



Monitoring and Evaluation of Solid Waste Management Services to
Enhance Service Delivery in Municipalities: A Case Study of
Gauteng Province in South Africa.

By

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ABSTRACT

The objective of the study was to determine the contributions of Monitoring and Evaluation (M&E) on the service delivery of Solid Waste Management Services (SWMS) in four Gauteng Province municipalities, namely; the City of Johannesburg, Ekurhuleni Metropolitan Municipality, Emfuleni Local Municipality and Mogale City Local Municipality. In 2006, the South African government adopted a Government Wide Monitoring and Evaluation System (GWMES) framework as a tool to track and enhance service delivery in government and its institutions. The GWMES was subsequently cascaded to provincial governments forming Provincial Wide Monitoring and Evaluation Systems (PWMES). Finally, the Municipal Wide Monitoring and Evaluation Systems (MWMES) were to be developed based on the PWMES.

This study, therefore, focusses on the MWMES and SWM service delivery in municipalities and its entities. Currently, municipalities are facing serious challenges which have become endemic and characteristic of the sector. The challenges that the sector experiences, among others include: lack of accountability of officials and Councillors; weak consequence management; lack of internal controls; weak financial management and financial discipline; weak governance principles; endemic corruption; poor service delivery; continuous unrest and protest action by communities; and patronage. The lack of service delivery is the common denominator that is cited by role players and stakeholders. It is against this background that the monitoring and evaluation (M&E) of solid waste management (SWM) service delivery is interrogated in the study.

The findings of the study show that the management of waste in the Gauteng municipalities differ according to essential resources such as finances, equipment, capacity and capability; and planning and design issues like legislation, information flow, population growth and migration. The differences tend to be more pronounced between the local municipalities and the metropolitan municipalities, wherein metropolitan municipalities tend to perform better than the local municipalities. One other important finding that emanated from the study is the lack of public participation in planning and implementation of waste management programmes. Engaging the public could be efficient and cost effective when compared to the

current regime where the municipality only uses its limited resources to render the solid waste services to the public.

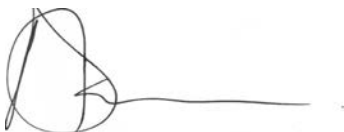
The findings also indicated that monitoring and evaluation (M&E) is understood and perceived differently across the different levels within the municipalities. Senior managers and middle managers have a better understanding of M&E even though its implementation is lacking. Lower management (supervisors) perceive M&E as an individual performance management system rather than an institutional management system. It appears that monitoring and evaluation, which was instituted in 2006, is still a new concept in the local government sphere and municipalities are still struggling to cascade it across all levels of the institutions.

Therefore, it is recommended that municipalities use the Systemic Performance Analysis Model for SWM (SPAM for SWM) as a tool to enhance service delivery in SWM. This model will assist in: institutionalising M&E; provision of real-time data collection, collating and analysis; public participation; focussed resource allocation and usage; and long-range planning. Finally, M&E would be more like a standard operations procedure (SOPs) and would assist the municipalities and South Africa towards the achievement of the Sustainable Development Goals targets. The study is significant to the key SWM stakeholders to enhance service delivery through improving on the current M&E mechanisms.

DECLARATION

I, Dumisani Milton Nkomo, hereby declare that:

- (i) The information and findings reported in this thesis, except where otherwise indicated, is my original research work.
- (ii) This thesis is submitted in fulfilment of the requirements for the degree of Doctor in Business Science (Public Management).
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Date: 27 March 2019

DEDICATION

This study is dedicated to my whole broader family; my wife (Maleho), my children (Simpfiwe, Dumisani Junior, Salukazi, Ndumiso), my mother (Angelina), my brothers (Lucky, Mduduzi and Mumu), sister (Sibongile); my late sister (Ntombikayise); and all my other family members who are too many to mention. To all of you I know you believed in me and supported me every step of the way.

I am eternally grateful to you all.

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LANGUAGE CERTIFICATE

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Editors Letter: To Whom It May Concern.

I am a former University of the Witwatersrand Senior Staff member (25 years), I have been a member of the University Editing panel for many years. (Refer) Dr Pamela Nichols – 011 717 4136/ 083 233 5270 Director of the Wits University Writing School.

I edit academic and professional papers for students, PhD candidates and faculty members from across the académie. I am a professional academic and commercial editor.

With regards to the PhD Thesis:

“Monitoring and Evaluation of Solid Waste Management Services to Enhance Service Delivery in Municipalities: A Case Study of Gauteng Province in South Africa”. by Mr Dumisani M. Nkomo.

I provided editing and proofreading services for the above paper in February 2018.

In terms of the authors writing, I found this to be of a satisfactorily proficient standard, with a competent descriptive tenor, I found the overall academic writing style, grammar and spelling to be of a high standard and the overall quality of the work to be high.

