and recovery of waste</li></ul> | <ul style="list-style-type: none"><li>• Waste minimisation: with a focus on waste prevention and building a secondary resources economy</li></ul> |

| 1999 NWMS                                                                                                                                                                                                                                                                                                                                                                                  | 2011 NWMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2020 NWMS                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>impact management and remediation</p> <ul style="list-style-type: none"> <li>• Holistic and integrated planning</li> <li>• Participation and partnerships in integrated pollution and waste management governance</li> <li>• Empowerment and education in integrated pollution and waste management</li> <li>• Information management</li> <li>• International co-operation.</li> </ul> | <ul style="list-style-type: none"> <li>• Ensure effective and efficient delivery of waste services</li> <li>• Grow the contribution of the waste sector to the green economy</li> <li>• Ensure citizens are aware of the impact of waste on their health, well-being, and the environment</li> <li>• Achieve integrated waste management planning</li> <li>• Ensure sound budgeting and financial management for waste services</li> <li>• Provide measures to remediate contaminated land.</li> </ul> | <ul style="list-style-type: none"> <li>• Effective and sustainable waste services: focus on local government in ensuring that citizens receive appropriate waste service</li> <li>• Waste awareness and compliance: focus on managing the environmental impact of waste and preventing pollution through changes in behaviour and attitude.</li> </ul> |

The sub-sections below are a synopsis on the goals of each of the NWMSs and focus on the evolution through various amendments.

#### 4.2.1 The 1999 National Waste Management Strategy

The 1999 NWMS presented government's first strategy for integrated waste management in South Africa, provided a long-term plan to 2010 to address the key issues, needs and waste management problems (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 1999). The basis of the NWMS was to identify and assess pollution control and waste management practices in South Africa and in so doing implement measures to mitigate current

poor waste management practices (DEA (Department of Environmental Affairs (South Africa)), 1997; DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000).

For this reason, the 1999 NWMS, and the Integrated Pollution and Waste Management (IP&WM) 2000, for the first time adopted a holistic approach to pollution prevention and integrated waste management, with a focus on sustainable environmental protection (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000). The aim was to reduce both the generation and environmental impact of waste through waste prevention and minimisation, as opposed to historical waste management through the impact management approach. This was the basis of the seven overarching goals of the NWMS and IP&WM as depicted in Table 4-1.

Some of the key goals and objectives included integrated waste management planning, waste information systems, general waste collection, waste minimisation, recycling, waste treatment and disposal, capacity building, education, awareness and communication to promote sustainable development (Department of Environmental Affairs (DEA) (South Africa)), 2009).

These were expected to be implemented by all tiers of government in support of the principles outlined in the NEMA and the Constitution. This marked an important milestone towards integrated waste management planning in South Africa (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 1999).

Table 4-2 below presents a summary of the change in trajectory from historically uncoordinated and uncontrolled waste management practices prior to 1999, to a more sustainable waste management approach post 1999. The objectives were to inform planning of the different tiers of government. Municipalities were to be specifically guided by integrated waste management plans (IWMPs) to primarily budget and plan for issues relating to resources and development, adequate service delivery and on how to plan to implement the waste hierarchy. Another key objective was for the development of and guidelines for a waste database (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 1999).

**Table 4-2: Waste management pre- and post-1999 (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 1999)**

| Pre-1999 waste management approach  | Strategic objectives for Integrated waste management |
|-------------------------------------|------------------------------------------------------|
| Limited focus on control mechanisms | Focus on sustainable environmental protection        |

|                                                     |                                                                           |
|-----------------------------------------------------|---------------------------------------------------------------------------|
| Inadequate waste collection services                | Adequate waste collection services for all                                |
| Adverse effect on the environment and public health | Sustainable protection of the environment and public health               |
| Fragmented approach with single media focus         | Consolidated multimedia approach                                          |
| Conflict of interests                               | Transparency in conflict of interest                                      |
| Insufficient information                            | Integrated waste information system                                       |
| Inadequate environmental planning                   | Holistic integrated planning and capabilities                             |
| Inadequate R&D programmes                           | Focused investigations that take cognisance of cross-cutting implications |
| Regulations inadequately enforced                   | Enforcement facilitated                                                   |
| Full waste management costs not realised.           | Polluter-Pays-Principle and total cost accounting.                        |

The strategy introduced the waste hierarchy based on four different functions in order of preference: waste avoidance and reduction; recovery, reuse and recycle; treatment; with disposal as the least preferred option (Nkosi *et al.*, 2013:304) as depicted in Figure 4-1 below (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000). The waste hierarchy was to evolve into the focal entry point of South Africa's IWMPs, which now are mandatory for all tiers of government under the NEMWA. Prior to this under the 1999 NWMS, IWMPs were formulated on a voluntary basis resulting in little to no success with implementation.



**Figure 4-1: Waste hierarchy from the NWMS 1999 (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 1999)**

One of the most notable outcomes of the 1999 NWMS was the first-ever National Waste Summit in South Africa and the resultant Polokwane Declaration of 2001, aimed at mapping the country's transition to zero waste and accordingly set the goal of reducing waste disposal by 50% and zero waste to landfill by 2022. This target in a South African context, considering its social and economic context with high unemployment and poverty rates does not seem realistic nor achievable as most of the country's waste is still disposed of in landfill sites and very few alternatives of any significance have been introduced over the years. With a lack of access to basic waste collection services and poor population who are unable to pay for such services, this goal seems to be not only visionary, but also unrealistic even in today's terms.

The key strategic goals and objectives of the strategy were not well formulated as goals and targets were unrealistic. On a political front, the South African nation at the time was undergoing a major transition after the apartheid era ended, and had to contend with all that this entailed, including the social and economic impacts. In spite of this, the NWMS did however provide a basis and key entry points towards sustainable and integrated waste management whilst promoting environmental and health protection and proposes the fundamental elements in achieving these goals and objectives.

While the 1999 NWMS was not a legislative requirement and implementation not mandatory and therefore never enforced (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2005) key elements of both the 1999 NWMS and the 2000 IP&WM were articulated into the development of the 2008 NEMWA.

#### **4.2.2 The 2011 National Waste Management Strategy (NWMS)**

Following the voluntary nature of the 1999 NWMS and subsequent inaction by local authorities, the 2011 iteration was made a legislative requirement of the NEMWA with the primary goal to give effect to the objectives of the NEMWA as summarised below:

- minimising pollution, environmental degradation, and the consumption of natural resources;
- implementing the waste hierarchy;
- balancing the need for ecologically sustainable development with economic and social development; and
- promoting universal and affordable waste services (DEA (Department of Environmental Affairs (South Africa)), 2011).

The NWMS was now intended as an enabling strategy manifested in eight strategic goals (Table 4-1), each with associated targets to be met by 2016 thus providing solutions to address the country's waste management challenges (Alberts, 2014; DEA (Department of Environmental Affairs (South Africa)), 2011). Whilst none of the goals of the 1999 NWMS were actually achieved, its introduction of this strategy paved the way for and underpinned some of the objectives of the 2011 NWMS to actively address the waste management challenges. The eight goals therefore build on the 1999 goals, are more specific and provides more clarity in terms of the desired goals. It also recognises the role of government, civil society and private business as a collective in the waste management process.

It also introduced the new internationally endorsed waste hierarchy, which represents an inverted model of the previous 1999 waste hierarchy, and can be linked to concepts of a green and circular economy (Figure 4-2) (DEA (Department of Environmental Affairs (South Africa)), 2011; Mokoena, 2019). The new waste hierarchy was a compelling advancement on the voluntary 1999 waste hierarchy, with waste avoidance and waste reduction as the most preferred waste management option and treatment and disposal as the least preferred option (Nkosi *et al.*, 2013).

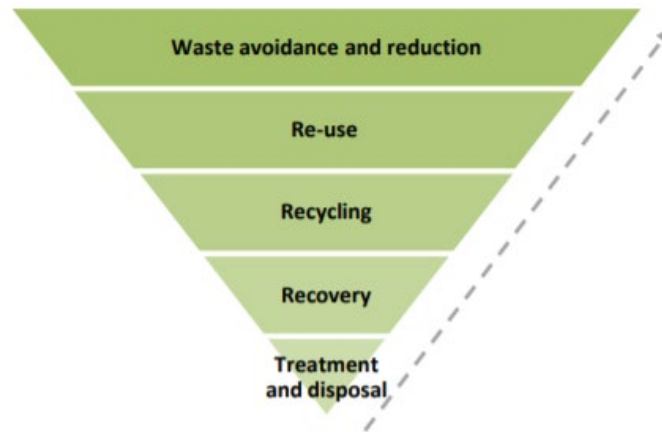


**Figure 4-2: Waste hierarchy from the NWMS 2011 (DEA (Department of Environmental Affairs (South Africa)), 2011)**

The 2011 NWMS also introduced various instruments to promote and implement the goals of the strategy (Mokoena, 2019; Muzenda, 2014). These include the waste classification and management system, norms and standards, licensing of waste management activities, industry waste management plans, extended producer responsibility, waste information system, priority wastes and economic instruments (DEA (Department of Environmental Affairs (South Africa)), 2011; Mokoena, 2019).

The 2011 NWMS focused primarily on local government issues: domestic waste management planning, budgeting, service delivery by municipalities, education and awareness programmes, integrated waste management planning, including remediation of contaminated land (Mokoena, 2019). To this end, most of the actions in the 2011 NWMS were directed at local authorities with little or no actions for the private sector nor civil society. Given this was a mammoth task for authorities to execute and deliver on, the goals were somewhat unrealistic. The strategy also did not consider any provision to improve the waste definition.

