Solid waste management (SWM) in Johannesburg: Alternative futures

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Declaration

I, Charity-Ann Chisadza, declare that the entire body of work contained in this research assignment is my own, original work; that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

CA Chisadza March 2015

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I dedicate this work to the memory of my baby girl Kunashe Z'iva Wurayayi.

"For I know the thoughts that I think towards you, says the Lord, thoughts of peace and not of evil, to give you a future and a hope." – Jeremiah 29:11

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Abstract

Johannesburg generates in excess of 1 500 000 tonnes of general waste annually and has on average 10 years' lifespan remaining on its four landfill sites.

As a signatory to the Polokwane Declaration, the City of Johannesburg has recognised the need for new interventions to divert waste from landfills by various methods, such as separation at source; alternative treatment methods and the conversion of waste to energy. Progress has, however, been slow and this research aims to investigate alternative waste management techniques that can be applied in the City of Johannesburg to fast track the realisation of these targets.

Using scenario planning techniques, the research considers implications for policy and management decisions in realising the best possible future in the area of waste management in Johannesburg. The scenario process was used to develop the following scenarios for waste management in Johannesburg:

Long walk to freedom. Waste collection coverage includes pockets of the community where waste collections services are less than optimal. The residents of the city, particularly in these under-serviced areas, are also not very knowledgeable of the impact that the waste generated within their communities can have on the environment and what alternatives there are to manage this.

Pick it up. The City provides full services to a society that functions in relative oblivion of the implications of their behaviour on the environment. It is assumed to be the role of government to "pick up" after communities and dispose of waste. This scenario is oblivious of the waste hierarchy and the role communities could play in minimising waste.

Wishing on a star. The city continues to have under-serviced areas, public awareness is high and this fuels correct behaviour and a mind-set shift with regard to waste management.

Working together we can do more. The City optimises its service provision to cover all areas while also ensuring maximum public awareness and behaviour change with regard to waste management.

Key words

Solid Waste management, Scenario Planning, Waste Minimisation, Johannesburg

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Solid waste management is a key challenge and responsibility for city governments in the 21st century. As urban populations grow, the volume of waste generated also increases. The World Bank estimates that over a 25-year period in urban East Asia, solid waste will increase from 760 000 tonnes/day to 1.8 million tonnes/day (Urban Age, 1999).

The primary concern presented by increasing volumes of waste is the necessity to ensure public health as a priority. However, governments in developing countries need to balance this out against competing budgetary needs in other areas of urban development. Many cities in developing countries still need to extend basic services to significant portions of their communities, whereas other areas with service coverage have limited ability to pay for municipal services rendered. In addition, developing countries are still facing more pressing basic developmental challenges such as poverty, unemployment and inequality and therefore often apply techniques that respond to basic objectives of human safety and health.

While the urban population is growing, the land available to dispose of waste is diminishing (Urban Age, 1999), making it critical to find alternative methods of waste management, which would limit disposal to landfills. In response to climate change concerns and to reduce methane and greenhouse gas emissions, there is also a growing global trend of reducing untreated waste disposed in landfills by means of initiatives that separate waste at source, recycling and intensive thermal and/or mechanical biological treatment of waste.

In order to ensure sustainability and conservation of natural resources, waste management practices are transitioning towards more sustainable options. Numerous alternative methods of solid waste management have been developed in various parts of the world. The more affluent countries are able to move beyond meeting basic waste management needs to encouraging behavioural changes targeted towards environmental conservation.

Various legislative changes have influenced waste management. The intention of these legislative changes is to ensure that waste management is sustainable and will preserve the environment for future generations.

Thus the focus is shifting towards integrated solid waste management (ISWM), which is the selection and application of suitable techniques, technologies and management programmes to achieve identified waste management objectives and targets (Tchobanoglous *et al.*, 1993). ISWM includes a spectrum of waste activities – collection, separation, sorting, recycling, reusing, transportation, and disposal.

In this research, the focus will be on the experiences of the City of Johannesburg in waste management and to explore the alternatives in view of waste management which could be applicable in Johannesburg, in order to minimise waste that ends up in landfill sites.

1.2 RESEARCH PROBLEM STATEMENT

According to the Department of Environmental Affairs National Waste Information Baseline report (2012), 108 million tonnes of waste was generated in South Africa in the year 2011, of which 98 million tonnes ended up in landfills. Only 10 percent of the general waste is recycled.

Traditionally South Africa has used what is referred to as “end of pipe” strategies to waste management, meaning that disposal to landfill was the only option used and the focus was on acquisition of additional land for new landfill sites. South Africa’s approach to waste management has historically been focused on waste collection by municipalities with onward disposal in landfills.

In recent years, rural-urban migration has resulted in numerous informal settlements, particularly in the urban periphery. However, in response to growing international trends and pressure exerted on developing countries globally, increasing focus is being placed on alternative approaches to waste management based on the waste hierarchy.

Johannesburg generates in excess of 1 500 000 tonnes of general waste annually (Joburg, 2040). Waste management in the City of Johannesburg is the responsibility of Pikitup, which is an independent municipal-owned entity, wholly owned by the City of Johannesburg. Pikitup offers domestic and commercial services comprising the collection and disposal of waste, street cleaning, area cleaning, management of litterbins, and collection of illegally dumped waste and operation of garden sites. Commercial services include the collection and treatment of healthcare waste, bulk collection services, collection and disposal of hazardous waste, composting, recycling and operation of landfill sites.

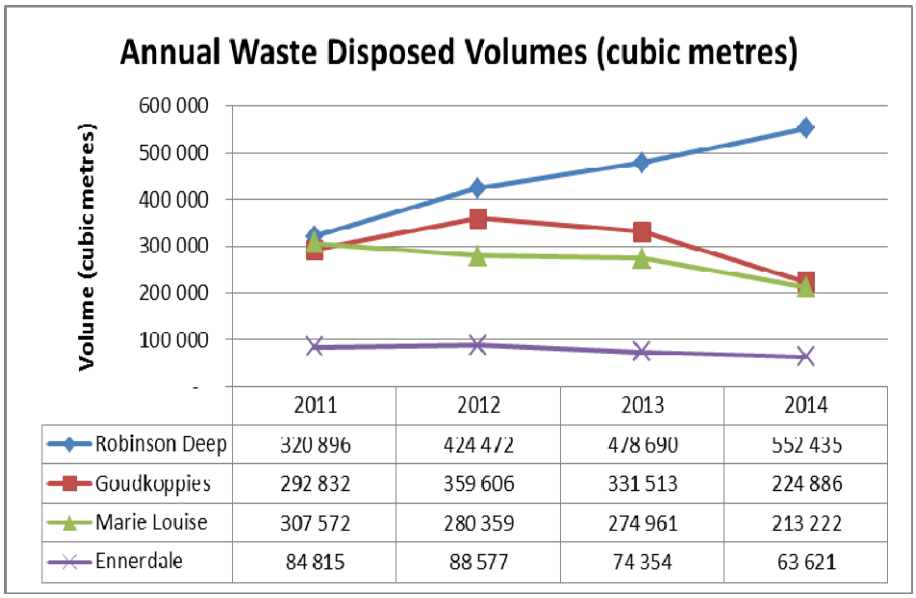
Table 1.1: Remaining landfill lifespans

Landfill site name	Available airspace in cubic metres	Lifespan (years)	Estimated closure date
Robinson Deep	4 972 680	7	May 2021
Goudkoppies	4 581 290	15	Jan 2030
Marie Louise	1 744 613	6	Jan 2021
Ennerdale	1 112 271	13	July 2027

Source: 2013-14 Fourth Quarter Performance Report Pikitup.

Historically over 93 percent of all waste has been directed to landfills (Joburg, 2040). Establishing new landfills is hampered by limited suitable land and the associated high costs. Table 1.1 depicts the remaining lifespans of the landfill sites available to Johannesburg and highlights the critical need for alternative waste management options.

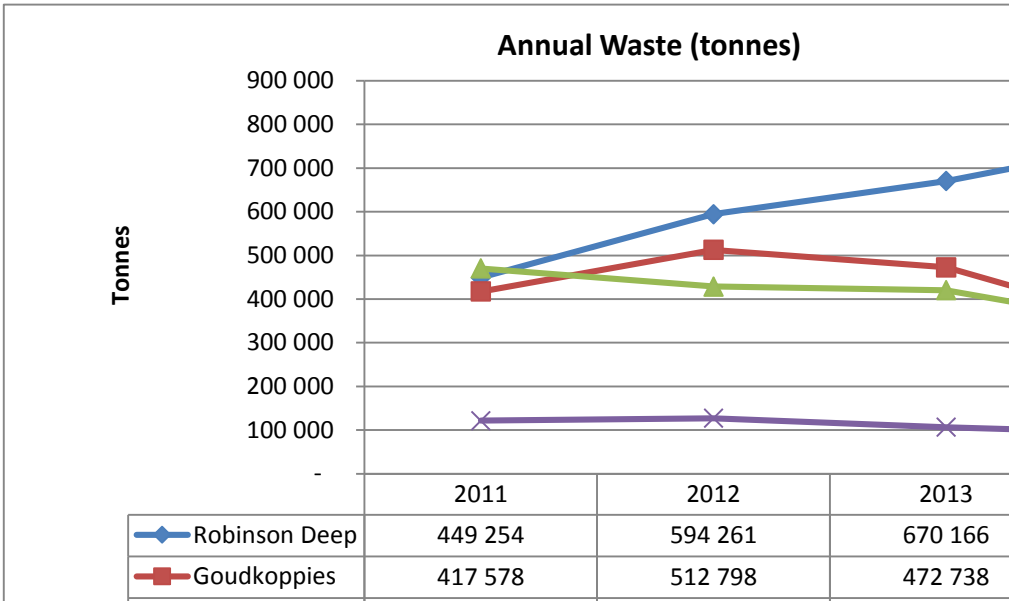
Figure 1.1 and Figure 1.2 below reflect the respective weight and volume of waste disposed to each of these landfill sites over the past four years.



	2011	2012	2013	2014
Robinson Deep	320 896	424 472	478 690	552 435
Goudkoppies	292 832	359 606	331 513	224 886
Marie Louise	307 572	280 359	274 961	213 222
Ennerdale	84 815	88 577	74 354	63 621

Figure 1.1: Annual waste disposal volumes

Source: 2013-14 Fourth Quarter Performance Report Pikitup.



	2011	2012	2013
Robinson Deep	449 254	594 261	670 166
Goudkoppies	417 578	512 798	472 738

Figure 1.2: Annual waste weight

Source: 2013-14 Fourth Quarter Performance Report Pikitup.

In the Polokwane Declaration, which was adopted at the National Waste Management Summit in 2001, the goal was set to stabilise waste generation and reduce waste disposal by 50 percent by 2012 and to develop a plan for zero waste by 2022 (Polokwane, 2001). As a signatory to the Polokwane Declaration, the City of Johannesburg recognised the need for new interventions to divert

waste from landfills by various methods such as separation at source, alternative treatment methods and the conversion of waste to energy.

In response to the Polokwane Declaration, Johannesburg had set itself targets to divert 15 percent of waste from landfills by 2010. Although Pikitup is committed to the Polokwane Declaration, there is concern as to whether the targets set are realistic or attainable. The principles of waste reduction and diversion from landfills are, however, fully supported and being pursued, albeit at a slow pace. At the time of this study, the City of Johannesburg had only managed to achieve a seven percent diversion from landfills (COJ, 2014).

As urban populations increase and the volumes of waste generated also increase, it is therefore important to explore alternatives to solid waste management that are financially sustainable. As the demand for services increases and adds pressure on infrastructure requirements (which already have unresolved historical backlogs), it is clear that public funding is insufficient to adequately address the growing demands from the city's residents. Financial pressure experienced as a result of the global economic downturn and the resultant depressed economic growth rates has provided additional incentive for developing countries, such as South Africa, to explore other alternatives that are sustainable in funding the needs of communities.

This research therefore seeks to explore alternative methods of waste management that have been successfully implemented in other parts of the world in ensuring waste reduction while also being developmental and sustainable.

1.3 RATIONALE OF RESEARCH

A review of various studies, including Engledow (2007), Spamer (2009), Crane *et al.* (2010), have covered the subject matter of solid waste management in South Africa. However, limited material is available regarding critically analysing solid waste management using scenario planning methodology within the context of a specific municipality. The focus of this research will thus be the use of scenario planning to assess the possible impact of alternative waste management practices in order to minimise waste.