I am yours Sincerely

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ACRONYMS

3Rs	Reduce, Re-use and Recycle
AGSA	Auditor-General of South Africa
ATT	Alternative Treatment Technologies
BPEO	Best Practicable Environment Option
BVPI	Best Value Performance Indicator
CBA	Cost Benefit Analysis
COGTA	Department of Cooperative Government and Traditional Affairs
COJ	City of Johannesburg
CSIR	Council for Science and Industrial Research
DP	Dynamic Programming
DSS	Decision Support System
EIA	Environmental Impact Assessment
GDACE	Gauteng Department of Agriculture, Conservation and Environment
GDARD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
GGP	Gross Geographic Product
GNP	Gross National Product
GST	General Systems Theory
GWMES	Government-Wide Monitoring and Evaluation System
ENPT	Extended Normalising Process Theory
IAP	Interested and Affected Parties
IDP	Integrated Development Plan
ISWM	Integrated Solid Waste Management
IWMP	Integrated Waste Management Plan
LCA	Lifecycle Assessment
LP	Linear Programming
M&E	Monitoring and Evaluation
MDGs	Millennium Development Goals
MFA	Material Flow Analysis
MIP	Mixed-integer Programming
MIS	Management Information System
MWM	Municipal Waste Management

MWMES	Municipal-Wide Monitoring and Evaluation System
MOE	Municipal Owned Entity
NLP	Nonlinear Programming
NPM	New Public Management
PSC	Public Services Commission
PWMES	Provincial-Wide Monitoring and Evaluation System
RA	Risk Assessment
RBM	Result-based Management
SA	Sustainable Assessment
SALGA	South African Local Government Association
SD	Scenario Development
SD	Sustainable Development
SDBIP	Service Delivery Budget and Implementation Plan
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SoEA	Socio-economic Environmental Assessment
SWM	Solid Waste Management
SWMS	Solid Waste Management Services
UN	United Nations
WM	Waste Management
WRDM	West Rand District Municipality
WtE	Waste-to-Energy

CHAPTER ONE

INTRODUCTION AND OVERVIEW OF THE STUDY

1.1 INTRODUCTION

The chapter introduces the municipal era before the 1994 democratically elected government and then posits the municipal era after the 1994 dispensation. The current municipal solid waste management service delivery challenges, which is the focus of the research, are discussed in the context of service delivery challenges experienced by municipalities and Gauteng province as a case in point. The chapter, further, introduces the aim of the research, the research objectives and the questions that the research is meant to answer. The problem statement and the relevance of the study are also detailed. This chapter ends with an outline of all the chapters included in the study.

1.2 BACKGROUND TO MUNICIPAL SERVICE DELIVERY

1.2.1 Pre-1994 Era

Prior to the advent to democracy in 1994, South Africa had about 843 local authorities which were all under the control of their respective provinces (Municipal Managers Forum 2017: 8). The powers, functions and structuring of the local authorities differed according to the statutes of the provinces (National Treasury 2017). Municipal Managers Forum (2017: 8) states that 'municipalities existed at the mercy of provinces'. Accordingly, service delivery was skewed racially in terms of the prevalent apartheid policies of government. Municipal services were focussed on the White communities and not in areas where the Black populace resided.

1.2.2 Post-1994 Era

In the Constitution of South Africa of 1996, sections 151 and 152, deemed that municipalities became an independent sphere of government. The 843 local authorities, from pre-1994, were rationalised to about 257 municipalities (Municipal Managers Forum 2017). Over the

years the number of municipalities has changed to the current 257 municipalities nationally. In terms of the South African Constitution (1996: s151) and the South African Local Government: Municipal Systems Act (2000: s76) the mandate of a municipality is to deliver services to the communities which are: electricity, water, sanitation and waste management. There are other ancillary services that the municipality provides to the community as well.

The advent of democracy meant that services had to be delivered to all communities equitably (Municipal Managers Forum 2017: 4). National Treasury (2017) also states that in the advent of democracy municipalities had to provide a 'wall-to-wall' local government system. This meant that every territory in the Republic of South Africa had to be covered. The challenge that resulted as a consequence of the apartheid planning and structuring was that the distribution of resources and infrastructure was lacking in predominantly Black residential areas.

1.2.3 Performance of Local Government

The performance of local government in providing basic services has been showing little or no improvement and in many instances showing signs of decline on an annual basis (Auditor General of South Africa (Media Release) 2017: 3; Auditor General of South Africa (2012, 2013, 2015). Of the four major service delivery services rendered by municipalities, namely; water, sanitation, electricity and waste management, waste management presents more of a 'visual indicator' on the progress that has taken place in uplifting the community. Waste management is equally affected when service delivery is seen not to be reaching the intended recipients.