To truly understand the physical impact of the 2011 NWMS or lack thereof, reference must be made to the status quo assessment report published in 2019. The report and its results must also be seen against the backdrop of a decade of rampant corruption and mismanagement at all levels of government, political infighting, and a general disregard for enforcement of local by-laws, lack of good governance and ethical behaviour within government agencies (State Capture Commission, 2020). In terms of the 2011 NWMS, the spirit and law makers were willing, but the flesh and implementation on the ground proved weak across all strata of society.

Highlights of the status quo assessment report showed that while South Africa generated 42 million tons of general waste in 2017 only 34% of recyclables were recycled with just 11% of

general waste diverted from landfill (Linkd, 2019). A mere 1% improvement on the 2011 figure of 10% (Department of Environmental Affairs (DEA) (South Africa), 2018). The 2011 NWMS had set a target to divert 25% of waste from landfills for reuse, recycling, or recovery (DEA (Department of Environmental Affairs (South Africa)), 2011). Recycling rates for hazardous waste were even poorer with only 7% of the 38 million tons recycled during the same period (Linkd, 2019).

The inabilities of local authorities at this time is underscored by Godfrey & Oelofse (2017), who stated of the 34% of actual waste recycled, 80%-90% was collected not by local authorities but by an estimated 90 000 informal waste pickers from either kerbsides or landfill sites (Godfrey & Oelofse, 2017). While attempts were made to create awareness and educate the population on litter and waste management, this has failed due to lack of service delivery by municipalities, compounded by a lack of national campaigns to socialise the issues (Linkd, 2011).

The status quo assessment report on the 2011 NWMS further mentions the establishment of the South African Waste Management Information (SAWIS), but despite this waste quality data remains poor (Linkd, 2019).

As a collective, this clearly demonstrates that the process of diverting waste from landfill has been slow, with low recycling rates, and highlights the need for more aggressive strategies in support of diversion of waste disposal in landfill sites. Notably, nearly two decades after its emergence, and the good intent, recycling in South Africa remained in its infancy going into the 2020 iteration of the NWMS.

The 2011 NWMS demonstrates improvement and progression on the 1999 iteration. It has built on the strategic goals and refined these to provide more clarity in terms of its intent as well as desired outcomes. It became a mandatory requirement and explicitly designed to give effect to the NEMWA and as such compliance must be measured.

#### **4.2.3 The 2020 National Waste Management Strategy (NWMS)**

Despite the continued challenges and failures of recent years, the 2020 NWMS is a clear demonstration of the government's determination to succeed. The most prominent change in the 2020 NWMS is the circular economy at its core. It strongly advocates waste minimisation and separation at source initiatives to increase recycling. There is clear recognition of the need to re-orient service delivery away from merely collection and disposal. For this reason, the two distinct strategic entry points of the latest strategy is waste prevention and waste as a resource.

Waste prevention interventions are aimed to reduce waste before it is discarded and around the design and packaging of products by producers, while waste as resource interventions are to

stimulate secondary economic resources and productive economic activity in line with the circular economy ambition.

For this reason, DEFF has updated the waste hierarchy in support of these new key principles, (Figure 4-3 below), which better align with international concepts of reduce, recycle and reuse to promote a circular economy.



**Figure 4-3: Waste hierarchy from the 2020 NWMS (DEFF (Department of Environment Forestry and Fisheries (South Africa)), 2020b)**

The three new overarching goals of the 2020 NWMS (Table 4-1) are intended to articulate core objectives of NEMWA; reduced from eight goals in the 2011 version and can be viewed as an improvement as this should provide for greater focus and coherence across the three tiers of government. With the circular economy at the core, key priorities include waste prevention and waste resource management as waste minimisation strategies to implement the circular economy; industrial symbiosis and extended producer responsibility; separation at source; awareness and enforcement to build a culture of compliance and innovation (DEFF (Department of Environment Forestry and Fisheries (South Africa)), 2020b; Magomola, 2019).

Further strategic changes include addressing the role of waste pickers, advocating approaches to minimise waste through improved product design, better preparation for separation at source initiatives, evaluation of alternative approaches to command and control, and addressing budgetary requirements for alternative waste treatment options, skills gaps as well as budgetary requirements for municipalities associated with effective implementation of the strategy and NEMWA.

It must be kept in mind the achievement or impact of the 2020 NWMS may be critically affected in the short to medium-term by the economic ravages of COVID-19 and the relegation of South African sovereign debt to junk status (National Treasury (South Africa), 2020). These issues are impacting the fiscus nationally, provincially, and locally, leading to a dramatic rise in unemployment and government borrowing and budgetary cuts across the board. Add to this the

real underperformance of implementing the 2011 NWMS and it is difficult to envisage how and by when the goals and strategies of the 2020 iteration will be realised.

Nevertheless, unlike the two previous strategies, the 2020 NWMS involves stakeholders inclusive of government, civil society and private business, which is a great improvement. This more comprehensive and logical approach allows for collective responsibility and accountabilities and may well encourage new business opportunities, create jobs and attract private sector investment; in some respect a counterbalance to the current economic woes afflicting South Africa and a step closer to realising a true circular economy.

The change in objectives of the NWMS over time do reflect a progressive improvement in terms of focus and strategic objectives. Primarily a government strategy at its inception in 1999, the NWMS has clearly evolved into a more comprehensive and inclusive strategy, at least on paper. The strategies have also evolved and to the extent of being aligned with global initiatives such as the circular economy.

There can be no doubt South Africa has clear and honest aspirations through the various iterations of the NWMS, however these appear to be visionary documents as opposed to strategies with achievable goals. The evolution of the South African NWMSs over time, unfortunately appears to be simply updated over time, without effective implementation. Many of the goals have not been achieved, diversion of waste from landfill remains poor as the country's poor and unemployed population is unable to afford more expensive alternatives. Further to this, very few alternative waste management solutions of any significance have been introduced to date. Lack of compliance and enforcement, societal education and change in general, has conspired to blunt the aims of the NWMS since inception in 1999 to today.

#### **4.3 Results related to Research Objective 2: Comparison of the evolution of South African NWMS with international strategies and policies**

The sections below compare how the South African NWMS has evolved in comparison with the evolution of waste management policies, laws and strategies in the developed countries, of Netherlands and Taiwan, and developing countries of Nigeria and Thailand.

##### **4.3.1 Comparison of the evolution of the South African NWMS with the Netherlands**

Since not all countries have same strategies nor timelines associated with development, specific timelines and initiatives during those timelines will be compared in relation to the South African NWMS.

Table 4-3 provides the timelines of some of the key advancements in the evolution of waste management in the Netherlands, which will be further discussed in the following section.

**Table 4-3: The Netherlands waste management progress**

| 1972-2010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2011- 2016                                                                                                                                                                                                                                               | 2017-2020                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• 1919: Waste incineration</li> <li>• 1979: Lansiks ladder (waste hierarchy)</li> <li>• 1990s: Policy shift from disposal to recycling and separate collection of household wastes</li> <li>• 1991: Packaging Ordinance</li> <li>• 1994: Lansik's ladder becomes a legislative requirement</li> <li>• 1995: Ban on 35 waste streams and landfill tax</li> <li>• National Waste Management Plan: LAP (2002-2013)</li> <li>• National Waste Management Plan: LAP 2 (2009–2015)</li> <li>• 2010: Incineration plants had an overcapacity</li> </ul> | <ul style="list-style-type: none"> <li>• 2012: 12 waste incineration plants to process MSW</li> <li>• Waste incinerators with energy recovery: in the form of energy and heat</li> <li>• 2014: Waste to resource programme: circular economy.</li> </ul> | <ul style="list-style-type: none"> <li>• National Waste Management Plan: LAP3 (2017-2027)</li> <li>• A Circular economy in Netherlands by 2050</li> <li>• Develop new production methods, design new products, and organise areas differently</li> <li>• Promote new ways of consumption of generally available raw materials.</li> </ul> |

| 1972-2010                                                                                            | 2011- 2016 | 2017-2020 |
|------------------------------------------------------------------------------------------------------|------------|-----------|
| <ul style="list-style-type: none"> <li>1972-2003: Waste collection fees increase by 270%.</li> </ul> |            |           |

The Netherlands is renowned as the first Western European country with separate waste collection, dating back to 1972, and a waste hierarchy since 1979 (Oldenziel & Veenis, 2013). The quick acceptance of recycling in the Netherlands shows how the ideology of environmental awareness and engagement was built on the tradition of thrift and reuse.

In 1979, the Netherlands developed and introduced the first waste hierarchy model, the Lansik Ladder (Figure 4-4), which provided a priority order for waste management: prevention, reuse, useful application, incineration and, lastly, landfill as the least preferred option (Van Eijndhoven *et al.*, 1985).