Amer *et al.* (2013) highlight how scenario planning is increasingly being used because of its usefulness in times such as the present, which are characterised by uncertainty, complexity, rapid changes and unprecedented innovation. Scenario planning makes use of multiple futures as a means of simulating strategic thinking.

Scenarios can be defined as alternative "futures" resulting from various combinations of trends and policies (Fontela *et al.,* 1993). Scenarios have been used to articulate thought patterns in order to improve decision making. A wide range of options are taken into account in outlining possible future outcomes. These scenarios stimulate thinking around the status quo and point to possible changes that could challenge the prevailing mind-set.

Scenario planning has been used by large public and private institutions in making critical decisions, especially in circumstances involving high uncertainty. Large corporates such as Shell have used scenarios to test corporate strategies during the uncertainty of the oil crisis in the 1970s (Joseph, 2000).

In South Africa the scenario planning approach has been used in the Dinokeng Scenarios for South Africa. These scenarios sought to critically review South Africa as a nation 15 years into its democracy, in order to simulate the development of various possible future scenarios for South Africa as a country.

1.4 RESEARCH OBJECTIVES

Johannesburg is the destination of choice for many migrants and as a result has experienced substantial growth in the 10 years from 2001 to 2011 with the total population increasing by 37 percent to approximately 4.4 million. Over the ten-year period from 2001 to 2011, households increased by 36.7 percent from 1 049 671 households in 2001 to 1 434 856 households in 2011 (COJ, 2013a).

Over the same period, Johannesburg's budget has grown from R12 billion in 2001 to over R40 billion in the 2013/14 financial year. The proportion of the City's budget allocated to waste management has, however, remained consistent within the three to four percent range, despite the growing population (COJ, 2001 & 2011). The City leadership therefore faces the difficult challenge of balancing increasing service delivery needs using finite resources, while also ensuring sustainability.

The purpose of this research is to investigate alternative waste management techniques that can be applied in the City of Johannesburg. Johannesburg has developed a thirty-year Growth and Development Strategy (Joburg, 2040) based on defined key priorities that also respond to the national objectives. Among these priorities is "Going Green" with sub-programmes for "Integrated waste management" and "Low carbon Energy" which focus on alternative and environmentally friendly methods of responding to waste.

This research seeks to:

- Consider the factors that are unique to Johannesburg, in the context of its long-term strategic vision specifically in waste management;
- Explore various alternatives that have been successfully implemented in other parts of the world and consider their applicability in the context of Johannesburg;
- Consider various alternative scenarios and implications to policy and management decisions in realising the best possible future in the area of waste management in Johannesburg.

1.5 IMPORTANCE/BENEFITS OF THE STUDY

Despite the fact that the City of Johannesburg is a signatory to the Polokwane Declaration, achievement of the waste reduction targets has been slow. A number of strategic interventions have been put forward as part of the Integrated Waste Management Strategy. These interventions have yet to yield tangible benefits, however. It is therefore the intention of this study to assess the status quo and develop alternative "futures" in waste management, using scenario planning techniques. This process will consider lessons learnt in waste management around the world and use these in developing various scenarios that will inform the City's decision-making processes. These scenarios will provide information as to the nature of decisions that need to be taken to ensure tangible developments in waste management and waste reduction. This research will therefore assist the City's leadership to make informed decisions on sustainable waste management methods within the context of its growth and development strategy – Joburg 2040.

1.6 STRUCTURE OF THE RESEARCH REPORT

The first chapter of this research report provides an introduction to the study and highlights the challenge of increasing waste generation in urban centres as well as the need to implement measures to minimise waste and divert waste from landfills. The chapter will focus on defining the problem statement, the objective of the research and the motivation for the study.

The second chapter will give an outline of the literature review and provide the conceptual definitions of various aspects of Solid Waste Management, particularly recent developments in solid waste management and applicable legal and regulatory frameworks. A detailed literature review will be provided on municipal solid waste management experiences globally, extracting best practice in waste management. The chapter will also introduce the theory behind scenario planning and its application in assessing suitable waste management alternatives in Johannesburg.

The third chapter will describe the research design and methodology of this study. The scenario planning method used is qualitative and is applied to create hypothetical sequences of events constructed for the purpose of focusing attention on key drivers and decision points (Kahn & Wiener, 1967). This approach offers the opportunity to explore possible policies and decisions and their impact on waste management in the context of Johannesburg. This chapter consolidates the lessons learnt from global experience with the analysis of the status quo for Johannesburg to determine key driving forces which form the basis of developing the final scenario matrix for waste management in Johannesburg.

Chapter 4 presents the scenarios, recommendations and conclusions. This section will summarise the implications of the study and the choices that are available to the city's leadership with regard to waste management.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

Solid waste management is a challenge faced by many city governments. As cities grow, the amount of waste generated increases owing to the effects of increasing industrialisation and rising income levels (UN-Habitat, 2010). It is therefore important for city authorities to find sustainable waste management mechanisms. An integrated approach to solid waste management has come to the fore to ensure an effective and sustainable use of available funds. Integrated Solid Waste Management (ISWM) can thus be seen as a holistic method to ensure the application of efficient, simple and low-cost methods to manage waste, while also being cognisant of the possibilities of job and wealth creation and the reduction of the emission of greenhouse gases (UN-Habitat, 2010).

The current strategies and policies in environmental management and particularly waste management are largely influenced by the Rio Earth Summit in 1992. Agenda 21 of the Rio Earth Summit included the following portion relating to waste management:

> *"Managing Solid Wastes and Sewage*
>
> *Governments should urge waste minimization and increased reuse/recycling as strategies toward sound waste treatment and disposal; encourage "life-cycle" management of the flow of material into and out of manufacturing and use; provide incentives to recycling; fund pilot programs, such as small-scale and cottage-based recycling industries, compost production, irrigation using treated waste water, and the recovery of energy from wastes; establish guidelines for the safe reuse of waste and encourage markets for recycled and reused products."*

This chapter begins by providing a literature review of municipal solid waste management experiences globally, contrasting developed and developing countries. The intention of the literature review is to glean best practice from global experience and to show how this can be applied in Johannesburg in creating the desired waste management future. As the proposed future waste management alternatives will be considered using scenario planning techniques, this chapter will also introduce the theory behind scenario planning and its applicability in the context of this research.

2.2 SUSTAINABLITY IN WASTE MANAGEMENT

The waste management tools and approaches being used in many countries around the world are increasingly based on the need to ensure long-term sustainability. In order to meet the definitions of sustainability, waste management systems must be appropriate to the particular circumstances and challenges of the community, considering the perspective of the entire cycle of material use – from

production, distribution, consumption, waste collection and disposal. Sustainable waste management aims to minimise the waste while optimising the efforts to promote environmentally sound disposal and treatment methods (Meadows, 2008).

Thus, waste management practices are increasingly influenced by the waste hierarchy, especially by diverting waste from landfills, preventing the generation of waste and promoting the recovery of waste material.

2.2.1 Waste hierarchy

The world over, waste management frameworks and strategies are beginning to incorporate the concept of a waste hierarchy (Figure 2.1). The waste hierarchy is viewed as the first step towards stopping the “end of pipe” view of waste management and shifting towards an integrated approach (Wilson, 2007:200).

Industrial ecologists, Lyons *et al.* (2009) and Lyons (2005), argue that production and consumption systems should mimic natural systems in order to minimise the impact of waste on the environment. Solid waste management is thus transitioning towards a holistic resource management approach of “cradle to cradle”, such that waste materials from one process become inputs for another process or are used to make another product.

- Avoidance – actions taken to prevent generation of waste, e.g. cleaner production methods in industries
- Reduction – decreasing the amount of solid waste generated, e.g. imposing tax on plastic bags
- Reuse – recycling material by making use of its original purpose or similar purpose without changing its physical form, e.g. reusing drink bottles to collect water
- Recycling – remanufacturing material by using it as a resource or component in the manufacture of a new product, e.g. recycling plastic to make lower grade plastic
- Recovery – controlled extraction of a material or retrieval of energy from waste to produce a product
- Treatment – process designed to change the character of a waste product, remove/reduce hazardous/toxic component of waste
- Disposal/Landfill – Transfer of waste into a landfill site as a final form of disposal

Figure 2.1: Waste management hierarchy

Source: NWMS, 2011.

The principles of the waste hierarchy were developed in the 1970s in the Netherlands (Oelofse & Godfrey, 2008). Dutch and other European governments adopted these principles into legislation in

the 1970s. As the magnitude of waste problems increased has grown worldwide, these principles have increasingly been used to reduce the negative impact of waste on communities.

In many countries (mostly developing countries) the waste hierarchy is, however, often inverted as most waste is disposed in landfill sites (Markel *et al.*, 2008). Landfill disposal is the least favoured method of waste management in the waste management hierarchy. It has been argued that alternative waste management methods are considered expensive, requiring extensive capital investment with financial resources and capacity often being limited, particularly in developing countries. The next section of this report explores the experiences of the developed counties and how they have been able to successfully implement waste management systems based on the waste hierarchy systems. The intention is to glean lessons from their experiences that may be useful in proposing workable alternatives in the application of the waste hierarchy in developing countries with a particular focus on Johannesburg.

2.3 GLOBAL EXPERIENCE IN WASTE MANAGEMENT

The waste management practices seen around the world have evolved from varying circumstances, be it the need to safeguard public health in the most efficient manner, the need to preserve the earth's resources for future generations, or the need to respond to the increasing waste generated in cities as a result of rapid urbanisation and economic growth. Whatever the motivation, each particular set of circumstances contributes to the body of knowledge on waste management.

In the 19th century legislation was introduced in Europe and North America in response to the public health concerns arising from the outbreak of cholera and other diseases. The legislation resulted in the establishment of municipalities that took on the role of removing solid waste and keeping public spaces clean. Up until the 1960s and 1970s, waste management continued to focus on waste collection until the emergence of the environmental movement. This led to the introduction of new legislation in the 1970s to address issues of uncontrolled dumping, pollution and contamination of natural resources, amongst others. Thus began what is referred to as the modernisation of solid waste management in developed countries (UN-Habitat, 2010).

In the 1990s, after the Rio Earth Summit, a new focus emerged, particularly in the developed world, focusing on climate change and the need to limit emissions of methane gas from landfill sites (NWMS). Methane gas is formed when biodegradable waste (kitchen and garden waste, paper amongst others) decomposes in the absence of air in a process referred to as anaerobic decomposition. Legislative focus thus shifted towards diverting biodegradable municipal waste from landfills, landfills bans for recyclable waste, setting targets for recycling, composting and recovery of waste. Logistical, geographical and institutional changes to waste management also began to play a significant role in discouraging the disposal of waste to landfills. By developing regional landfill sites with weigh-based gate fees which result in spiralling cost of collection, cities are able to encourage other waste disposal alternatives that divert waste from landfills. In this way, the US was able to

increase its recycling goal from 15 percent to 50 percent within a short period in the 1980s (UN-HABITAT, 2010).

Although many high-income countries are now shifting their attention in waste management towards increased innovation, many cities in low- and middle-income countries are still working through the basics of service delivery, including the process of phasing out open dumps and establishing controlled disposal. What has worked in high income, developed countries may however not necessarily work in developing countries that are now grappling with the same challenges. Some solid waste technologies that have worked in the high income countries which have relatively dry waste, may not be so easily applicable in lower income countries where waste tends to contain more organic waste, and is generally wetter (World Bank Urban Series).

The body of knowledge on waste management practises has significantly grown over the last 30 to 40 years, as cities have applied various ways to take control of growing quantities of waste and to maintain a clean environment. In doing so, they have gathered experience about what works. What is often overlooked, however, is that high-income developed countries have gone through an evolution process to develop their current waste management systems, in the context of their climate, social conditions and economies. Any lessons learnt from their experiences would thus need to be tailored to suit the context.

A few cities have been selected for assessment of their waste management practices to establish lessons learnt.