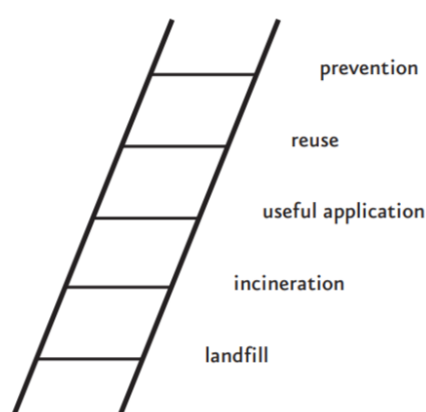


**Figure 4-4: Ladder of Lansik (Van Eijndhoven *et al.*, 1985)**

South Africa significantly lagged behind the Netherlands during the 1970s with the absence of separate waste collection systems, formal waste recycling initiatives, and waste incineration capacity. During this time, pollution control was merely managed through impact management as set out in the NWA and the ECA. This also marked a period when the country was facing challenges due to social segregation and disenfranchisement.

It took South Africa another 20 years after the Netherlands introduced the waste hierarchy, and a complete change in the political landscape to initiate the 1999 South African NMWS and, for the first time, introduced a waste hierarchy to promote more integrated waste management and planning.

The Netherlands also takes pride in its technological advancements since 1919, when they already used waste incinerators to treat wastes (Wong, 2014). The lack of available land space for landfill disposal is the main driver of these technological advancements. Today, they pride themselves with waste incineration plants that generate heat and energy to the extent that wastes from other countries are imported to keep the incinerators running (Cimpan *et al.*, 2015; Wong, 2014). As a huge consumer of energy, limited landfill space and lack of natural resources, WTE is most certainly the preferred waste management option. Technological advancements were also made possible as Netherlands is an economically stable country and capital investments were made possible for these alternatives. Introduction of landfill tax, and prohibitions of waste streams were made possible due to the fact that other waste treatment alternatives were available in the form of separate waste collection facilities, recycling and waste treatment facilities and its rich nation is able to pay for these more expensive options. These can be considered as major drivers that led to its successful diversion of waste from landfill and high recycling rates that have earned its place as a global leader in waste management.

Today, South Africa continues to dispose approximately 90% of its waste in poorly designed and unlicensed landfill sites continuing to negatively affect the environmental and health of people. This is largely due to technological and capital constraints, which makes it difficult for the country to adequately advance the waste hierarchy. In addition, South Africa has a significantly higher unemployment rate when compared to Netherlands, and therefore its society cannot easily afford more expensive solutions for waste management.

South Africa significantly lags behind the Netherlands in terms of technological advancements as it is too expensive, which presents challenges with efforts to move up the waste hierarchy. To date waste to landfill is still the preferred and cheapest waste disposal method, with less than 60% of the population having access to basic waste collection services as municipalities struggle with lack of resources and funding. To add to this, separate waste collection and recycling facilities are not readily available, which are also key drivers to move up the waste hierarchy. Landfill tax and a ban on waste to landfill similar to what was introduced in Netherlands, is a concept that cannot be readily introduced in South Africa due to high poverty and unemployment rates where the population is unable to pay for such services.

Notably, the Netherlands only underwent a major policy shift from disposal to recycling and separate collection of household wastes during the 1990s (Goorhuis *et al.*, 2012). During the same period, the South African waste policy development was still in its infancy. It was only in 1999 with its first NWMS that South Africa proposed an integrated waste management system, unfortunately this was hindered by the fact that the 1999 NWMS was not a legislative requirement,

and implementation thereof was not mandatory. It took South Africa another 12 years before the 2011 NWMS attained legislative requirement status.

Both the 1999 and 2011 South African NWMS were largely government strategies and focused primarily on local government planning issues but lacked the social and local authority buy-in experienced by the Netherlands as far back as the 1970s.

Further advancements in the Netherlands during the 1990's included the Public Ordinance Act, which included the Lansnik Ladder into legislation in 1994. Then in 1995 there was a simultaneous ban of 35 waste streams for landfill disposal and the introduction of a landfill tax aimed at diverting waste from landfill disposal. By the start of the 21<sup>st</sup> Century, the Netherlands, through progressive and aggressive advancements in integrated waste management planning with high success rates, continued on an upward trend to enact further waste management improvements.

Since 2002, the Netherlands has made significant progress in terms of well-established integrated waste management systems. These include waste separation programmes, high recycling rates, high diversion of wastes to landfill, to name a few, to the extent the focus on further waste reduction and recycling initiatives was realised. While the South African NWMS strategies through evolution aimed to achieve diversion of waste from landfill, increased recycling rates, impose waste separation programmes, introduce alternate waste treatment facilities, effective waste service delivery to name a few, these are still in its infancy when compared to the Netherlands. Many of the goals of the South African NWMS's were never realised, nor effectively implemented and therefore remains a visionary document. The reality of the differences between a third world and first world economy and a young and mature democracy can be drawn.

By 2014, through the introduction of the Waste to Resource programme, the Netherlands transitioned to the circular economy, optimising existing waste management initiatives, sustainable products and consumption to stimulate circular economy concepts to fully realise its aims by 2050.

Six years after Netherlands introduced the circular economy, South Africa published its 2020 NWMS with the circular economy at its core. While this aligns well with international initiatives, notably the Netherlands only introduced the circular economy concept once all other integrated waste management initiatives were well established and effectively implemented. South Africa is far from achieving some of the basic and fundamental goals, targets and objectives as set out in the different strategies; such as waste separation at source, increased landfill diversion rates, high recycling rates, nor does the country have the facilities or infrastructure in place to enable the transition to a circular economy.

While the 2020 NWMS is good on paper, it appears rather to be a 'simply transplanted' in current circumstances and when compared to the past performance, which leaves much in question on how achievable the goals of the new NWMS are in real terms when considering that Ellis, 2011, specifically mentions that countries should suitably adapt their general principles to their unique circumstances (Ellis, 2011). For this reason, it would seem rather ambitious to expect that South Africa will achieve all the fundamental, yet rudimentary goals and a circular economy simultaneously in the near future.

It is unfortunate that until 1994 when South Africa achieved majority rule, 95% of the people were socially and politically disenfranchised from participating in the economy in any meaningful way (Human Rights Committee, 1998) and the impact of this misfortune continues to have a real impact today.

In comparison, the Netherlands has enjoyed centuries of relative economic, political and social stability, benefiting greatly from its current membership of the European Union (The global economy.com, 2020).

As a developed country, with a history of being socially and politically stable, notwithstanding a strong economy and low unemployment rates when compared to South Africa, the Netherlands has been able to address their waste management challenges effectively and consistently, amend, adjust and implement their waste management policies. This was made possible through capital investments for separate waste collection, treatment and disposal methods that were made available to the public, with due consideration for the country's lack of space and lack of natural resources that were major drivers for the selection of WTE plants.

South Africa as a developing nation, history of social and political challenges and economical constraints, it has an abundance of space available for landfill sites, when compared to Netherlands. The country is also rich in fossil fuels, hence alternative energy sources are not key drivers for diversion of waste from landfill. The associated negative environmental impacts from the country's poorly designed and managed landfill sites are not considered as great a priority on political and other fronts as it is barely able to feed its nation, with a high unemployment rate and a huge percentage of its population living below the poverty line. With due consideration of these specific social, political and economic challenges faced by South Africa, its country specific challenges plays a pivotal role in its lack of advancement up the waste management hierarchy and achievement of the goals of its waste management strategies and policies.

The assessment above therefore demonstrates that South Africa as a developing country, through the evolution of its various NWMSs since 1999, compares well with Netherlands on paper

only in so far as its principles, goals and objectives are concerned. However, South Africa is lagging behind Netherlands as a developed country to the extent there can be no real comparison in terms of implementation and progress. Similarly, further progress towards a circular economy as outlined in the 2020 iteration of the NWMS in South Africa will be hampered by the country's current constraints.

#### 4.3.2 Comparison of the evolution of the South African NWMS with Taiwan

As exemplified above, not all countries have the same strategies nor timelines associated with development and implementation, nevertheless specific timelines and initiatives will be compared in relation to the South African NWMS. Table 4-4 below provides the timelines of some of the key advancements in the evolution of waste management in Taiwan that will be further discussed in the section below.

**Table 4-4: Taiwan's integrated waste management system**

| 1972-2020                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• 1974: Waste Disposal Act (WDA)</li> <li>• 1984: The Guideline to the Disposal of Urban Garbage (plan for disposal of garbage and subsidies for the local governments for building garbage disposal facilities, resulting in increase of garbage disposal from 24% to 56%)</li> <li>• 1988: Waste Disposal Act introduced the EPR</li> <li>• 1997: 4-in-1 recycling programme (Recycling rates from 5.78% to 12.72 in 2001)</li> <li>• 1999: Guideline to Garbage Disposal: incineration (garbage disposal from 60% in 1987 to 93 % in 2001)</li> <li>• 2001: Pay-as-you-throw regulations</li> <li>• 2002: Resource Recycling Act (RRA) led to a 20% decrease in plastic bag use</li> <li>• 2003: Zero waste policy led to marked decrease of MSW for landfill and incineration and by 2007 recycling rate was 37% vs target of 25%</li> <li>• 2005: Separation at source legislation</li> <li>• Industrial waste 76% minimisation by 2006, 1 year before target</li> </ul> |

In 1974, Taiwan already had a Waste Disposal Act (WDA), governing wastes and subsequent disposal thereof. It is unfortunate that the country continued to suffer from grave waste mismanagement, at the time.

A major change in trajectory was observed between 1984 and 1999, that resulted in marked increase in waste disposal, waste collection and recycling rates as depicted in Table 4-3. This was achieved through the amendment of the WDA to include the EPR, further guidelines and policies to encourage proper and sanitary waste disposal aided by subsidies. While South Africa has considered EPR in legislation since the inception of NEMWA in 2008, it only became a mandatory requirement in 2020, in the hope effective implementation will result in improved waste management and encourage recycling rates (DEFF (Department of Environment Forestry and Fisheries (South Africa)), 2020a). The mandatory introduction of the EPR is therefore lagging 32 years behind that of Taiwan.

By 1999, Taiwan's integrated waste management system through its laws, policies and programmes had reached a high level of maturity and was well entrenched as evidenced through the statistical evidence presented in Table 4-3. South Africa only introduced its first ever NWMS in 1999 that set out the country's goals and objectives aimed at a holistic approach to waste management and for this reason South Africa can be deemed as lagging behind Taiwan.

Post 1999, Taiwan has made further advancements to the extent that their recycling and minimisation targets were either exceeded or achieved prior to the deadlines. This further demonstrates that through the evolution of its integrated waste management systems, Taiwan has evolved over the years from an initially highly regulated approach, aided by a well supplemented approach through the provision of government subsidies and capital to support and encourage its waste recycling initiatives.

South Africa, in 2020, through its well documented NWMSs, is well aligned with the strategic goals and objectives in Taiwan, despite the fact that South Africa have still not managed to adequately implement the waste hierarchy due to lack of compliance and enforcement and lack of funding. Suffice to say as a developed economy with socially and culturally aware and committed citizens, Taiwan is streets ahead of South Africa and is likely to remain so due to any number of socio, economic and political constraints afflicting the South African nation.

As a developed country, Taiwan has demonstrated through the imposition of aggressive and stringent targets, adequate financing from authorities, its education and awareness programmes that as a collective, government, civil society and private enterprises can successfully achieve these and even exceed targets through well-co-ordinated, defined and implemented measures.

Unfortunately, in South Africa, despite the evolution of its NWMS over time, both diversion of waste from landfill and recycling rates remain low as the country suffers from the lack of technological and financial assistance from both government and private enterprise to accelerate the process of investments in new and alternate waste treatment infrastructure to enable a move up the waste hierarchy. South Africa's high unemployment rate, lack of basic waste collection services and other basic services further demonstrates that a developing country is unable to implement expensive alternatives, where poverty is rife, and funding is poor.

Aided by its economic success, Taiwan have managed to implement the waste hierarchy through its recycling programmes supported by infrastructure developments in a relatively short time. This success can be attributed largely to the fact that Taiwan is not only a wealthy nation with adequate financial support from both the public and private sectors to invest in the various programs, it's low unemployment rate also means that civil society is in a financial position to pay for more expensive options. This demonstrates not only a major shift in regulatory landscape, but that they have been able to adequately influence and change behaviour of civil society and private enterprise. A level of dialogue South Africa has yet to achieve.

Due to existing policies, laws and strategies that are already well- entrenched, Taiwan is currently looking into transforming towards a circular economy, and is busy developing a masterplan on the circular economy (Gong & Trajano, 2019; Netherlands Embassy in Bangkok, 2020; Ullrich, 2020), a concept only introduced in the South African NWMS in 2020. Based on Taiwan's success rate to date, this wealthy nation has a much higher probability of success to further its transformation towards a circular economy as opposed to South Africa.

The assessment above demonstrates that South Africa as a developing country, with the evolution of its various NWMSs since 1999, compares well with Taiwan on paper only in so far as its principles, goals and objectives and intent are concerned. Whilst this holds true, South Africa is lagging behind Taiwan as a developed country to the extent there can be no real comparison in terms of implementation and progress.

#### **4.3.3 Comparison of the evolution of the South African NWMS with Thailand**

As with the Netherlands and Taiwan, discussed above, not all countries have same strategies nor timelines associated with their development when compared to the South African NWMS.

Table 4-5 below provides the timelines of some of the key advancements in the evolution of waste management in Thailand that will be further discussed in the section below.

**Table 4-5: Thailand's integrated waste management system**

| 1972-2010                                                                                                                                                                                                                                                                                                                                                                                              | 2011- 2015                                                                                                                                                        | 2016-2020                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• 1979: Industrial Estate Act</li> <li>• 1981: National Environmental policy</li> <li>• 1990: 7th National Economic and Social Development Plan (1991-1996)</li> <li>• 1996: The National Environmental basic plan</li> <li>• 1997: The Pollution Prevention and Mitigation Policy (1997-2016)</li> <li>• Environmental Management Plan (2007-2011).</li> </ul> | <ul style="list-style-type: none"> <li>• 2014: Road Map on Waste and Hazardous Waste Management</li> <li>• 2015: Thailand Minimal Wastes (2015 – 2016)</li> </ul> | <ul style="list-style-type: none"> <li>• National 3R strategy</li> <li>• 2015: Industrial Waste Management Plan (2015–2019)</li> <li>• 2016: National Solid Waste Management Master Plan (2016 – 2021)</li> <li>• 2016: Thailand Zero Waste– participatory principle</li> <li>• 2017: Strategy on plastic waste management policy (2017-2021)</li> <li>• 2017: Plastic Debris Management Plan (2017–2021)</li> <li>• 2018: Roadmap on Plastic Waste Management (2018-2030)</li> <li>• 2020: Busy developing a masterplan on circular economy.</li> </ul> |

While Thailand is considered a developing country like South Africa, its waste legislative environment has been in place since 1979 through the Industrial Estate Act as indicated in Table 4-4 (Kamuang & Siriratpiriya, 2017). In recognising the shortcomings and continued negative environmental and social impact caused by pollution, Thailand introduced its first National Environmental policy in 1981 aimed at preserving nature and protection of natural resources in order to promote social and environmental well-being (Kamuang & Siriratpiriya, 2017). While this may have appeared good on paper, effective implementation failed as the country was unable to implement this policy due to rapid urbanisation during the 1980s leading to increased environmental pollution. A situation similar to South Africa's experiences today, and with similar problems for the African nation. Historically, both Thailand and South Africa have been politically unstable with high poverty rates which are both factors that will inevitably have an impact on any

policy implementation, with waste disposal to landfill still being the preferred option where unemployment and poverty is rife.

Based on the evidence presented in table 4-4, there appears to be lag period with little or no further responses implemented between 1981 and 1990. This is not surprising as the country was in a state of political turmoil during this time with bouts of coups and civil unrests in efforts to oust the strong military dominance in its political structure. Then during the 1990s, there was a sudden upsurge in environmental policy and law in support of sustainable development. Progressive advancements during this time also led to the enactment of the National Environmental basic plan (1996) and the Pollution Prevention and Mitigation Policy (1997-2016) aimed to promote solid waste reduction and control, through improved waste collection by municipalities, implementation of plans for sanitary solid waste disposal, PPP and the 3R principle (Kamuang & Siriratpiriya, 2017; Wichai-utcha & Chavalparit, 2019).

On a social, political and economic front South Africa was also undergoing major transformation post 1994, as it transitioned from the apartheid rule to a majority rule and was able to re-integrate into the international market. As a result, the 1990s also marked a new era for South Africa with an integrated waste management approach through its 1999 NWMS strategy as outlined in Table 4-1 above, including the introduction of the waste hierarchy that correlates well with the 3R principle introduced in Thailand.

Another notable advancement in waste management in Thailand was through its Environmental Management Plan (2007-2011) (Kamuang & Siriratpiriya, 2017). It's primary goal to promote sustainable business development, where people can participate and receive benefits through the sustainable maintenance of the natural resources and the environment. It also promoted the 3Rs in relation to solid and hazardous waste management, inclusive of waste reduction targets, waste recovery and recycling targets, waste disposal target as well as supporting the green economy and eco-design (Kamuang & Siriratpiriya, 2017). This plan correlates well with the South African Polokwane declaration of 2002, that set a goal to reduce waste disposal by 50% and zero landfill by 2022. Whilst both countries what appears to be different reduction goals and targets the underlying principle was diversion of waste from landfill and therefore correlate well.

By the time South Africa updated its NMWS in 2011, Thailand was already well underway and working towards achieving the goals and objectives as set out in its strategies set out in the preceding era up to 2010, and further introduced its 2014 Road Map on Waste and Hazardous Waste Management and Thailand Minimal Wastes (2015 – 2016) (Simachaya, 2017). This demonstrates continual and progressive advancements in the country's integrated waste management system that promoted sustainable growth and resource management.

Unfortunately, South Africa is one year away from 2022 and nowhere near achieving what appears to have been an overambitious target set in 2002. Further to this, none of the 1999 NWMS targets were met nor implemented by the time the 2011 iteration of the NWMS came into effect.

Some of the principal goals and objectives during this new era were to minimise waste generation, separation at source initiatives, establishment of waste database, measures to deal with improper waste disposal measures, implementing alternate waste technology, reduction of landfill space, establishment of public-private partnership for solid waste management, introduction of economic instruments and incentives for pollution prevention, zero waste technology and development of green technologies. Many of these plans invariably correlate well with the goals and principles as articulated in the South African 2011 NWMS. Comparatively, South Africa's 2011 NWMS also correlates well with not only the timing, but also key objectives as set out in Thailand during the same timeframe.

As a developing country, notably, Thailand's policies and plans during this time had advanced more when compared to the goals, targets and objectives in South Africa. It is also evident that Thailand's initiatives since the 2000s promote moving up the waste hierarchy, with later developments introducing some concepts to support the green and circular economy. In this respect, South Africa was lagging behind, and is still largely dependent on waste disposal to landfill, with few waste separation initiatives and absence of alternative waste treatment facilities to enable a move up the waste hierarchy and for this reason, again lags behind in terms of any effective realistic and determined implementation.