2.4 CURRENT PRACTICES – DEVELOPED COUNTRIES

2.4.1 Adelaide, Australia

Adelaide generates over 742 000 tonnes of municipal solid waste per annum and has a 100 percent waste collection coverage (percentage of the city's population covered by waste collection services) (UN-HABITAT, 2010). Waste management processes in Adelaide are well developed and regulated, given that for over 30 years, the city has developed extensive environmentally conscious standards for both industry and government. Industries are technology intensive and in line with this, the waste collection system is therefore highly modernised. Although Adelaide has considerable landfill space available, they continue striving to make waste disposal as irrelevant as possible by means of a combination of material specific bans, e.g. a plastic bag ban, increased landfill taxes and encouragement of innovation in recycling and recovery by provision of grants and research programmes.

The experiences of Adelaide reflect the importance of a high level of political will to implement radical waste management policies. The political leadership support these policies by means of effective institutional structures, financial mechanisms and appropriate organisational capacity. Their waste management system ensures the effective use of available technologies and incorporates other

aspects such as recycling and waste recovery processes. Public awareness and education also contributes towards meeting set targets of waste reduction (UN-HABITAT, 2010).

2.4.2 San Francisco, United States

San Francisco collects over 508 000 tonnes of municipal solid waste per annum (2006 data) with 100 percent waste collection coverage. San Francisco is an innovator in environmental and resource management, having been one of the initiators of the United Nations Environmental Programme (UNEP) Urban Environment Accords. The accords were a set of concrete actions in seven thematic areas, including energy, waste reduction, urban design, biodiversity, sustainable transport, environmental health and water. These actions were intended to ensure sustainable city development. Escalating landfill, transport and material processing costs led San Francisco to explore innovation in order to combat increasing costs.

As San Francisco does not have its own landfill. Waste is transported 85 km away for disposal and this cost is factored into municipal rates to encourage recycling and composting, this reducing the need to dispose at the landfill. In this way, the waste diversion strategy of “pay as you throw” encourages recycling and composting by charging no additional cost on residential customers for collecting recyclables and organic waste and a 75 percent discount for commercial customers. An average resident of San Francisco generates 1.7 kg of waste per day and 72 percent of this waste is recycled. The city has been able to achieve much in the area of waste minimisation and this is supported by an enabling legislative framework, even at national level, that encourages recycling, the use of “green” compostable products and puts a ban on products such as plastic bags.

Another key aspect is public awareness and community involvement. The city hosts community clean-up programmes that involve Public Works staff, working with business owners and residents, to encourage best practices by means of events such as street fairs. As a result of such outreach programmes, San Francisco disposes only 28 percent of its waste to landfills. As much as 72 percent of waste is diverted from landfills by reuse, recycling or composting for agricultural use (UN-HABITAT, 2010).

The experiences of San Francisco also indicate the importance of creating an enabling environment via the enactment of ordinances and regulations that instil the desired behavioural change. Community involvement has also been a key factor in minimising the waste disposed in landfills.

2.4.3 Rotterdam, Netherlands

Rotterdam generates over 308 000 tonnes of waste per annum with 100 percent waste collection coverage. Although the national policy framework targets elimination of landfill disposal and maximisation of material and energy recovery from waste, Rotterdam is more focused on maximising energy recovery than material recovery.

In the 1970s and 1980s, the Netherlands, together with Germany and Denmark, were the leaders in the area of waste recycling and as a result of this; Rotterdam is in many aspects far ahead of many

other urban centres with regards recycling processes. This has been achieved through an aggressive national policy framework on waste management coupled by widespread environmental awareness. By means of these awareness programmes, residents are able to actively play their part in separating waste for collection via depots, drop-off containers and house to house collections. By collecting waste items separately, operators are able to ensure effective end-of-life management and energy recovery of these products, thus limiting disposal to landfills to 0.01 percent with the bulk of waste being incinerated (70%) and the balance recycled or recovered in some way (UN-HABITAT, 2010).

Rotterdam has achieved virtually zero waste to landfill by means of a combination of an effective legislative environment, efficient collection systems that facilitate diversion of waste from landfills and active participation by residents.

The analysis of the developed cities highlighted above clearly indicates that waste management in developed countries has evolved over many years to its current state. The evolution has been backed up by political will in implementing radical policies and legislations that support the separation of waste plus recycling and minimising waste disposed in landfills. These cities make use of advanced technologies and automated separation processes with extensive community involvement.

2.5 CURRENT PRACTICES – DEVELOPING COUNTRIES

Whereas developed countries make use of highly industrialised processes in managing waste, developing countries make use of less sophisticated processes that are often more labour intensive. Service coverage in many instances is insufficient and often augmented by informal waste collection activities by waste pickers or “scavengers”. These “scavengers” are usually low- income or unemployed citizens with no other option but to work under the conditions that put them under health and safety risks.

2.5.1 India

As a result of rapid population growth, industrialisation and the associated urban migration, thousands of tonnes of waste are generated annually in many Indian cities. As the country continues to pursue industrialised nation status, the amount of municipal solid waste generated is anticipated to continue growing (Sharma & Shah, 2005). The continued unplanned growth of cities makes it difficult for local authorities to provide the desired level of service. Municipal solid waste management is thus one of the greatest environmental challenges facing India’s megacities as most of the waste generated is disposed of in uncontrolled dumpsites.

Most Indian cities use a system of communal bins placed at various points along roads. House-to-house collections are limited. Many municipalities use private contractors to transport the bins from the communal collection points to disposal sites, whereas others make use of local communities and NGOs to supervise local separation and collection from where waste is generated to the communal

collection points. This is particularly so in overcrowded low-income areas that are not fully serviced by the municipality.

One of the earliest initiatives of the Indian government in municipal solid waste management was to encourage composting. This dates back as far as the 1960s and included the provision of state grants and loans to those local governments that set up composting plants. As a result, many of India's cities set up manual composting plants with capacities of 150 to 300 tonnes per day. Composting is the most widely employed MSWM technique in India, with above 56 composting plants in more than 43 cities. Currently, nine percent of waste is diverted to composting (Biswas *et al.*, 2010).

The city of Delhi is a typical example of the challenges faced in solid waste management in India. Delhi generates 2.5 million tonnes of waste per annum. The community container infrastructure is used in Delhi, where residents bring their waste to temporary storage points called *dhalaos*. Private door-to-door collection services are provided by waste-pickers who are co-ordinated by NGOs, the municipality and resident welfare associations (RWAs). The waste pickers are each provided with a rickshaw to collect the waste, as well as space to separate the waste. These waste-pickers charge a monthly fee for providing this service to 80 percent of households ranging from low to high income. The waste-pickers scour through the waste separating out the valuable materials before disposing into the *dhalaos* (UN-HABITAT, 2010).

There are over 150 000 waste-pickers in Delhi, which ensures that 25 percent of waste generated is recycled and diverted from disposal sites. By means of Public Private Partnerships with the municipality, private companies service the *dhalaos* collecting the waste and disposing it in three controlled disposal sites. The city is considering gas recovery projects for these disposal sites in the future as a way of reducing greenhouse gas emissions (UN-HABITAT, 2010).

In India, the informal sector plays a critical role in ensuring increased coverage of household collection services and the separation of waste for recycling. This is a clear variation from what has worked in developed countries. Countries like India have therefore redefined the role of the informal sector in waste management and it is being increasingly considered in strategic documents.

The review of waste management practices in developed countries indicated that a critical component of waste management in ensuring diversion of waste from landfills is ensuring 100 percent collection service coverage. Cities in developing countries like India are responding to the collection service gaps by incorporating the activities of the informal sector into the broader integrated waste management strategies. These informal activities are also playing a significant role in economic empowerment as they provide a livelihood for immigrants and marginalised people (Sharholy *et al.*, 2007). India's model of waste management is therefore able to provide a localised unsophisticated method of dealing with their growing waste and still achieve 25 percent diversion of waste from landfills.

The example of India indicates how developing countries can find mechanisms to respond to waste in a manner that responds to the waste hierarchy without necessarily replicating the approaches used in more industrialised and technologically advanced communities.

2.5.2 Dhaka, Bangladesh

Dhaka, the capital city and economic centre of Bangladesh, is one of the most densely populated cities in the world with a population density of 19 178 persons per square kilometre. Its official population is recorded as 7 million (2009) with 1 168 000 tonnes of waste produced annually. As is the case in any urban centre that is an economic hub, Dhaka is faced with the challenge of responding to growing in-migration and thus needs to develop adequate infrastructure that meets the growing demand. With a human development index of 0.543, poverty and a poor living standard are prevalent. Over 3 million people live in what are considered to be slums.

Waste collection in such conditions is based on a door-to-door service provided mostly by micro-enterprises operating in much the same way as waste collection practises in Delhi, where waste is taken to designated collection or transfer points. The municipality then services these designated collection points. There is also active involvement of citizens by means of ward-based waste management schemes. These schemes promote public awareness as citizens receive training on waste management and mechanisms to monitor performance of the service providers and assist in troubleshooting. The micro-enterprises that collect waste within the wards also receive training to ensure they are properly aligned to the municipality's secondary collection service. Within the communities there are also over 120 000 waste pickers who ensure that anything which can be separated from the waste to generate additional value, is stripped out before disposal. Waste that is recovered is sold or reused via a complex network of formal and informal partners, both in the public and private sector. Dhaka is therefore able to respond to the challenges of a large population which is densely located and which produces a large volume of waste daily. By making use of the informal sector working with the formal service providers, Dhaka is able to ensure that 18 percent of waste is recycled, despite only having a 43 percent coverage ratio in waste collection (UN-HABITAT, 2010).

2.6 SOLID WASTE MANAGEMENT IN SOUTH AFRICA

2.6.1 Waste Management Governance framework

Given the significant impact of municipal waste management within the social and environmental context of South Africa, it is important to consider the regulatory framework within which it operates. Most modern environmental governance frameworks are influenced by the outcomes of the Rio Earth Summit and therefore advocate waste minimisation, environmentally sound waste reuse and recycling, environmentally sound waste disposal and treatment and the extension of waste services within communities. These principles, amongst others, have significantly influenced the development of South Africa's legal framework on waste management and key aspects are summarised below:

Table 2.1: South African Legislative Framework

Year	Legislation	Main area of emphasis
1996	Constitution 108 of 1996 – Bill of Rights	Waste removal as a local government function
1989	Environment Conservation Act, 73 of 1989	• Environmental Impact Assessment Regulation (EIA) • Framework for the protection of the environment
1998	National Environmental Management Act, 107 of 1998	
1999	National Waste Minimisation Strategy	• Waste minimisation and prevention
2000	Whitepaper on integrated pollution and waste management for South Africa	Prevention of pollution, waste minimisation and considering other alternatives.
2001	National waste Summit – Polokwane Declaration	First national summit on waste
2007	National Waste Management Bill	Overarching National legislation on waste management
2008	National Environmental Management: Waste Act	Overarching National legislation on waste management

Source: Engledow, 2005.

The objective of the National Environment: Waste Act, 2008 is "to reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith."

The National Environmental Management: Waste Act of 2008 provides, for the first time, a comprehensive and coherent legislative framework that responds to the concepts of waste hierarchy. The White Paper on Environmental Management introduced waste hierarchy to the South African policy environment. The concept of waste hierarchy was later enacted in the National Environmental Management: Waste Act (Waste Act). The act also obliges holders of waste to take responsibility for ensuring that reasonable measures are taken to implement the waste hierarchy while protecting the environment and ensuring public health.

The Waste Act is premised on the constitutional responsibilities assigned to national, provincial and local government. While national government institutes national legislation setting norms and standards to ensure national uniformity, local government has the responsibility of cleansing and refuse removal, refuse dumps and solid waste disposal. Municipalities are, however, permitted to develop their own standards provided they are not in conflict with national standards.

The South African local government sector is well regulated with the overall framework being set out in the Municipal Finance Management Act, 2003; Municipal Systems Act, 2000 and the Municipal

Structures Act, 1998. In terms of section 74(1)(h) of the Municipal Systems Act, a municipality must adopt a policy that amongst other provisions ensures optimum use of resources.

When considering current levels of unemployment in South Africa as a whole, there is added pressure to ensure that service delivery at a local level stimulates the creation of labour intensive activities to absorb the unemployed. Effective waste management strategies can be used as a tool for deriving economic benefit and job creation in waste management by means of waste collection and recycling. The Waste Act thus seeks to integrate environmental objectives with developmental transformation objectives, not only addressing public health concerns, but also economic development, poverty alleviation and job creation.