While both are developing countries, the culture and history of the two peoples are very dissimilar. While South Africa can keep pace through the iterations of its National Waste Management Strategy (NWMS), it is obviously lacking in raising public awareness, involvement of private and public into education and awareness programmes, inclusive of capacity building, establishing proper waste collection and disposal facilities. This presents key areas for the advancement of 2020 NWMS goals. Thailand today has also managed to progress well economically over the years with a marked reduction in poverty, which is an important enabler in moving up the waste hierarchy and being able to fund infrastructure to support the waste management initiatives.

It is believed that Thailand is currently busy developing a master plan on the circular economy. South Africa is ahead of Thailand in this regard as the 2020 NWMS has formally introduced the concept of the circular economy. But without advancing up the waste hierarchy with separation at source programmes, education and awareness programmes, availability of alternative waste

treatment technologies and infrastructure, once again the question is raised of whether South Africa is premature in terms of introducing the concept of a circular economy.

The assessment above demonstrates notable similarities between South Africa and Thailand as developing countries, as they have evolved similarly not only in terms of timing, but also its fundamental principles, goals and objectives of their integrated waste management systems. Thailand as a developing country has been able to advance further than South Africa during this time in implementing many of its goals and objectives.

#### **4.3.4 Comparison of the evolution of South African NWMS with Nigeria**

In this section the evolution of the South African NWMS will be compared with the evolution in Nigeria to assess how well two developing African countries have evolved. While not all countries have same strategies nor timelines associated where development and implementation are concerned, specific timelines and initiatives during those timelines will be compared in relation to the South African NWMS strategies in those specific timelines selected. That said, Nigeria has similar political and civil issues as South Africa, in fact, more in common than with the other three comparison countries in this study.

Table 4-6 below provides the timelines of some of the key advancements in the evolution of waste management in Nigeria that will be further discussed in the preceding section.

**Table 4-6: Nigeria's integrated waste management system**

| 1972-2010                                                                                                                                                                                                                                                                                                    | 2011- 2020                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• 1978: Public Health Act of 1958 as amended in 1978</li> <li>• 1988: The Hazardous Waste Criminal Provisions Decree 42 of 1988</li> <li>• 1989: National Policy on Environment</li> <li>• 1991: Various regulations relating to solid and hazardous waste</li> </ul> | <ul style="list-style-type: none"> <li>• 2011: National Environmental (Soil Erosion and Flood Control Regulations, S. I. No. 12 of 2011</li> <li>• 2011: National Environmental (Control of Bush/Forest Fire and Open Burning) Regulations, S. I. No. 15 of 2011</li> <li>• National Environmental (Domestic and Industrial Plastic, Rubber and Foam Sector) Regulations, S. I. No. 17 of 2011.</li> </ul> |

|                                                                                                                                                                                                                                             |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| management pollution control<br>regulations <ul style="list-style-type: none"> <li>• 2009: Vision 20:2020</li> <li>• 2009 – Various regulations relating to different industries and waste management in that specific industry.</li> </ul> |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

Laws addressing solid waste management in Nigeria have been in place since 1978, when the Public Health Act of 1958 as amended in 1978, included specific provisions for solid waste management. It was, however, only in the late 1980s, post the toxic waste dump incident in Bendel state, there resulted a sudden upsurge in laws relating to environmental protection and waste management. These came into effect with the establishment of the 1988 Federal Environmental Protection Agency Act (FEPA), which led to several regulations being published relating to management of wastes from various different industries.

In comparison with South Africa, Nigeria had promulgated several regulations in the late 1980s, leading to the country's first environmental policy, National Policy on Environment in 1989. In recognising the importance of environmental protection and sustainable waste management, further waste related regulations followed in 1991. Regulations during this time were targeted mainly at specific industries to manage and control their wastes and included provisions for waste minimisation, pollution abatement technologies, and imposed fines and penalties for contraventions.

Similarly, in South Africa, there were a number of diverse laws in existence prior to 2008 as each industry tried to manage and control their wastes separately, leading fragmented and largely uncoordinated legislatives frameworks (DEAT (Department of Environmental Affairs and Tourism (South Africa)), 2000; Muzenda, 2013:79). It was only with the 1999 NWMS South Africa attempted to achieve better coherence toward integrated waste management. Through the initial NWMS, South Africa's journey towards holistic and integrated waste management and pollution was born, subsequently leading to the NEMWA of 2008. During the same time frame, Nigeria triggered the National Environmental Standards and Regulation Act 2007 (NESREA) once again leading to an upsurge in environmental laws and regulations for specific industries.

It was again only in 2009, through Nigeria's Vision 20:2020, also known as countries blueprint of economic transformation for the period 2009–2020, that a more holistic approach to

environmental protection was adopted. While there are now a host of policies, laws and regulations in Nigeria, it has been found compliance and enforcement is weak, fines and penalties are weak and for these reasons, have all failed to protect the environment (Izoukumor, 2019).

South Africa and Nigeria are both faced with several challenges relating to implementation and enforcement of policies, laws and strategies, it is clear that South Africa has made much more progress in terms of environmental protection through its integrated waste management laws, policies and strategies than Nigeria. While all the goals and objectives and targets of the South Africa NWMSs has not been fully achieved, steady progress has been made towards achieving these goals when compared to Nigeria. Whether this is in part due to political continuity in South Africa is a cause for speculation, but it is a major fact differentiating two countries with very similar civil, cultural, ethical and governance issues, both at a society level and within the organs of government.

While South Africa has advanced through the evolution of its NWMS in 2020, introducing the concept of the circular economy, there has been very little actual on-the-ground progress. Nevertheless, South Africa remains in a better position than Nigeria to transition to a circular economy as the West African country as a whole has demonstrated scant regard for real environmental protection and sustainable development over the years (Ogunsanwo & Ayo-Balogun, 2020).

The assessment above demonstrates notable similarities between South Africa and Nigeria as developing countries. As developing countries both suffer from corruption, political instability, high crime rates. Further to this, both countries lack basic services in terms poor waste collection services and the general lack or absence of basic, let alone alternate waste treatment facilities that would enable them to move up the waste hierarchy. Both countries have high poverty rates, hence society is unable to support expensive waste management alternatives. Despite many of the similar challenges faced. South Africa has progressed much faster in terms of policies, laws and strategies for integrated waste management and to this end is in much more advanced state with its integrated waste management system than Nigeria. The existing waste management system in Nigeria is therefore elementary, ineffective, and unsustainable.

#### **4.3.5 Key underlying principles underpinning waste management: South African NWMS vs other countries**

The evolution of South African NWMS strategy compares well and can hold its own against waste management policies, laws and strategies of both developed and developing countries. All the case countries selected, except Nigeria, in this study have either formally or informally adopted a

circular economy goal to make the recycling process more responsive for successive waste management. This is to be accomplished largely through the waste management hierarchy with a specific focus on the concepts of 3Rs. Versions of the 3Rs concept are already well entrenched in developed countries, while developing countries do appear to be aware and responsive but are lagging behind in implementation, infrastructure, and culture change, especially in the sub-Saharan region.

The section below will outline some of the key underlying principles required for integrated waste management planning and also provide a comparison of South Africa's progress in relation to some of the international case countries selected.

#### **4.3.5.1 Legal landscape in support of integrated waste management**

Sound leadership and commitment at all levels is pivotal to ensure effective roll-out of integrated waste management strategies, policies and laws, with due consideration for international obligations. For this reason, political will is a key element as waste management must be a priority at all levels of government (Nahman & Godfrey, 2010:19). This furthermore requires adequate funding from the government, a concept that holds true for most developed countries such as Netherlands and Taiwan, while developing countries such as South Africa and Nigeria struggle on this front with high unemployment rates and more than 50% of its population living in extreme poverty, means that the required revenue is not available through municipal taxes and levies and therefore unable to fund better solutions.

On the international level, current integrated waste management planning presents a major paradigm shift from a linear economy to a circular economy aimed not only at waste minimisation, but through unlocking the potential of waste as a resource for re-introduction into the economy.

To a large extent, both developing and developed countries selected have similar waste management legal landscapes, policies, strategies and are also signatories to various global waste management initiatives.

South Africa is slowly moving up the waste hierarchy supported by increased policy coherence. This has been mandated in the various Acts, Plans, Strategies and other responses in line with international treaty, with the circular economy at the core of the 2020 NWMS. For this reason, the South African NWMS compares well with both developed and developing countries through its progressive regulatory framework and, therefore, does not necessarily require more legislation. Instead, what is required, and with urgency, is practical implementation of the identified strategies through stabilisation of the fiscus, education and consequence management of the civil population and the eradication of corruption; issues being addressed in 2020 through mechanisms like the

State Capture Enquiry and renewal of the National Prosecuting Authority. As South Africa's closest counterpart as a developing country, Nigeria is still significantly lagging behind, despite the existence of their waste legal landscape, due to continued and probably institutionalised corruption linked to poor compliance and enforcement and private sector and public indifference to the laws. While there are many similarities between the two countries, there are many differentiating factors of importance. In all fairness, there is one major difference between the two countries. South Africa has a population of 56 million against Nigeria's 180 million, over 62% of people still live in extreme poverty (Central Intelligence Agency, 2020d, 2020e).