Despite the introduction of numerous policies that aim to give impetus to the waste hierarchy, landfilling remains the predominant waste disposal method in South Africa. South Africa remains far behind more developed nations such as the Netherlands and Germany, where the use of landfills is seen as a final disposal method in the waste hierarchy.

2.6.2 Johannesburg context

The City of Johannesburg produces approximately 1.5 million tonnes of waste per year which includes approximately 226 899 tonnes in the form of illegal dumping and 88 869 tonnes collected as litter from the streets (COJ, 2014). For the City of Johannesburg this is a costly affair, with the collection of illegal dumping and street litter costing in excess of R150 million (Ladouce, 2011). Waste collection coverage using the weekly domestic collection process is at 98 percent (Pikitup, 2014).

At the time of this study, the City of Johannesburg had only managed to achieve a 7 percent diversion from landfills (COJ, 2013b). The availability of suitable land for landfill space also remains a challenge with only four landfills available. The simplest way of extending the lifespan of landfill sites is to divert waste away from the landfill. The existing Johannesburg landfills will reach their capacity within the next 10 years. Implementing more sustainable practices such as waste minimisation and recycling can lead to savings in airspace at landfill sites, job creation and stimulation of the recycling economy.

In response to the target of waste diversion, guided by the waste hierarchy, Johannesburg has introduced a number of initiatives. By 2016 it is envisaged that every household will have the necessary receptacles to facilitate mandatory separation at source with the aim of increasing levels of recycling. The project was commissioned in 2009 in one suburb and encourages residents to separate their waste in different bags provided by Pikitup – orange bags for paper waste and clear bags for other recyclables like bottles, cans, etc. Any residual waste is disposed in the 240 L bin collected in the weekly rounds, for final disposal at the landfill site. According to the Pikitup performance report for the Fourth Quarter 2014, altogether 495 102 households are participating in the waste separation at source project. For the financial year ended 30 June 2014, altogether 13 722

tonnes of recyclable waste was collected from these households, with over 500 jobs created. This initiative, which is voluntary, has been run as a pilot project in selected communities. The largest volumes have been from Waterval (3 847 tonnes) and Zondi (2 852 tonnes) (COJ 2014). Figure 2.2 below is a pamphlet used by Pikitup to drive public awareness of the separation at source programme in the Waterval area.

Figure 2.2: Separation at Source awareness pamphlet

Source: www.pikitup.co.za

The City of Johannesburg's waste for food programme also supports the recycling initiatives in low income areas as it aims to encourage collection of recyclables by poor households in exchange for food packages. An average poor household is estimated to collect about 5 kg of recyclable waste

every 2 weeks, which can be exchanged for a food parcel to the value of R15. Over the spectrum of the 142 households targeted, this initiative would yield about 18 tonnes of recycled waste per year, which is minimal in comparison to the over waste reduction targets.

In support of the recycling initiatives, the city has also established waste sorting/buy-back centres. The City is currently renovating a Material Recovery Facility (MRF) located at Robinson Deep landfill site which will process 500 tonnes of recyclables per day. The project also aims to ensure that re-claimers who are picking recyclables at the landfill site are employed in the facility. About 200 jobs will be created at Robinson Deep MRF when it is fully operational. Plans are also in place to establish MRFs at all of the other 3 landfill sites.

The City of Johannesburg is also currently implementing a waste to energy project which aims to extract and combust gas from landfills and generate electricity while reducing greenhouse gas emissions from the landfill. In the long term, the intention is to generate a total of 19 MW of electricity from 5 landfill sites which have the potential to generate energy for about 12 500 middle- income households. At the time of this research two sites were under development, namely Robinson Deep and Marie Louise.

Approval for the signing of a power purchasing agreement (PPA) with Eskom was received from the National Department of Energy in October 2013 for 18 MW as part of the Independent Power Producers programme. Construction at the three remaining landfill sites (Goudkoppies, Ennerdale and Linbro Park) is set to commence soon and electricity generators will also be commissioned in all sites. The project was registered with United Nations Convention on Climate Change (UNFCCC) in December 2012 and can sell carbon credits, accrued from the date of commissioning the site, in the carbon markets under the Kyoto Protocol.

In the opinion of the writer, the plans articulated in the City's planning documents and annual reports do not reflect significant volumes of waste reduction as targeted by each initiative to support the realisation of the intended goal to reduce waste to landfill. There does not seem to be clarity on how the separation at source will be rolled out in all regions in terms of the type of infrastructure, nature of collection service to collect receptacles and mechanisms for funding the required infrastructure. Given the voluntary nature of current recycling activities, the success of the separation at source will also greatly depend on the mechanisms employed to instil a culture of recycling and improved public awareness as well as education on waste related issues.

Thus the author seeks to respond to the challenges facing Johannesburg with regard to waste management, using the scenario planning approach to determine alternative "futures" for Johannesburg, depending on the choices made and policies put in place. The scenarios will take into account what has worked in both developed and developing countries, applied in the context of Johannesburg.

2.7 SCENARIO PLANNING

Scenario planning is a technique that has been used to assist organisations to prepare for possible eventualities in the context of uncertainty. Scenarios are therefore used to outline aspects of the future and assist in decision-making processes.

Herman Kahn, who is considered the father of scenario planning, defined scenario planning as “a set of hypothetical events set in the future constructed to clarify a possible chain of events as well as their decision points.” Scenarios therefore allow one to map out a plan from the actual present state to the proposed future situation, based on trends and policy decisions. They also assist in analysing the possible consequences of policy decisions.

Scenarios are useful in analysing the present and seeing it differently, by questioning the status quo and exploring new possibilities not previously considered. The process also includes describing the path that leads to the new possibilities. Schoemaker (1991 & 1993) suggests that scenario planning “must outline the possible futures, capture a whole range of options, stimulating thinking about the future and challenge the prevailing mind-set and status quo.”

Scenarios are developed, based on the needs of the potential audience, taking into account their varying needs and expectations. It differs from forecasting, as it does not predict the future but rather gives a range of possible future options.

Scenario planning has mainly been applied in long-term planning (ten years and more). Uncertainty, however, increases, the longer the time horizon. Thus a wider range of possibilities is seen in the future as indicated in the figure below.

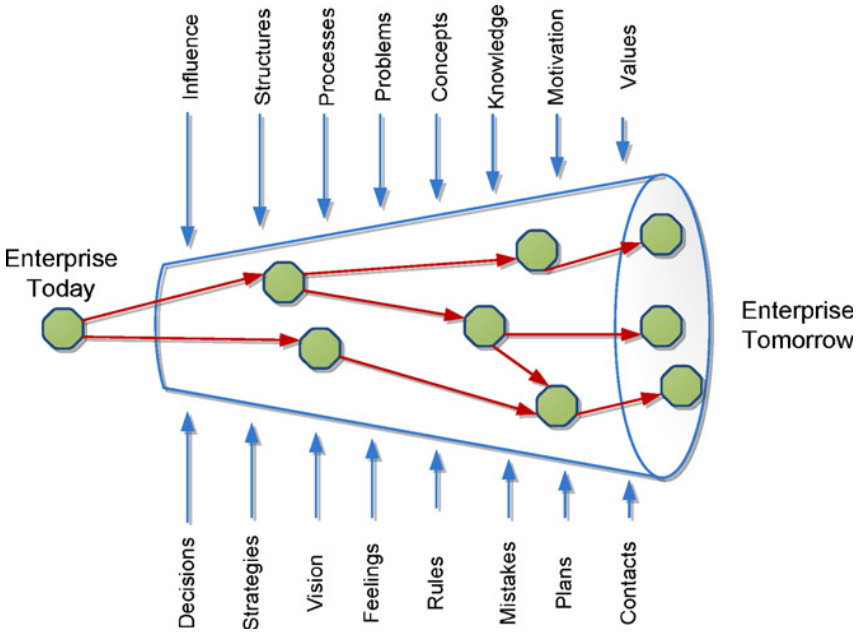


Figure 2.3: Range of scenario possibilities

Source: Pillkahn, 2008.

Pierre Wack (1985) put forward three main principles for developing scenarios building criteria:

i. Identifying the predetermining elements of the environment under review, such as historical actions, past events and the consequences of these events that will drive future outcomes;

ii. Ability to re-perceive the current reality in such a way that that the current environment is looked at with a new mind-set; and

iii. Developing a macroscopic view of business environment by exploring the environment over a wider area than the normal perspective.

Three major approaches to developing scenarios have emerged over time and these are:

- The intuitive logics method, which has multiple purposes and uses a one-time activity to make sense of situations and developing strategy. It is a process-oriented approach, which is essentially subjective and qualitative. The starting point is usually a particular management decision, issue or general concern;
- La prospective methodology which is mostly used as a one-time activity associated with developing more effective policy and strategic decisions. It is an outcome-oriented approach, which is directed, objective, quantitative and analytical, relying on complex computer-based analysis and modelling. The starting point is often a specific important phenomenon of concern; and
- Probabilistic modified trends (PMT) methodology which is a one-time activity to make extrapolative prediction and policy evaluation. This is an outcome-oriented approach, very directed, objective, quantitative and analytical, using computer-based extrapolative simulation models. The starting point is usually based in decisions/issues for which detailed and reliable time series data exists (Bradfield *et al.,* 2005).

The number of scenarios developed from the process may range from three to six, depending on what is appropriate for the matter being assessed. What is critical, however, is to develop a manageable number in a systematic manner, while ensuring that all dynamics are effectively dealt with (Mietzner & Reger, 2005).

Schnaar's literature review on scenario planning concluded, however, that most researchers recommended developing at least three scenarios. Less than three scenarios would not make it possible to adequately highlight the possible alternatives and therefore may not be appropriate.

2.8 SUMMARY

This chapter illustrated the application of the various waste management methods in different parts of the world. It is clear that what works in one country does not necessarily work in another, as the context in every country and city is different. In most cases developed countries are far ahead in terms of their legislation, policy development and the technologies in use in waste management. In many ways, that which developing countries are now experiencing in addressing growing waste

volumes, was experienced by developed countries over 30 years ago. Despite these differences, what is common, is the desire to find appropriate solutions to local challenges faced in waste management while keeping abreast with the global focus on waste prevention, waste minimisation and waste diversion.

The experiences of the cities highlighted in this chapter, have provided the following insights which will be applied in view of the scenarios to be developed for Johannesburg:

- Political will and leadership is a key driver in ensuring the development of an enabling legislative environment with effective ordinances and by-laws that are actively enforced;
- Correct institutional structures and organisational capacity that ensure the development and implementation of appropriate policies;
- Appropriate use of technology and equipment that takes into account all available technological advances within the financial means of the city to provide the right solutions in waste management;
- Efficient collection mechanisms that ensure the highest possible percentage coverage of collection services. Waste that is collected can be correctly managed to limit disposal to landfills;
- Collaboration between local authorities and the private sector (both formal and informal), including the use of micro-enterprises and community collection points to support municipal services;
- Training of private service providers and communities;
- Composition of waste;
- Ward-based waste management schemes that can be used to galvanise community participation as well as monitoring of service provider performance at community level; and
- Public awareness campaigns.

This report will use scenario planning to determine how these key drivers for waste management can be incorporated in the waste management processes of Johannesburg in order to meet the targets of waste reduction. The next chapter delves deeper into the mechanics of scenario planning and its applicability in this particular context.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 INTRODUCTION

There are various methods of developing scenarios available. When considering the totality of available methods for scenario building, all techniques essentially emphasize defining the issue; identifying the stakeholders; analysing trends, constraints and any other relevant information. These are ranked in order of importance and uncertainty (Keough *et al.*, 2008).

The scenario building models developed by Schoemaker (1991 & 1993) and Schwartz (1996) have been much cited in literature and seem to be the most popular models applied. Schwartz uses an eight-step process where scenarios are developed by focusing on key scenario drivers.

The purpose of this chapter was to provide a brief overview of the scenario process using the Schwartz model. This method allows for the formulation and consideration of several plausible alternative futures. The narratives were based on researched information and contain relevant detail that would facilitate understanding of the issues under discussion and facilitate real-life decisions. The scenarios presented provide a tool for directing perceptions and are aimed at directing sound strategic decisions, based on all scenarios which may be deemed plausible.