During the research for this study, among all the inhibitors affecting most developing countries, the problem of corruption stands out. It is interesting to compare the countries as per the 2019 Corruption Perceptions Index published by Transparency International. This is the perceived levels of public sector corruption in 180 countries/territories around the world: The Netherlands is the 8<sup>th</sup> least corrupt nation; Taiwan is at 28; South Africa is rated 70<sup>th</sup>; Thailand is 101<sup>st</sup> ; and Nigeria is perceived as the 146<sup>th</sup> most corrupt nation in the index (Transparency International, 2019). This could be a snapshot indication of these countries abilities to physically realise implementation of environmental and waste management legislation .

#### **4.3.5.2 Implementation plan**

The implementation plan must give effect to the overall goals; short-, medium- and long-term, targets and action plans in support of the legal framework. It provides a structured process to implement change and for identification of additional financing and resources that are critical in order to achieve the desired end state.

The status quo assessment of the 2011 South African NWMS reported that while there are set goals, targets and action plans, the country is lacking in terms of effective implementation of the plans (Linkd, 2019), when compared to the high rates of waste collection, separation at source, recycling rates, alternative waste treatment technologies, etc, seen in the Netherlands and Taiwan. It is self-evident developed countries have progressed well in terms of effective implementation and this is only to be expected considering the long-term stable nature of such countries. When compared to another developing country, like Thailand, South Africa appears to be lagging behind in the physical achievement of goals. Notably, however, the South African NWMS appears to be streets ahead when compared to Nigeria and, therefore, is more comparable with the other developed and developing countries.

#### **4.3.5.3 Goals and objectives**

Both developed and developing countries selected have embraced the principles of the waste hierarchy in their respective laws, policies and strategies and set ambitious goals.

Developed countries such as The Netherlands and Taiwan have successfully achieved their goals and objectives, through the adequate provision of mechanisms to facilitate this transition, while developing countries, have demonstrated a much slower transition up the waste hierarchy as each deal with differing internal fiscal, civil and enforcement issues.

Despite good initiatives like South Africa's Polokwane Declaration to reduce waste disposal by 50%, and zero waste by 2022, the country is not even remotely close to achieving these in 2020. The country still landfills approximately 90% of wastes with a minimum of R17 billion worth of potential recycle/reuse resources lost to the economy each year. This clearly demonstrates failure in achieving goals and objectives as well as in implementation. For this reason, the 2020 NWMS provides for what appears to be more realistic targets, such as 40% waste diverted from landfill within six years, 55% within 10 years, and at least 70% within 15 years, leading to zero-waste to landfill at some stage (Wichai-utcha & Chavalparit, 2019). The uncertainty of how this will be achieved is still questionable considering the fact that approximately 90% of waste is still being landfilled, thus confirming the dismal failure in achieving the reduction targets of zero waste to landfill by 2022 as set out by the Polokwane declaration.

As a developing economy, Thailand is one of the largest plastic manufactures in Asia, has suffered years of mismanagement of plastic waste in particular, and reported in 2018 that only 27% of plastic waste was recycled by manufacturers, despite good initiatives like the 3R policy (Wichai-utcha & Chavalparit, 2019). During the same period, it was reported that only 12% of their waste disposal sites were properly managed (Wichai-utcha & Chavalparit, 2019). This at a time when China has banned the import of plastic waste with the Netherlands profitably importing and recycling/reusing and disposing of plastic waste.

#### **4.3.5.4 Performance Assessment and review of policies**

On-going performance assessment, monitoring and review is critical to ensure the desired end-state is being achieved. It is thus vital to the viability and performance of any plan; the process must identify and gaps and shortcomings. It must allow for the scrutiny of targets, encourage and enforce compliance, give law makers an accurate overview, identify areas of best practice and where resources can best be invested. The involvement of private enterprise as contractors on the ground also provides opportunity for encouraging investment in world-leading technologies,

economic diversification and employment and can evolve into an aspect of performance assessment and nation building.

Developed countries have through the timeous and on-going review of their performance assessments, monitoring and review processes, been able to continuously update and review their progress, adjusting and updating policies and strategies to respond to local and international initiatives. In doing so, this provides the opportunity to quickly adopt any trends and challenges requiring urgent interventions. They also have the economic muscle and buy-in of the civil and private sectors to ensure such flexibility.

Little evidence exists that demonstrates whether South Africa, Thailand or Nigeria have timeously conducted performance assessments and updated strategies when compared to developed countries. Developing countries have only to a limited extent been able to respond to critical challenges as demonstrated by Thailand's response to the marked increase in imports of plastic wastes that resulted in more stringent regulatory and actual enforcement measures to address the problem. Similarly, Nigeria also responded well to the electronic waste challenge by placing a ban on imports of used electronic goods (Izoukumor, 2019). Whilst the increased imports of plastic wastes into Thailand, and the imports of used electronic goods into Nigeria may have been deemed as lucrative business opportunities, there was total disregard for the resultant negative environmental impacts and waste management challenges. Business opportunities like these therefore provide a false solution for waste streams in order to make a quick profit, and has merely exacerbated existing waste management challenges already prevalent in these receiving countries and further does not support the circular economy solution supposedly provided. The effectiveness of these bans and responses are still questionable as reviews of such plans have not been adequately measured these challenges are still prevalent in these countries.

It must be noted that while enacting regulatory responses to waste management issues through bans, as demonstrated in both developed and developing countries, may have progressed well, the effectiveness in developing countries may only appear good on paper. With high levels of corruption, unemployment and general lack of compliance and enforcement in developing countries, such bans may actually further encourage the illegal trades in these waste streams.

Despite the delays, the progressive review and updates of the South African NWMS, as required by the NEWMA, demonstrates the practical evolution and improvement of the Strategy. It also recognises lessons learned to inform the progressive performance assessments and updates to the South African NWMS and to this end compares well with international reviews. While this may hold true, the timeous monitoring and review has also been lacking as the status quo assessment on the 2011 NWMS was only published in 2019 together with the draft 2020 NWMS. Little

evidence exist to confirm the monitoring and review process is timeously done in the Thailand and Nigeria either.

#### **4.3.5.5 Compliance and enforcement**

Compliance and enforcement are critical core elements to ensuring the effective implementation of any policy, law or strategy (Nahman & Godfrey, 2010:20).

Through effective compliance and enforcement measures, the Netherlands and Taiwan have recorded great success rates in terms of moving up the waste hierarchy and diverting waste from landfill and achieving high recycling rates. This success also demonstrates the effectiveness of the state, citizens and the private sector working in harmony through education, understanding and enforcement of mutually acceptable environmental standards.

While compliance and enforcement has been an integral goal in the evolution of the South African NWMS, the failure to realise this has consistently been documented as a major flaw and shortcoming negatively affecting the effective realisation of and advancement of strategies and goals. Lack of compliance and enforcement is a common flaw in developing countries such as South Africa, Thailand and Nigeria, all of which are faced with several challenges such as political instability resulting not only in corruption, and lack of support on a political front, but struggles within local authorities for resources and competent staff. These challenges are further exacerbated by a general unwillingness of civil society to change behaviours towards waste management. Many developing countries also struggle with a lack of funding to ensure that proper compliance and enforcement measures are in place.

This status quo in developing countries cannot continue and concerted efforts must be made to ensure leadership commitment at all levels of government, with necessary actions taken to address challenges and constraints to ensure the integrated governance measures are effectively implemented, managed and controlled.

#### **4.3.5.6 Adequate and efficient service delivery, separation of waste source**

Adequate service delivery in terms of household waste collection and separation at source initiatives is a crucial component to achieve improved waste management as it is ultimately the first step in moving up the waste hierarchy (Nahman & Godfrey, 2010:20).

This is an integral pre-requisite to support diversion of waste from landfill and to support the reuse and recycling of wastes. For this reason, budgeting and financial management for waste services are included in the South African NWMS, considering the fact that poverty and unemployment is rife and as such, unemployed peoples are unable to pay for municipal services and many rural

areas do not have access to basic waste collection services. Achieving its goals are directly linked to issues such as service delivery, resources, job creation, education and awareness and budget for infrastructure. This then needs to be funded from the national fiscus and taxes collected for other purposes rather than at local government level where residents pay for the service provided, another challenge faced in developing countries such as South Africa and Nigeria with high with high poverty and unemployment rates.

In South Africa in 2020, the government announced a major infrastructure investment programme which, when unpacked, will hopefully address the needs of delivering on the NWMS 2020. Through consistent sound budgeting and targeted taxation, developed nations such as the Netherlands and Taiwan have successfully managed to provide adequate and sustainable waste collection and separation at source services, and provided recycling infrastructure, such as waste incineration with waste to energy capabilities.

Unfortunately, even if sound budgeting was practiced, the current South African and Nigerian systems are not designed to separate recyclables, which presents as a major shortcoming in trying to achieve increased recycling rates. Furthermore, the bulk of recycling in both these countries is largely dependent on the informal sector through waste pickers, who have not been formally included in national strategies nor the formal waste economy. Developing countries like South Africa, Thailand and Nigeria also lack recycling infrastructure, technological advancements and funding. If poor waste collection services continues, illegal unsanitary dumping practices will continue until adequate waste collection and separation at source services, compliant landfill sites and other alternative waste treatment facilities can be provided.