3.2 METHOD OF SCENARIO DEVELOPMENT

As one of the world's leading futurists, Schwartz (1996) presents the following steps for developing scenarios:

Step 1: Identify focal issue or decision

Start "from the inside out" by beginning with a specific issue or decision and then build out toward the environment. Begin with important decisions that have to be made in order to ensure that the differences that distinguish the relevant scenarios will actually bring about changes in the business. In the context of this research, the critical decision that needs to be made is:

"How does the city put in place appropriate policies to ensure that waste is effectively minimised and diverted from landfills?"

Step 2: Key forces in the local environment

List the key factors that will influence the success or failure of the issue or decision identified in Step 1. These might be basic facts about customers, service providers, competitors, etc.

The key stakeholders that need to be considered in the scenarios include:

- Consumers (households, businesses, government, amongst others);

- Collectors of waste (formal and informal);
- Waste processors;
- Brokers who buy and sell recycled material;
- End-use markets that purchase recovered or converted materials;
- Policy makers;
- NGOs and community groups.

Pikitup currently services 967 000 households and aims to increase this by 4 percent to 1 010 000 by 2016. Altogether 653 673 tonnes originate from round-collected services using waste collection vehicles on weekly rounds. An additional 88 869 tonnes originate from collection of street litter and 226 899 tonnes from collection of illegally dumped waste. It was found that the balance of waste was collected from informal settlements (COJ. 2014).

Step 3: Driving forces

List the driving forces in the macro-environment that can influence the key factors identified in Step 2. These can include social, economic, technological, political and environmental forces. Also ask the question: "What are the forces behind the micro-environmental forces identified in Step 2?" Determine what is inevitable and necessary (e.g. demographics) and what is unpredictable and subject to choice (e.g. public willingness). To define the driving forces adequately, research was required in areas such as markets, new technology, political factors, economic forces, etc. The aim was to search for major trends and trend breaks.

Step 4: Rank by importance and uncertainty

This is based on two criteria:

- Degree of importance for the success of the focal issue or decision;
- Degree of uncertainty surrounding the identified factors and trends.

Ranking would identify the two factors or trends that are most important and most uncertain.

Step 5: Selecting scenario logics

The ranking exercise determines the axes along which differences in the eventual scenarios were presented. The axes were then presented as a matrix (with two axes) in which different scenarios can be identified and their details compiled. The logic of a given scenario would be characterised by its location in the matrix.

Step 6: Fleshing out the scenarios

The list of key factors and trends identified in steps 2 and 3 is then re-evaluated individually in order to flesh out the skeletal scenarios and determine which side of an uncertainty the factor should be

located and in which scenario. Lastly, the pieces should be weaved together in the form of a narrative: Describe how a situation will get from here to there and define what events might be necessary to make the end point of the scenario plausible.

Step 7: Implications

With reference to the focal issues or decisions identified in step 1, the alternatives were then considered by asking the questions:

- What does the decision in each scenario look like?
- What vulnerabilities have been revealed?
- Analyse the strength of the decision or strategy across all scenarios and identify how the strategy can be adapted to make it more robust.

Step 8: Selection of leading indicators and signposts

Once the different scenarios have been fleshed out and their implications for the focal issue determined, it is recommended to identify a few key performance indicators to monitor in an ongoing way. These will assist the organisation in knowing what the future holds and how that future is likely to affect their strategies and decisions.

3.3 DEVELOPMENT OF THE SCENARIO MATRIX

3.3.1 Determining the focal issue

To be useful, scenarios must be focused. The scenario development process for this research was therefore anchored by the following focal question:

How can the City of Johannesburg achieve zero waste to landfill by 2030?

3.3.2 Brainstorming results for key driving forces

A list of all the discussed driving forces and/or factors that could influence the future of waste minimisation efforts in Johannesburg is given in Appendix A. The categories of social, political, economic, environmental and technological factors were used as a guideline for considering key factors.

These factors were grouped into the following overarching categories of key drivers:

i. Political will and leadership in creating an enabling legislative environment with effective ordinances and by-laws;

ii. Visible by-law enforcement;

iii. Appropriate institutional structures and organisational capacity;

iv. Appropriate use of technology and equipment;

v. Efficient collection mechanisms that ensure the highest possible percentage coverage of collection services. Waste that is collected can be correctly managed to limit disposal to landfills;

vi. Collaboration between local authorities and private sector (both formal and informal), including the use of micro-enterprises and community collection points to support municipal services;

vii. Composition of waste;

viii. Impact of public awareness campaigns;

ix. Population growth rates resulting in increased waste generation; and

x. Limited landfill space.

3.4 KEY CERTAINTIES AND UNCERTAINTIES

Table 3.1 gives the key certainties and the key uncertainties for the above-mentioned categories. These were determined in a perception survey conducted with key personnel from the Pikitup Business Planning and Performance Monitoring unit.

Table 3.1: Key Certainties and Key Uncertainties

Key Driving forces	Certainties	Uncertainties
i. Political will and leadership in creating an enabling legislative environment with effective ordinances and by-laws	South Africa as a country is moving away from “end of pipe” waste solutions and must implement the hierarchical management of waste with emphasis on waste avoidance and minimisation, through to responsible disposal. At the National Waste Summit held in Polokwane in September 2001, the Polokwane Declaration was adopted which commits South Africa to a reduction of 50% in the amount of waste being landfilled by 2012 and to zero waste by 2022. High-level political support is, however, insufficient, as political support at the level of ward councillors is required to create awareness and assist in enforcing programmes.	Enforceability of waste reduction targets, as they are currently not stipulated in law. There is also insufficient information on waste volumes in various waste streams to inform decision making on target setting.
ii. Visible by-law enforcement	Waste management is mostly con-trolled by municipal by-laws. The City’s enforcement structures make provision for fines for infringement of by-laws. The fines may, however, need to be reinforced and made more onerous.	Ability to integrate enforcement efforts between JMPD, environmental inspectors and surveillance technology to improve by-law enforcement. Dependencies between enforcement agents are at times not clearly outlined, resulting in ineffective enforcement.

Table continues

Table 3.1: Continued

Key driving forces	Certainties	Uncertainties
iii. Appropriate institutional structures and organ-isational capacity	According to the constitution of South Africa, Waste Management is the responsibility of local government. Integrated Waste Management Plans which are an element of the Integrated Development Plan, are required of every municipality in terms of the Municipal Systems Act and should indicate the annual targets and key performance indicators. Although Pikitup has structures that incorporate research, project management and operations management, the roles and responsibilities are at times blurred, resulting in inefficient implementation of plans.	• Pikitup has reported a deficit for several years, but was able to report a surplus for the 2013/14 financial year, an indication that the measures put in place have yielded the results and strengthened the organisation. • Ability to attract sufficiently qualified and experienced staff for waste management as outlined in Integrated Waste Management Plans. • Recent media reports on their suspended MD have caused significant uncertainty in leadership of the company. • Uncertainty in South Africa's economic outlook may nega-tively impact the City's capacity to fund waste management ini-tiatives towards zero waste to landfill.
iv. Appropriate use of technology and equipment	By the count of the 2011 census, 24.9% of Johannesburg's 3.2 million working age residents were unemployed (31.5% youth unemployment). Availability of manual labour is therefore certain, thus favouring labour intensive interventions in waste management (COJ, 2013a).	• Ability to incentivise the recycl-ing and recovery industries, for example by providing tax exemptions for purchasing recycling equipment • Ability to provide low- interest funding to micro-enterprises for purchasing recycling capital equipment • Ability to attract the right skills for research and development work.
v. Efficient collection mechanisms that ensure the highest possible percentage coverage of collection services. Waste that is collected can be correctly man-aged to limit disposal to land-fills.	The City of Johannesburg is able to collect 98% of domestic waste in weekly round collections (COJ, 2014). To encourage recycling, Pikitup has adopted the separation at source model to ensure that there is no double handling of waste.	• Inadequate provision of service in informal settlements. From 135 out of 180 informal settle-ments in the City, Pikitup collect-ed in excess of 180 000 tonnes of waste on a daily basis. The balance of the informal settlements is serviced once a week and remains challenging from the perspective of resultant illegal dumping. • Public willingness to participate is a key uncertainty to the sepa-ration at source programme.

Table continues

Table 3.1: Continued

Key Driving forces	Certainties	Uncertainties
vi. Collaboration between local authorities and the private sec-tor (both formal and informal), including the use of micro-enter-prises and com-munity collection points to support municipal services.	By means of the Jozi@work programme launched in 2014, the City aims to provide services which can be co-designed with communities. The aim is to build capabilities in micro- enterprises, individuals and co-operatives, who can be assisted to initiate and build service offerings which not only meet the local needs identified (financed by government), but also allow those agents to sell their skills and service offerings to the wider local economy. These can be in the areas of waste collection, separation and recycling.	Although the Jozi@work pro-gramme gives indications of the expected jobs to be created from the waste sector (5 200 jobs by 2016 according to the Jozi@work operational model), there is no indication of the volumes of waste that will be diverted from landfills as a result of these initiatives.
vii. Composition of waste	According to the 2011 National Waste Information Baseline report, 35% of waste in South Africa is non-recyclable, 20% is construction and demolition waste, 13% organic waste, 13% metals and the balance a mixture of paper, plastic, glass, and tyres.	Determining a national waste information baseline for South Africa for 2011 proved extremely challenging due to a general lack of accurate waste data reporting. In order to put in place a clear and appropriate strategy on alternative ways to manage waste, it is important to have accurate records of the com-position of waste. It is important to measure what must be minimised. Accurate baseline information is not yet available for Johannesburg.
viii. Impact of Public awareness cam-paigns	The intentions of the City in terms of the community impact of waste minimisation initiatives are well documented in the City's strategic planning documents, including the targeted volumes of waste diversion. It is clear that the City would like to divert increasing volumes of waste from landfills. Current communication and aware-ness involves print coverage, media releases and radio interviews on such activities as clean-up campaigns and eco-rangers competitions.	• Impact of creative thinking in formulating incentives, for example a cost saving on the monthly disposal charges, would encourage a business to participate in source separation. • Use of ward committees to galvanise community participation.
ix. Population growth rates resulting in in-creased waste generation	The growth in urban population in South Africa is outpacing the national population growth. Johannesburg is home to more than 4.4 million people, accounting for about 36% of Gauteng's population and 8% of the national population. Over the last decade, Johannesburg has grown faster than the Gauteng region, as it continues to be the leading metropolitan gateway for migrants from other provinces across South Africa as well as international migrants (COJ, 2013a).	Specific growth rates and densities in areas to plan accordingly – growth in informal settlements, backyard dwellers without confirmed numbers
x. Limited landfill space	The remaining landfill space in Johannesburg is limited. Even though other waste management technologies are being pursued, the need remains for additional landfill space. Even if the first waste to energy project is implemented, it will only be operational in about 7 years.	Impact of diversion initiatives

Having analysed the key drivers, the key uncertainties are ranked in order of predictability and relevance to the City of Johannesburg's waste management targets. This was done with the assistance of the personnel from the Pikitup Business Planning and Performance Monitoring unit using the following matrix:

Table 3.2: Scoring Matrix

Rating	Impact on City Waste Management
1	Slight impact
2	Low impact
3	Moderate impact
4	High impact
5	Maximum impact

Rating	Predictability Scale
1	Highly unlikely
2	Low chance of occurrence
3	Moderate chance of occurrence
4	High chance of occurrence
5	Extremely likely, virtually certain

Source: Own compilation.

Each key driver was assigned a score for impact on waste management and a score for predictability. The outcome of these ratings determined where the key driver was plotted as reflected in Figure 3.1 below.

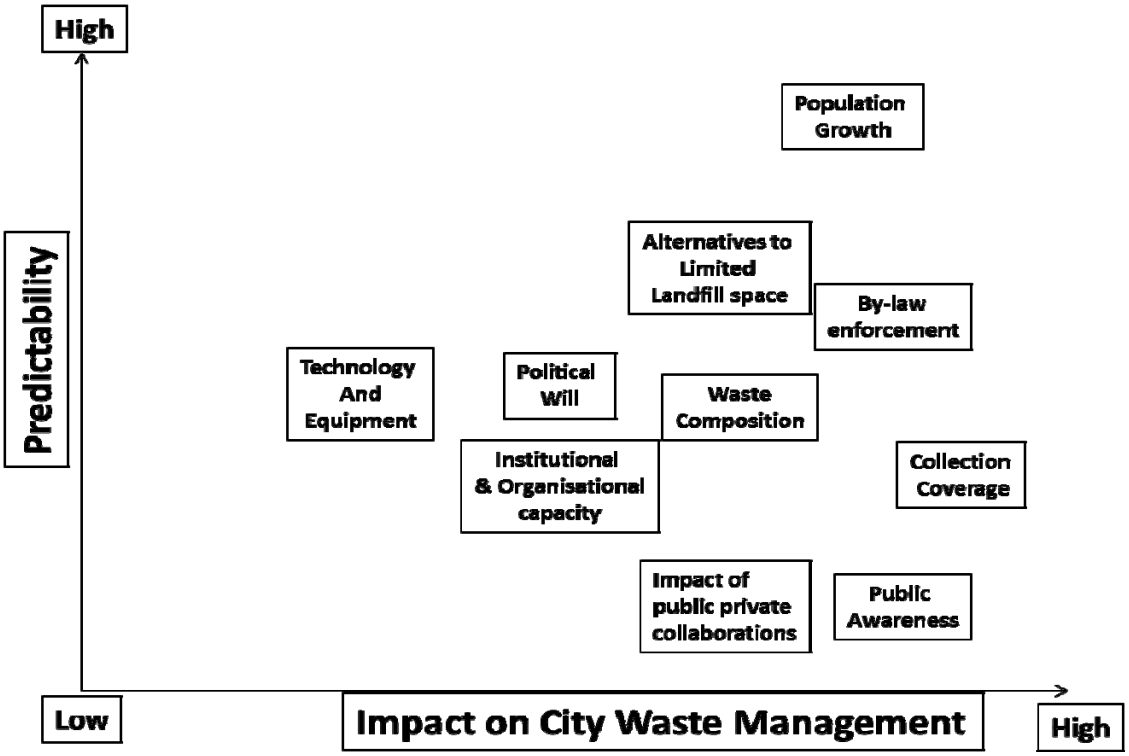


Figure 3.1: Ranking of key driving forces

Source: Own compilation.

Figure 3.3 indicates that the driving forces in the bottom right hand corner are the least predictable factors with the greatest possible impact on the City's waste management activities. These two factors are therefore the most relevant for providing the framework within which the scenarios can be developed.

3.4.1 Final scenario matrix

Figure 3.4 shows the final scenario matrix developed using the two key uncertain factors of change as identified in section 3.3.3, namely:

- Efficient collection mechanisms that ensure the highest possible percentage coverage of collection services. Waste that is collected can be correctly managed to limit disposal to landfills. Although the City has processes in place to cover routine waste collection in informal settlements, the continuous flow of new immigrants into Johannesburg makes this a moving target, as many new immigrants settle in informal settlements. Rural-urban migration is a leading contributor to the increasing rate of urban growth and proliferation of slums and informal settlements in Africa (AfDB, 2012);
- Impact of Public awareness campaigns – increased participation rates by residents across the entire city – would significantly alter the mindset on how waste is viewed. Current practices show limited creativity, however. There is little certainty of success of waste minimisation strategies given the current awareness programmes being run.

  By using the scenario matrix, four alternative futures for waste management in Johannesburg are subsequently identified. These futures, which are each considered plausible, were given descriptive names that identify principal characteristics of each scenario as indicated in Figure 3.2 below.

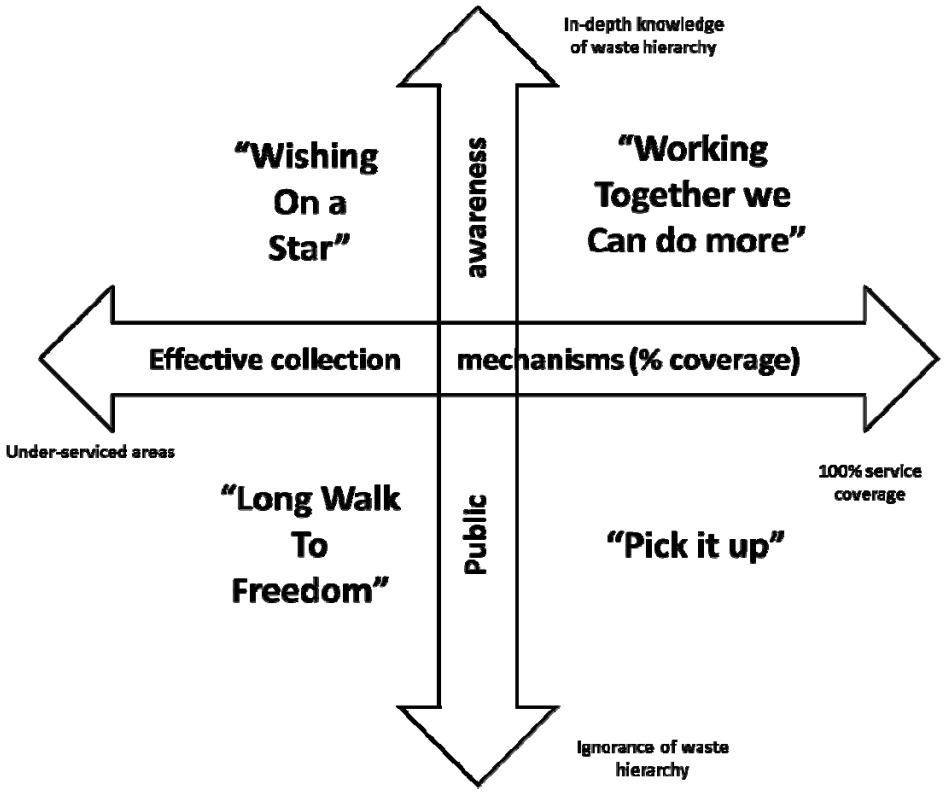


Figure 3.2: Scenario matrix for the future of waste management in Johannesburg

Source: Own compilation.

3.5 CONCLUSION

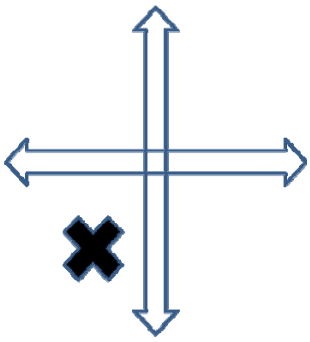
By following the scenario building process and specifically the identified key drivers, two of the most uncertain driving forces for the alternative futures were identified. These driving forces were used to develop four scenarios around which story themes for the alternative futures will be articulated.

CHAPTER 4
ALTERNATIVE FUTURES IN SOLID WASTE MANAGEMENT IN JOHANNESBURG

4.1 INTRODUCTION

This chapter elaborates on the identified futures through scenario narratives. The narratives are a way of portraying the core ideas of each scenario. They provide the rationale for how the futures may unfold through a series of possible events. In each scenario there are key indicators and signposts to indicate which of the scenarios is closest to the course of history as it unfolds.

4.2 "LONG WALK TO FREEDOM"



Long walk to freedom *represents the worst of both worlds. Waste collection coverage still includes pockets of the community where waste collections services are less than optimal. The residents of the city, particularly in these underserviced areas, are also not very knowledgeable of the impact that the waste generated within their communities can have on the environment and what alternatives there are to manage this.*

2014 – 2016

In 2014, Pikitup provided waste collection services to 98 percent of domestic households and daily waste collections to 75 percent of informal townships (135 townships out of 180), with the waste in the remainder of informal settlements collected on a weekly basis (COJ, 2014). As the rate of in-migration increases, there will be additional pressure to provide adequate services, particularly in informal settlements. Pikitup's response to illegal dumping of waste costs in excess of R80 million per annum for clearing illegal dumping and R74 million for clearing street litter. Pikitup cleaned up approximately 226 000 tonnes of illegally dumped waste in 2014 (COJ, 2014).

Looking ahead, economic growth continues to be weak and consequently the national fiscus is under pressure. As such, the share of national grants to local government is threatened (MTBPS, 2014). This puts further pressure on municipal leadership to stretch existing budgets to cover the gap created, using internally generated funds. At the same time a cost-reflective budget is approved for municipal services, including waste removal which puts strain on already over- extended customers in view of the macro-economic conditions. The energy supply challenges faced by Eskom in 2014 is giving rise to poor performance of companies, resulting in large-scale retrenchments and increased

unemployment. Rising unemployment does, however, not deter the migrants from coming to Johannesburg, which they perceive to be “the best place to find a job”, and this results in increased growth of informal settlements.

According to the United Nations, most of the world's population will be living in cities by the year 2030. By 2030, the towns and cities of the developing world will make up 81 percent of urban population (UNFPA, 2007). In developing countries, urban agglomerations are growing at twice the rate of overall population growth. Each day, approximately 160 000 people migrate from rural to urban areas. The estimated urban growth rate for more developed regions is 0.5 percent, compared to 2.7 percent in less developed regions and 4.5 percent in least developed regions (Gutberlet, 2009). As urban population growth rates continue to increase (a 27 percent growth in the population of Johannesburg is expected from 2011 to 2021), the volumes of waste generated will also grow (COJ, 2014).

Waste collection is one of the most vital urban environmental management services. It is a necessary part of urban infrastructure on the same level as the provision of housing, transport and healthcare. Collection coverage (the extent to which collection services reach households) is the most basic indicator of a waste system’s performance. Poor solid waste management impacts health and the general quality of the urban environment. Removal of solid waste is thus an essential function that the municipality should provide to its residents. The UNEPA (2006) states that waste that is not properly managed, from households and the community, poses a serious health hazard and could lead to the spreading of diseases.

Inadequate waste collection services invariably affect the poor more than the rich. Collections in informal settlements often do not take place as frequently as in more affluent areas and collections are done from centrally located containers which begin to overflow before the designated collection schedule. Uncollected solid waste piles up on roadsides, in drainage systems and in open spaces. Waste that is not collected, produces expensive environmental health impacts. It contaminates water and intensifies the effects of flooding. As the stench of uncollected waste becomes unbearable, community members fearing health hazards to children playing on the street decide to burn the mounds of waste, creating bellows of smoke that linger and pollute the air.

Many components need to work together to improve the quality of waste management service. Getting waste collection under control is the first step to ensuring modernised waste management. Countries like the Netherlands, where there are matured waste management systems, generally have 100 percent coverage in terms of waste collection. High waste collection coverage is considered to be indicative of good governance by the city authorities and would be linked with a more satisfied customer base.

In the present scenario there are ineffective channels of communication between the municipality and communities on the right way to deal with waste, especially in under-serviced areas, thus communities tend do not understand how they can assist in improving their environment even if the

level of service is below par. Lack of understanding of the environmental and economic impacts of dumping of waste further exacerbates the negative impact of inadequate collection services and the associated illegal dumping.

In this scenario, the public awareness processes that are in place, do not ensure correct understanding of waste management processes. This lack of understanding often leads to frustration and will result in sporadic service delivery protests becoming more pronounced, particularly in the run-up to the local government elections in 2016. The the long walk to freedom indeed continues as residents in underserviced communities grow increasingly frustrated with the notion that after more than 20 years of democracy they still do not live “freely” and “equally”, due to the discrepancies in quality of services rendered to the rich as apposed to the poor.

2016 – 2022

As in-migration continues into urban centres, the population growth rate in Johannesburg is soaring and is expected to reach 5.6 billion by 2021 (COJ, 2014). Potential job seekers stream to Johannesburg in search of employment opportunities and this fuels the exponential growth of informal settlments as the city cannot keep up with the demand for housing. With limited public awareness campaigns and community engagement, these new city residents understand little of how to preserve their environment by means of appropriate waste management practices. They also understand little about the potential economic benefits that could accrue to them if only they had the knowledge about the treasure that lies within the uncollected waste that surrounds them on their streets. Instead, they search for the elusive job in formal employment that drew them to the city.

As time goes by, with limited hope of ever landing that job, expectation turns to frustration and fuels protests over the quality of life in the informal settlements. South Africa has a rich history of civil disobedience and as such dissatisfaction is often expressed by way of public protests and service delivey protests. During this same time frame the country will go through one local government election in 2016 and a national and provincial election in 2018. Frustrations on the quality of service provided by government will also be expressed in the ballot boxes.

This scenario, by virtue of the anticipated elevated level of dissatisfaction with the quality of service, subsequently results in the possibility of extensive protests which may as such also negatively affect the public perception of Johannesburg as a “world class African City”.