It is, therefore, pivotal to improve the waste collection services in countries where this is lacking and beef up enforcement, as these essentially underpin separation at source initiatives that informs increased recycling rates as demonstrated by developing countries.

#### **4.3.5.7 Diversion of waste from landfill**

One of the key principles in the waste hierarchy is to divert waste from disposal to landfill (Nahman & Godfrey, 2010). This is only achievable if alternate options are available and the necessary infrastructure and political will is in place to support this.

The Netherlands and Taiwan have managed to divert waste from landfill through the ban of certain wastes to landfill. Infrastructure for alternative waste treatment options have been developed and implemented and funded inherently by a wealthy society, where civil society and private sectors have been educated and today enthusiastically support these initiatives.

This has not effectively worked in countries like South Africa, Nigeria and Thailand where waste disposal to landfill is still the preferred option due to relatively low costs, demonstrating current landfill charges are not sustainable as revenues do not even cover the cost of disposal and upkeep of these facilities. This further confirms that expensive solutions are not viable options for people who cannot afford such services. Many literature studies have stated that current landfill sites are still in a general state of disrepair, are not properly managed and illegal dumping is still rife. In these countries there is also lack of political will where education, funding and enforcement failures undermine viable options to promote separation at source initiatives.

The process of diverting waste from landfill has been slow over the years, with low recycling rates achieved and reasons recognised, hence the need for more aggressive strategies in support of diversion of waste disposal in landfill sites should be implemented (DEFF (Department of Environment Forestry and Fisheries (South Africa)), 2020b).

While it is evident that all countries are deeply concerned about promoting awareness and education among citizens, South Africa, Thailand and Nigeria are struggling on this front due to a lack of resources and finances to implement such programmes. Further to this, the national planning processes for waste management, while looking good on paper, is only achievable through effective implementation, compliance and monitoring.

Developing countries like Thailand, Nigeria and South Africa struggle to achieve strategic goals due to socio-economic conditions and budgetary constraints which gravely hinders the process and progress.

#### **4.3.5.8 Capital investment and innovation in the waste sector**

Capital investment and adequate financing are a key instruments to adequately sustain and enhance waste management (Kaza *et al.*, 2018). This includes financing for basic services such as waste collection services and capital investment for waste infrastructure, operation and maintenance thereof (Kaza *et al.*, 2018). In addition, technological innovation and adequate skills development in the waste sector is also largely influenced by availability of funds (DST (Department of Science and Technology (South Africa)), 2012).

Lack of adequate funding has been identified as a major restraint in many developing countries, that is directly linked to unemployment and poverty as poor people cannot pay for municipal services including waste disposal. This constraint has been exacerbated by institutional and political struggles that appear to be more prevalent in African countries (Kaza *et al.*, 2018).

Therefore, it may be prudent for developing countries to consider developing simple, cost-effective, but efficient and adequate waste management systems suitable to their local environments and resist international commitments they cannot possibly deliver on in real and tangible terms on the ground. There is also an argument for developed countries, many of whom built economies through colonial exploitation, such as Britain in terms of Nigeria and South Africa, to actively assist developing nations through shared technology, financial credits, training and any other means at their disposal. Political expediency, however, makes this an unlikely turn of events without strings attached.

#### **4.3.5.9 Waste data and information systems**

Reliable waste data and information is a key component required to inform waste policy and planning that will allow governments to select and design suitable waste management systems, sets targets for diversion, track and monitor progress and to adapt as waste generation patterns change (Nahman & Godfrey, 2010; World Bank Group, 2018).

While South Africa does have the South African Waste Information System (SAWIS), reporting and tracking is remains questionable and not all waste data is captured by the system (Linkd, 2019). Nigeria totally lacks any formal waste database with all the ensuing problems and difficulties in accurately quantify wastes on streets and in waterways. The Netherlands, Taiwan, and Thailand have developed more accurate databases which effectively capture waste information and enhances their monitoring and tracking and, therefore, the quality and effectiveness of decision making, regulations and enforcement.

#### **4.3.5.10 Social understanding, education and awareness**

According to Samiha and Addessalem (2015), *being responsible towards waste minimization is directly linked to how a society is educated to see it* (Samiha & Abdessalem, 2015:237).

It is against this backdrop, that social understanding, education and awareness of civil society and business is required in order to sustain and promote good waste management practices (Nahman & Godfrey, 2010:19).

Developed countries have through various programs, campaigns and incentives been able to a large extent to change the mindset and awareness of civil society to make more socially responsible decisions with regards to moving up the waste hierarchy and to make more responsible decisions in this regard.

Developing countries, on the other hand, have not adequately achieved this as they are lacking effective programmes to create such awareness and influence behavioural change in civil society.

Corruption, mismanagement of funds and general lack of confidence in government remain fundamental flaws and shortcomings in developing countries and deter genuine efforts within countries to promote good waste management practices.

#### **4.4 Chapter summary**

Since its first inception in 1999, the South African NWMS has evolved through the 2011 and now 2020 NMWS. Through its evolution, the waste hierarchy has similarly evolved in support of the key objectives of these strategies. Through performance assessments these strategies have had to change and adapt in order to revisit effectiveness of achieving its goals and objectives.

The evolution of the South African NWMS compares well with international waste management systems when compared to the Netherlands, Taiwan and Thailand, as they have adopted the strategy to align with global integrated waste management systems and has adopted the circular economy model in the 2020 NWMS.

Despite the good intent of waste management laws, policies and strategies in developing countries, they have largely failed to meet their objectives as these societies continue to a large extent suffer from waste mismanagement. This research demonstrates while some of these failures can be attributed to political instability, corruption, conflicts between authorities, developing countries also suffer from a general lack of knowledge and awareness; hence they experience difficulty in changing citizen's behaviours. These countries mostly have waste management systems in place that support many of the international initiatives; hence they do not require more legislation or policies, but effective implementation, enforcement and societal education programmes. South Africa and Nigeria in particular also suffer high poverty and high unemployment rates and thus these poor societies are unable to afford expensive waste management solutions and as such is a major limiting factor that continues to impede the successful movement up the waste hierarchy.

## CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

This chapter provides the conclusions and recommendations related to the two research objectives:

- **Research objective 1:** Critically evaluate the changes in the South African National Waste Management Strategy (NWMS) over time in context; and
- **Research objective 2:** Comparatively assess in context the evolution of then NWMS with international policies and strategies.

Section 5.1 provides the conclusions of the research, while section 5.2 provides recommendations.

### 5.1 Conclusions

This study focused on the evolution of the South African NWMS by evaluating changes over time in context of the wider geo-political, social and economic realities, past and present. It must be noted on a comparative basis with the selected countries (Nigeria, Thailand, Taiwan and the Netherlands), South Africa is a very young democracy, that has historically been subject to sanctions that may be viewed as an inhibiting factor in terms of its economic growth and practical ability to achieve ideal integrated waste management in the short-term.

The fact South Africa was capable and even willing to institute the 1999 NWMS can be viewed as recognition of its reinstatement to the international community with access to all that it entails, including first-hand knowledge of sustainable integrated waste management, its place in the real economy and, among others, the environmental benefits and benefits to the health and well-being of its citizens associated with appropriate waste management.

In full realisation of the potential benefits, South Africa has made great strides over the past 20 years through evolution of the NWMS to facilitate the development of a more comprehensive and sustainable integrated waste management system. Through the 1999, 2011 and 2020 NWMSs the country has dealt with waste management problems in an informed and progressive way, positively contributing to a more comprehensive and purpose driven waste economy.

The changes have evolved to support and realise the desired end-state of a circular economy and reflect international obligations nearly on a par with many developed nations like the Netherlands and Taiwan, and including developing countries like Thailand who has demonstrated profound economic growth in a short period of time that has facilitated its better development of

waste management programmes than economically constrained developing countries such as Nigeria, and South Africa.

Through the various iterations of the South African NWMS, notably the waste hierarchy has been updated each time in order to better align with the key goals and objectives of the strategy and remains the focal entry point to sustainable waste management. It has also evolved from what was initially a strategy aimed at government and actions required by different spheres of government, to goals and objectives that now include civil society, government and private sector as a collective in ensuring sustainable waste management in the 2020 NWMS. This progression in the strategy was necessary as a fundamental steppingstone for further advancements and progression of the NWMSs. Whilst many of the previous goals may not have been effectively realised, it identified and recognised some of the shortcomings of the preceding strategies and in so doing, provided guidance and structure for future development and improvements for future strategies.

It must be acknowledged, however, that the South African NWMS does mirror in some instances what has been set out in mostly developed countries, which may present a shortfall as literature has indicated that a rule cannot be taken out of its context and simply transplanted and that the value-add is in the learning from one another in various ways and being suitably able to adapt to the diversity of cultures and changing conditions, which does seem to apply to South Africa's current inability to realise the aspirations of the NWMS. One of the most apparent failures of the South African strategies is that almost 20 years after its first NWMS, diversion of waste from landfill has been slow, and recycling still remains at its infancy.

In conclusion, South Africa is clearly committed to the evolution of the NWMS, putting in place enabling strategy in 2020 for the time when various conditions improve and are more favourable to enforcement with a positive outcome as opposed to enforcement leading to civil strife and disobedience due to high poverty and unemployment rates and a severely strained fiscus across all tiers of government, which may consider these as more pressing priorities.

Only time will tell, but on an evolving policy, legislative and strategic basis South Africa is holding its own on the international waste management stage when compared to developed countries like Netherlands and Taiwan and Thailand as a developing the country. Through the progressive updates of its NWMS, South Africa can be considered a leader in Africa, as they are streets ahead of other developing African countries such as Nigeria.