Signposts

“Widespread protests over lack of Jobs and poor service delivery”

“Is this the quality of life Madiba sacrificed his life for?”

Key Performance indicators

i. *Migration statistics into the City*

ii. *Population growth rates*

iii. *Service standards in informal settlements for all services – water, electricity and waste services*

iv. *Unemployment statistics.*

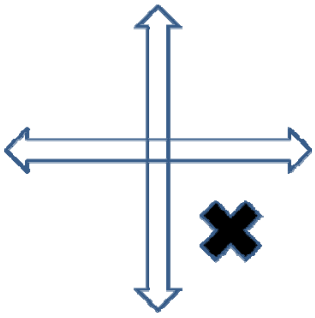
Key Policy Decisions to avert negative aspects of this scenario

i. *Public awareness policy on waste management*

ii. *Budget allocation for publicity*

iii. *Budget allocation for waste management aligned to population growth patterns*

4.3 "PICK IT UP"



Pick it up *represents a nanny state that provides full services to a society that functions in relative oblivion of the implications of their behaviour for the environment. It is assumed to be the role of government to "pick up" after communities and dispose of waste. This scenario is oblivious of the waste hierarchy and the role communities could play in minimising waste.*

2014 – 2016

In the face of political pressure resulting from the lost share of the vote in the national and provincial elections in 2013, Johannesburg's leadership made a commitment to secure votes for the 2016 local government election. Thus, in the context of a growing a urban population, increasing uncertainty on economic outlook and rising unemployment, the City is considering its approach to deal with the discontent amongst its electorate.

The City responds by prioritising visible service delivery. By means of community-based planning sessions conducted in preparation for the budget preparation, the City identifies hotspots from a waste management perspective, which will require additional budgeting in order to ensure that the collection coverage ratio is increased to 100 percent for all areas, including informal settlements. Aligned to this is a strategic focus towards investment in service delivery quality across all services (water and electricity) in order to ensure that there will be no cause for public protest on the basis of poor service delivery.

The waste management budget is targeted towards increased visibiity of environmental inspectors and to respond to incidents of illegal dumping within a set time limit.

The City's Jozi@work programme for regional project implementation across all services is implemented with limited focus on public awareness, which is critical in changing behavioural

patterns. Although the job creation targets are met and co-operatives and micro-enterprises are created to respond to waste management issues, waste continues to be generated in large volumes with little regard to the waste hierarchy principles. The co-operatives and micro-enterprises that were formed, work together with the City in a co-production model as part of the Jozi@work programme to ensure that waste is collected within communities at regular intervals.

In order to prioritize service delivery, while ensuring continued financial sustainability, the City, however, has to trade off and reprioritise its budget in other areas. As a result, expenditure on advertising, outreaches and awareness programmes is decreased, resulting in limited public awareness of the waste hierarchy and its potential for minimising waste to landfill, as well as for stimulating local economic development. Communities have thus become passive recipients of municipal services which they believe is their right. There is limited community involvement in waste management.

By improving the service delivery quality, there is renewed hope in the ability of Johannesburg's leadership and governance capacity. As a result, the ANC may remain the governing party in Johannesburg in the 2016 elections.

The improved service delivery has a downside, however, in that it becomes a pull factor for more migrants in search of a better life, thus adding more pressure to the existing infrastructure and resources.

2017 – 2022

The shift in focus towards service quality yields positive results and will continue towards the 2018 National and provincial elections. Continuing on this trajectory is, however, not sustainable, as it creates communities with high expectations with minimal involvement.

As population growth continues, fuelled by in-migration to Johannesburg, the population is expected to reach 5.6 billion in 2021. The demand for service delivery will soar, putting pressure on the City's financial position as it strives to maintain the service standards.

At the same time the City continues implementing its 10-year capital intensive programme, spending in excess of 10 billion per annum on capital projects (FDP, 2014). The financial development plan is premised on a set of key prudential ratios intended to safeguard the City's financial sustainability. Using these ratios, the affordability of the budget is determined, as well as the appropriate funding mix using grant funding, own cash and external loans. In the light of the continued weak economic performance, government grant funding is constrained, resulting in capital projects being mostly funded by loans and own cash. However, in order to maintain financial sustainability, a balance has to be maintained between obtaining aditional loans and generating internal reserves to fund capital projects. In maintaining this balance, the City implements austerity measures to ensure the continued generation of surpluses and therefore reduces some of its expenditure on operations. Although every effort is made to ensure limited impact on service delivery, the resultant impact is that the City begins

to look at other alternatives to ensure that service quality is maintained while reducing the cost carried by the City. This is done by mobilising communities to work together with the council through strengthening the Jozi@work approach to include building public awareness on maintaining service standards.

Following the 2018 elections, budget focus areas will have to be reviewed to ensure the continued financial sustainability of Pikitup and the City at large.

Signposts

"Service delivery protests a thing of the past"

"Joburg customers happy with service delivery – Customer satisfaction Survey 2016"

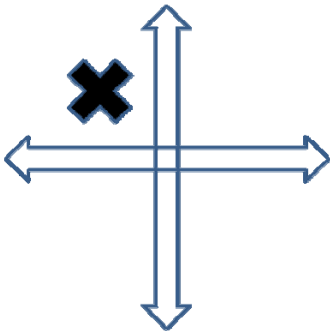
Key Performance indicators

i. *Track service delivery performance indicators*
ii. *Monitor the link between improved service quality and the incidence of protests*
iii. *Monitor migration patterns and align with service delivery plans*
iv. *Monitor key financial ratios to ensure continued financial sustainability*

Key Policy Decisions to avert negative aspects of this scenario

i. *Productivity standards to ensure optimal use of budgets in service delivery*
ii. *Set a defined portion of the budget for implementation of visible service delivery such as 100 percent waste collection services.*

4.4 "WISHING ON A STAR"



*In the **Wishing on a Star** scenario, although the City continues to have under-serviced areas, public awareness is high and this fuels correct behaviour and a mind-set shift with regard to waste management.*

2014 – 2016

The City optimises collaboration with private enterprises (including micro-enterprises and co-operatives through the Jozi@work programme). With these initiatives, the city targets to increase waste collection coverage especially in under-serviced areas. An important addition to this scenario is, however, the introduction of innovative approaches to building awareness of waste minimisation within the context of ensuring that the City remains financially sustainable.

Awareness creation campaigns in communities are aimed at changing people's attitudes and behaviour to ensure a cleaner environment. Such awareness campains are not only be targeted at communities, but also at the administrative and political leadership of the municipality in order to effect change in resource allocation.

Good awareness campaigns should encourage sustainable practices that reduce littering and illegal dumping in the long run. More emphasis is required on awareness creation relating to the implementation of the waste hierarchy. Thus, waste minimisation and waste separation at source need to be encouraged to enhance reuse and recycling activities. Willingness to pay for waste services will also improve with increased awareness of the benefits of waste services, as well as the actual cost thereof. Introduction of attractive incentive packages that encourage behaviour change also ensure sustainability of reuse and recycle initiatives.

It is important to make sure that communities are involved in the development of the waste by-laws and understand their role in achieving the goals of planned programmes and targets. Awareness and education programmes are therefore imperative. Public consultation during the annual processes to renew by-laws is encouraged in order to expose stakeholders and get their buy-in in such legislative frameworks.

In 2016, the City implements a public campaign programme based on the following Principles:

- Clean-up campaigns do not succeed in changing behaviour. Incentives associated with clean-up campaigns often reward bad behaviour;.
- The main messages of awareness campaigns must be: "Do not litter" and "Reduce, re-use and recycle";
- Payment for clean-ups must be decoupled from volumes of waste collected, but should rather relate to cleanliness of the areas;
- Advertising/creating awareness on a regular basis is important to inform household members who are new to the area;
- Start recycling initiatives and get buy-in from councillors and municipality officials before creating awareness amongst the public.

A dedicated department or section will be established to deal with awareness campaigns. They will partner with several stakeholders in the recycling industry to maximise impact. Schools, entrepreneurs and businesses will also targeted.

Awareness campaigns will include establishing the following:

KEY FACTS

- Each person in South Africa produces between half a kilogram and two kilograms of waste daily. This amounts to two bins per week in an urban household.
- By recycling 1 ton of paper, 17 trees can be preserved.
- By recycling 125 aluminium cans, enough energy can be saved to power one home for one day.
- 11 PET Plastic cool drink bottles can be recycled to make enough material for a pair of men's trousers.
- Recycling one bottle of glass saves enough electricity to light a 100 W bulb for 4 hours.

ROLE OF MUNICIPALITY IN WASTE MINIMISATION

- Providing suitable storage bins or facilities for different types of waste
- Showing people how to use these facilities
- Providing an efficient and affordable refuse collection system with waste separation and recycling options
- Initiating and supporting the development of recycling centres and transfer stations where needed.
- Setting aside suitable areas for landfill sites and Materials Recovery Facilities (MRF's)
- It is important for municipalities to put personnel in place who have sufficient capacity and knowledge to undertake the support and planning of waste minimisation and recycling schemes.

Figure 4.1: Public awareness drivers

Source: DEAT, 2002.

2017 – 2022

The principles noted above should be implemented by 2016 and become institutionalised going forward to ensure the City does not regress.

In the course of time, as awareness improves, communities in under-serviced areas should actively begin to manage waste in their area, based on the training provided through the waste hierarchy. These communities are engaged in recycling, material recovery and reuse in order to minimise the waste that must be collected weekly.

Thus as communities become increasingly aware of the role they can play in waste minimisation, they realise what can be achieved through waste management best practice. However as collection coverage is not at its optimum they continue to "wish on a star" for the day the municipality can work together with them to begin to improve the service delivery levels in all areas.

Signposts

"Reduce, Reuse, Recycle"

"Treasure from Waste"

"New Job opportunities in Waste"

Key Performance indicators

i. *Waste streams in different communities and map against public awareness programmes*

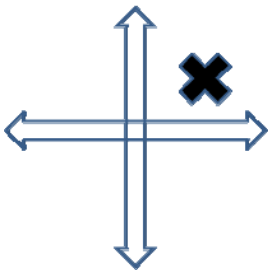
ii. *Waste volumes diverted from landfill*

Key Policy Decisions to avert negative aspects of this scenario:

i. *Budget allocation for establishment of a separate unit to implement public awareness programmes*

ii. Funding to establish buy-back centres and recycling centres within close proximity to communities involved in waste managment.

4.5 "WORKING TOGETHER WE CAN DO MORE"



*In the **Working Together We Can Do More** scenario, the City optimises its service provision to cover all areas while also ensuring maximum public awareness and behaviour change with regard to waste management.*

2014 – 2016

A waste minimisation unit will be established in Pikitup that will champion all initiatives aimed at minimising waste and the implementation of the waste minimisation plan. The implementation plan will include a comprehensive public awareness strategy that indicates how the waste minimisation unit will interface with other key roleplayers throughout the City's administration to ensure overall alignment of programmes.

Awareness creation campaigns in communities will target changing people's attitudes and behaviour to ensure a cleaner environment. Such awareness campaigns should not only be targeted at communities, but also at the administrative and political leadership of the municipality in order to effect change in resource allocation.

The waste minimisation team will also be responsible for ensuring that a waste stream analysis is done in order to ensure that the City can measure what needs to be minimised and set tangible targets for waste minimisation. In doing this analysis, the unit may also estabish the willingness of communities to participate in waste minimisation initiatives.

The waste stream analysis will also ensure that sufficient information is gathered upfront about whether sufficient quantities of recyclable waste will be produced in various areas of the city where initiatives are targeted. This process will also provide information as to the locations of markets for recovered and recycled material, taking into consideration the cost benefit of transporting loads of recyclables over long distances. Thus the City's land acquisition policy will take into account the requirements for waste recycling in determining any additional pieces of land that need to be purchased for the establishment of well-located recycling plants and material recovery facilities.

In 2014 the City implemented the Jozi@work programme. Using the regional Jozi@Work forums, residents will be able to propose approaches to providing services and improving delivery quality and coverage specific to their local conditions and potential capabilities. By means of the co-operatives and micro-enterprises formed in this programme, the City will be able to ensure the broadening of service provision to parts of the City previously not fully serviced. To strengthen the effectiveness of

these implementing agents at community level, the City will also need to invest substantially to ensure that there is adequate understanding and awareness of how the work of these agents fits into the broader strategy of the City. In the area of waste management, the implementing agents will therefore not only ensure waste collection at community level, but will also be adequately trained on the waste hierarchy and the importance of minimising the amount of waste that is disposed of in landfills.