### **5.1.1 Conclusions related to Research Objective 1: Critically evaluate the changes in the NWMS over time**

In response to both global and local waste management challenges, South Africa has progressively advanced and adapted their legislative framework and implemented short and long-term integrated waste management policies, laws and strategies to guide societal behaviour and promote environmental protection towards sustainable waste management.

The 1999 NWMS marked a milestone with a marked change in trajectory towards sustainable, holistic and integrated approach to waste management. At the time, the strategic goals were well articulated, and its objectives well outlined in addressing the most critical requirements for a successful integrated waste management system. It also introduced and promoted the first waste hierarchy. The fact that compliance was not a mandatory requirement was a flaw corrected in 2011.

Unlike the 1999 NWMS, the 2011 iteration was mandatory and intended to give effect to NEMWA. The fundamental drawback of both the 1999 and 2011 NWMSs were that they were largely central government documents setting out actions mainly to be taken by local authorities. A marked improvement in the strategy lies with the updated waste hierarchy through each update of the NWMS.

It is unfortunate that despite the good intent, few of the goals and objectives of the 1999 and 2011 NWMS were met, that suggests that some of the goals were too ambitious to start with. These may have been achieved if more realistic goals were set. In spite of this, some improvements were achieved despite the deteriorating ethical and governance circumstances in the country. Some of these challenges can be attributed to various social and economic factors in South Africa, such as political instability, high level of corruption, high levels of poverty and unemployment, inadequate budgeting, lack of capital investment and technological advancements, notwithstanding the limited education and awareness on waste.

Nevertheless, legislators remained both determined and ambitious with the 2020 NWMS having a circular economy at its core of the new waste hierarchy model. As with the previous strategies, the 2020 NWMS has not abandoned the goals of the preceding strategies. At face value, the latest NWMS includes a number of stakeholders, government and civil society, allowing for collective responsibilities and accountability in the waste management system.

### **5.1.2 Conclusions related to Research Objective 2: Comparatively assess the evolution of the South African NWMS with international policies and strategies**

The evidence presented in the study indicates that all countries selected as case countries have a similar history of poor and uncontrolled waste management, that has inevitably led to environmental degradation and threats to human health. Rapid industrialisation has been one of the major contributors to increased volumes, and complexities in waste streams generated.

In recognising global and local waste management challenges all countries have had to respond to these challenges. This has been achieved primarily through the progressive introduction of sustainable integrated waste management policies, laws and strategies.

For all case countries selected, the era from 1990 saw a major upsurge in policies, laws and strategies to address waste management challenges all largely aligned with global initiatives on sustainable and integrated waste management.

The emergence of these integrated waste management systems in all countries have all initially stemmed from governments actions to identify and acknowledge waste management challenges and developing strategic goals and objectives to address these firstly at a government level and then moving on to include of all stakeholders in the process that include civil society and private enterprise.

It is evident that this model of inclusion for all the stakeholder is a pre-requisite to moving up the waste hierarchy and to a circular waste economy. A common trend observed in all countries over time is the change in trajectory of the goals from the traditional command and control approaches that has been supplemented by other approaches such as market based, civil based and other hybrid approaches. This has been achieved through the progressive evolution of the waste management policies, strategies and laws in all countries including South Africa.

South Africa, Netherlands, Taiwan and Thailand strategic goals and objectives compare well and is aligned with the international treaties and conventions and therefore shows their commitment towards global waste management initiatives.

All countries selected as case studies, except Nigeria have progressively incorporated principles of integrated waste management planning, waste information systems, general waste collection, waste separation at source, waste minimisation, recycling, alternate waste treatment and disposal facilities, capacity building, education, growing the contribution of the waste sector towards a green economy, awareness and communication to promote sustainable development.

For this reason, the evolution of the South African NWMS's evolution compares well not only with developed countries such as Netherlands and Taiwan, but also with a developing country like Thailand, at least on paper.

When compared to Nigeria, South Africa is on the cusp of realising many of the NWMS aspirations and will undoubtedly emerge a leader in this area in sub-Saharan Africa. Despite the myriad of laws, Nigeria has not made much progress and is still in deplorable state in so far as waste management policies and practices are concerned. A notable difference is that developed countries are miles ahead of developing countries not only with the development of the goals and objectives, but also with implementation. The study clearly demonstrates that each case country selected presents its own challenges and opportunities that informs the most viable waste management treatment option. There are also country specific drivers, such as the need for additional energy in Netherlands and Taiwan that will further inform the most suitable technology selection. Further to this country specific waste management challenges also play a pivotal role as each country is faced with specific waste challenges and may require unique solutions to remedy their problems.

Despite their economic wealth, developing African countries such as South Africa and Nigeria, face notable challenges in so far as high unemployment and poverty rates are concerned. In addition, both countries are still in political turmoil, despite attempts to rectify past injustices, these challenges still prevail. High unemployment and poverty rates also mean that the poor population cannot afford expensive waste management options and will therefore continue to struggle unless some of these pertinent matters have not been addressed.

South Africa has made great strides with the constant change in its conceptual approach through the updates of the waste hierarchy that support the 3R principle in each update of the NWMS and a further advancement with the circular economy incorporated into the 2020 NWMS

Diversion of waste from landfill, the 3R principle and a circular economy are all fundamental principles in waste management systems globally and for this reason the South African NWMS through its evolution is therefore well aligned with countries like Netherlands and Taiwan and Thailand. Unfortunately, South Africa has not made notable progress in terms of both diversion of waste from landfill and advancing up the waste hierarchy, with few of the goals and objectives achieved since the first NWMS in 1999. The situation in Nigeria is even worse and it is unfortunate that despite Nigeria's position and economic power in Africa, they have failed to realise these strategic goals and remain severely polluted. Whilst South Africa and Nigeria over the years have grown their economies, they have not been able to adequately improve many social conditions such as high poverty and unemployment rates, whilst political instability is still rife and they continue to

suffer with poor funding and lack of resources in the government, it seems unlikely that changes in the strategies will be effectively realised in the short-term. Based on the comparative study presented, these appear to be critical elements that drive the successful implementation of any strategy. It further demonstrates that in countries where poverty and unemployment is rife, these poor nations are unable to afford expensive waste management alternatives. The grave lack of funding and infrastructure by government and private sector further presents grave capital and technological advancements, further inhibiting potential advancements towards realising the goals and objectives of integrated waste management.

Despite several shortcomings and drawbacks in the South African context as outlined above, South Africa as a developing country has demonstrated both its intent and commitment towards achieving a circular economy, through the progressive advancement, review and update of its NWMS since 1999 to the 2011 and 2020 NWMS. This confirms that South Africa is a global player in integrated waste management through the regular and proactive review of the NWMS. While Notably, this aligns well, at least on paper with global initiatives and the progression of integrated waste management as evidenced by Netherlands, Taiwan and Thailand. It is, however, unfortunate, based on historic poor achievement of the goals and objectives of the South African NWMSs, realising the 2020 NWMS strategic goals appear to be once more visionary and not realistic. It is also unfortunate that Nigeria as a developing country, has been unable to achieve any of its aspirations.

## **5.2 Recommendations**

Section 5.2.1 provides recommendations for improving the South African NWMS, based on the results of this research, while Section 5.2.2 provides recommendations for further research.

### **5.2.1 Recommendations for improving the South African NWMS**

Recognising the growth and improvements to the South African NWMS over time, the following recommendations for further improvement are made, based on the results of this research:

- Regular reviews of the NWMS and status quo assessments must be done to make it more responsive to practical local conditions and what can reasonably be expected to be achieved.
- Status quo assessments must inform the drafting of the updated NWMS and address shortcomings of preceding strategies.

- Key learnings, best practices and principles from both developed and developing countries must be considered and adapted to the South African economic, environmental social, political and cultural context.
- Despite the good intent of the NWMSs, South Africa has largely failed to meet its objectives. These have been mostly visionary documents with overambitious targets that have been poorly accomplished. Focal areas for improvement should therefore be on effective implementation, adequate funding, compliance and enforcement and societal education programmes.
- Concerted efforts should be to include government, private business and society to take collective responsibility and accountability for sustainable waste management and progressive development of a practical circular waste economy for South Africa.
- Future NWMSs must move further away from traditional command-and-control environmental management approaches towards more inclusive hybrid approaches including widespread and well-funded education programmes and the private sector as a source of investment, innovation and enabler and innovation and to enable reasonable expectations to be achieved.
- Future NWMSs must aim to set more realistic goals and targets that are achievable, with due consideration to the country's social, political and economic conditions. Since many of the goals and target have historically not been adequately achieved, these strategies will be deemed as nothing more than visionary documents with over ambitious targets.

### **5.2.2 Recommendations for further research**

The following recommendations are made for further research:

- An evaluation of the effectiveness of the implementation of the South African 2011 NWMS.
- A critical analysis in the evolution of the effectiveness of the implementation of the South African NWMSs over time.
- A practical evaluation of service delivery in terms of household waste collection, separation at source and recycling initiatives.
- Opportunities for the further development, enhancement and implementation of existing education and awareness programs.

- Opportunities and challenges with developing and implementing separation at source and waste recycling programs in South Africa.
- Opportunities for further research and development of achievable waste management services and technologies for South Africa, including waste-to-energy.

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