Through these Jozi@work initiatives, co-operatives can become involved in waste collection, recycling and recovery activities. Micro-enterprises are formed which could make use of the recycled waste and produce economically viable products for resale. Jobs will thus be created in communities to absorb the growing number of migrants. To ensure the momentum of the community projects, continuous training and public awareness will however be required together with effective and visible by-law enforcement. The tariff structure for waste should be amended accordingly to promote waste minimisation and encourage separation at source.

There is limited impact to the budget, as all community projects are funded from already approved budgets, the only difference being that community groups are the implementing agents in line with the Jozi@work principles (Jozi@work, 2014).

By 2016, the City's waste minimisation unit will be fully functional and operating to achieve the IDP target of 20 percent reduction in waste (COJ, 2013a).

Buoyed by the success of the Jozi@work programmes, improved customer satisfaction and service delivery quality, the ANC may win the elections in the 2016 local government elections.

2017 – 2022

Setting forth the momentum achieved up to 2016, the City would continue with its community- based initiatives towards reaching the target of zero waste to landfill by 2022 in line with the Polokwane Declaration.

All communities should be sufficiently educated on the benefits of recycling and all the necessary infrastructure rolled out to ensure that every household has access to recepticles to ensure separation at source. In some communities these are at household level and in other communities, where access is limited, the recepticles are at centralised points, facilitated by community agents. In so doing, 100 percent waste collection will have been achieved, which will help ensure that what is collected, can be correctly treated. The recyclying facilities will produce sufficient volumes of recycled paper approved by the City in view of the policy to use only recycled paper in all its offices.

The waste to energy plants are to be fully functional at all the City's existing landfill sites, ensuring that waste that was generated historically will also be put to good use. In the light of the pressure on Eskom's generating capacity, this additional energy assists the City to limit the impact of constraints to the Eskom capacity in the period 2015-2021.

Signposts

"Reduce, Reuse, Recycle"

"Joburg creates Jobs in waste management"

"New Job opportunities in Waste"

"No Power Outages in Joburg"

Key Performance indicators

i. *Number of jobs created by JOZI@WORK*
ii. *Attainment of Customer Service Charter commitments*
iii. *Reduction in service delivery complaints*
iv. *Improvement in Customer Satisfaction Survey index*
v. *Number of partnerships entered into for collective implementation of JOZI@WORK*

Figure 4.1 below summarises the key decisions that will need to be made by the city administration in order to achieve the positive outcomes of this scenario.

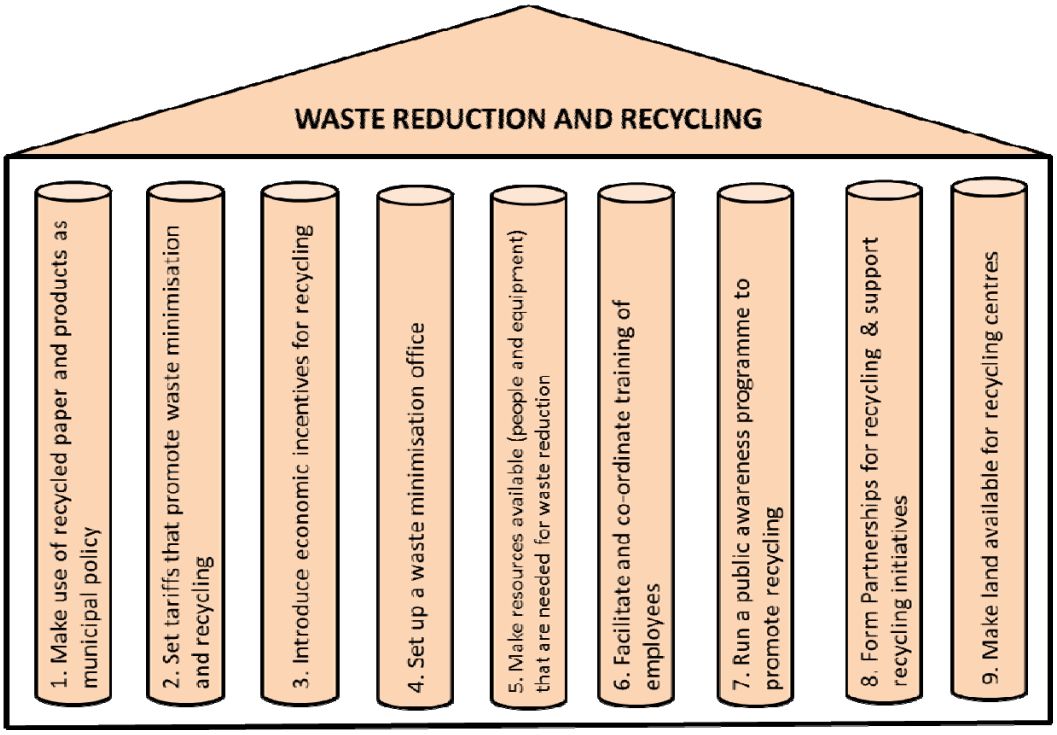


Figure 4.2: How municipalities can promote recyclying

Source: DEAT, 2002.

4.6 CONCLUSION

Using scenario planning methodology, a scenario matrix has been developed in this research, with four alternative futures for waste management in Johannesburg. The scenarios presented in this

research have therefore analysed the potential for waste reduction through balancing public awareness and ensuring 100 percent service coverage.

The “Working Together We Can Do More” scenario was found to be the optimum, where service provision covers all areas while also ensuring maximum public awareness and behaviour change with regards to waste management. However, for this scenario to be realised, key policy decisions need to be made, particularly in the following areas:

i. Tariff structure for waste management to encourage waste minimisation;

ii. Economic incentives for waste minimisation and recycling;

iii. Institutionalising public awareness programmes to align with strategic programmes such as waste minimisation;

iv. Institutionalisation of partnership programmes like the Jozi@work that ensure sustainable partnerships between the City and communities in improving service delivery quality.

CHAPTER 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF RESEARCH RESULTS

This research sought to explore alternative futures for the City of Johannesburg in respond to the question:

“How can the City of Johannesburg achieve zero waste to landfill by 2030?”

Using scenario planning techniques, this research has identified four alternative futures. The scenario process produced four alternative futures using two key uncertain drivers, namely:

- Efficient collection mechanisms;
- Impact of public awareness campaigns.

Using these drivers, the following scenarios were developed:

5.1.1 Long walk to freedom

This scenario represents the worst of both worlds. Waste collection coverage includes pockets of the community where waste collections services are less than optimal. The residents of the city, particularly in these under-serviced areas, are also not very knowledgeable of the impact that the waste generated within their communities can have on the environment and what alternatives there are to manage this.

This scenario a “do nothing” approach where the status quo is maintained. There is no overt action taken to improve the coverage rate in provision of collection services nor in improving the extent of public awareness on waste management best practice. Over time as the population grows, particularly in where waste collection services are often less than optimal, there is growing discontent amongst these communities. Given South Africa’s history with civil unrest, this growing discontent fuels service delivery protests.

This scenario highlights the importance of ensuring that the City prioritises improving the quality of services in informal settlements particularly in light of the population growth trajectory for the city based on current statistics. As the urban population grows it will also become increasingly important to ensure that communities are adequately educated on the role they can play in correctly managing waste.

5.1.2 Pick it up

This scenario represents a “nanny” state that provides full services to a society that functions in relative oblivion of the implications of their behaviour on the environment. It is assumed to be the role

of government to “pick up” after communities and dispose of waste. This scenario is oblivious of the waste hierarchy and the role communities could play in minimising waste.

The focus in this scenario is on improving service delivery quality focusing on visible service delivery especially in identified hot spot areas such as informal settlements. Using the City’s Jozi@work programme, which uses co-production between the City and its residents as a means of delivering services, collection coverage improves. As visible service delivery improves, communities develop greater confidence in the City’s ability to deliver services which ensures election success at the local and national elections in 2016 and 2018 respectively.

However in order to achieve this, the City has to make budgetary sacrifices to focus on visible service delivery at the expense of other areas such as the costs of improving public awareness and education. This approach is however not sustainable from a financial sustainability perspective and thus in the medium term will need to be reviewed.

5.1.3 Wishing on a star

In this scenario, although the city continues to have under-serviced areas, public awareness is high and this fuels correct behaviour and a mind-set shift with regard to waste management.

Through intensified public awareness that is focused on achieving behaviour change, the municipality can introduce sustainable best practice waste management. The awareness programmes are focussed on both residents of the City as well as its employees. By using economic incentives that are attractive behaviour change becomes sustainable. Enforcement through by-laws is important for continued success of initiatives.

5.1.4 Working together we can do more

In this scenario, the City optimises its service provision to cover all areas while also ensuring maximum public awareness and behaviour change with regard to waste management.

This is the best of both worlds and converges various City initiatives to build community participation together with best practice waste management. By establishing a waste minimisation unit, waste minimisaion initiatives receive undivided attention to ensure implementation of best practice in waste management. 100 percent waste collection will therefore be achieved, which will ensure that what is collected, can be correctly treated.

By using these scenario descriptions, one can imagine how the City can move from one scenario to another over time. However, the four scenarios may not happen in a direct path from one scenario to another. In reality, the City may circle back and forth between scenarios.

Although the scenarios are independent of each other and each is plausible, there is, however, one scenario that is the preferred option, i.e. **Working Together We Can Do More.** To realise this scenario, the City needs to ensure that the appropriate decisions are made by city leadership.

Decisions need to be made to address the uncertainties associated with the key drivers identified. These decisions include the following:

i. Set aside resources to focus on waste minimisation. This includes establishing the waste minimisation office;

ii. Set tariffs that promote waste minimisation;

iii. Introduce economic incentives for recycling;

iv. Facilite staff training and change management;

v. Establish partnership arrangements in waste management;

vi. Make municipal land available fro recycling and buy-back centres in close proximity to communities.

5.2 RECOMMENDATIONS

The City should consider these scenarios in developing waste management strategies going forward. The plans should place great emphasis on effective strategies for building up public awareness on waste management, as well improving the extent of waste collection coverage in the City.

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APPENDIX A

Key driving forces

A. SOCIAL FACTORS

1) Expertise in alternative waste management methods;
2) Illegal dumping;
3) In-migration and urban population growth rate;
4) Community mobilisation and willingness to participate in waste minimization initiatives using the City's regional structures;
5) Inequality gap;
6) Provision of waste management services to poor areas, e.g. informal settlements;
7) Littering in public areas, e.g. streets and taxi ranks;
8) Potential for "Pay as you throw charges";
9) Creative thinking in implementing initiatives;
10) Mandatory waste separation;
11) Role of NGO's, communities, schools and consumer groups;
12) Role of research groups.

B. POLITICAL FACTORS

1) Political oversight and governance processes;
2) Management stability in Pikitup;
3) Political will to change the status quo;
4) Response of the trade unions to alternative approaches to waste management;
5) Impact of government "bureaucracy" in implementing change;
6) Effective use of ward committee structures to improve awareness and willingness to participate;
7) Policy-making processes.

C. ECONOMIC FACTORS

1) Funding/financing structure of the waste management business;
2) Re-fleeting to align with separation at source initiatives;
3) Full cost accounting of waste management;

4) Cost-reflective tariff structure;

5) Landfill taxes;

6) Entrepreneurship opportunities in waste treatment that have the potential to stimulate local economic growth;

7) Availability of markets for recycled, recovered and converted waste products.

D. ENVIRONMENTAL FACTORS

1) Impact of Kyoto Protocol;

2) Environmental impact of growing volumes of waste;

3) Sufficiency of existing landfills to absorb increasing volumes of waste;

4) Clean air targets especially near landfills;

5) Environmental inspectors to enforce compliance with by-laws.

E. TECHNOLOGICAL FACTORS

1) Integrated disposal and treatment systems;

2) Waste to energy technology solutions fully functional at all landfills;

3) Networks of Material Recovery Facilities and composting plants in all regions;

4) Any other alternative waste treatment technologies.

F. LEGAL FACTORS

1) Product bans, e.g. plastic packaging;

2) Alignment of municipal by-laws to National and Provincial legislation;

3) Penalties and disincentives to control negative behaviour.