Bhardwaj (2015) reported, in Municipal IQ, that in 2015 municipalities were having protest action every second day in a year. The Institute of Security Studies reported 3 protests a day between 2013 and 2015 (Bhardwaj 2015). In the Institute of Security Studies Report the reported protests were not limited to service delivery rendered by municipalities, but included others like labour related protests (Bhardwaj 2015). The cited protests statistics from various sources, even though not in agreement, suggest that municipal service delivery protests are a common feature in the South African municipal landscape.

National Treasury (2017: 5) stated as follows:

‘Some municipalities are failing at effectively delivering the services, billing for services and collecting the revenue due. Consequently, outstanding debtors are increasing and they are not able to maintain positive cash flows to pay creditors within the thirty days timeframe as legally prescribed. In addition, the governance at these municipalities have been weak within inadequate leadership and guidance’.

This summarises the challenges and the state of affairs within the municipal sector. The sector is not able to effectively collect revenue from the consumers, not able to spend the revenue that is apportioned from the national fiscus. The sector is only able to collect 91.2 per cent (R359.4bn) and only to spend 87.2 per cent (R348.6bn) of the operational budget (National Treasury 2017: 2). Only about 79 per cent of the capital budget is spent on infrastructure and related matters (National Treasury 2017: 2).

The Municipal Managers Forum (2017: 29) cite a few challenges that are facing municipalities, they include: bankruptcy, insolvent municipalities, inability to pay creditors, low liquidity ratio, constrained short to medium term viability and insufficient reporting. Thirty-five (35) municipalities were in an overdraft situation and not able to pay creditors and also not being able to deliver services to the communities (Municipal Managers Forum 2017: 38). Perennial challenges that are cited in the Auditor General of South Africa – Media Release (2017: 1) and Municipal Managers Forum (2017: 44) report details the lack of the following:

- Accountability,
- Internal controls
- Consequence management,
- Financial management discipline,
- Financial health,
- Institutional resilience and capacity, and
- Governance and oversight.

This further illustrates the dire situation in the municipal sector and possible reasons for the increased unrest experienced in the sector.

In a study commissioned by the Municipal Managers Forum and Salga, violence, intimidation and threats against Councillors and against Municipal Managers came to the fore as issues

that need attention (Mail & Guardian 2017: 32; Municipal Managers Forum 2017: 50). The Councillors targeted for violence, in terms of the findings of the study, are the Chief Whips and Speakers of all political parties. This violence usually emanates from their own political party members, opposition party members and from labour unions (Mail & Guardian 2017: 32; Municipal Managers Forum 2017: 50).

In the Gauteng province municipalities situation, Smale (2016: 5) cites a few issues that are peculiar to the province in the municipality sector. These are: competing land uses for industrial, commercial, agricultural and residential; a growing SMME sector; unavailability of land space for SWM; economic, social and spatial challenges; and bringing previously disadvantaged communities into the economy.

The challenges faced by municipalities are multi-faceted and varying in depth and breadth. It is the intention of this study to determine those factors that have a major impact on the provision of service delivery, with specific focus on SWM.

1.2.4 Historical Interventions

National Treasury (2017: 20) and Municipal Managers Forum (2017: 64) recommend the following as possible solutions to the sector:

- Addressing the culture of non-payment,
- Focus on financial sustainability,
- Clarifying roles between different spheres of government,
- Designing a collective and coordinated approach by all spheres of government, and
- Top 20 worst performing municipalities to be assisted in governance and in financial management.

In the possible solutions to the challenges that the municipal sector is facing M&E is not prioritised or mentioned by various state institutions. Service delivery, which is a priority, is intertwined with M&E and with the logic framework that is the government's tool of implementation. It is apparent that the lack of M&E in the government's plans and also in remedial plans is at the core of the service delivery challenges. Almost all the perennial

challenges cited in the Municipal Managers Forum (2017: 44) report can be dealt with when instituting an M&E system. The dearth of service delivery in municipalities can be attributed to the absence of an effective M&E system.

1.3 RESEARCH PROBLEM

The current National and Gauteng waste management strategy of reducing (at source), re-using and recycling of waste material, is not effective (South Africa, Department of Environmental Affairs 2011a: 16). As a result of the inefficiency of reducing waste at source, the waste management model (which comprises; waste generation, collection, transfer, recycling [re-use and composting] and disposal) is overloading the system down-stream. A further challenge to the local government sector is the dearth of research in waste management performance regimes and models that can be used to revamp the local government (municipalities) sector and the public sector in general. Mail & Guardian (2017: 32) and Masindi (2010: 5) cite several challenges faced by municipalities in Gauteng, including: increased volumes of waste, shortage of landfill sites, large numbers of unpermitted dumping sites and illegal dumping, shortage of hazardous disposal sites, lack of capacity of staff, violence against Councillors, violence against Municipal Managers, infrastructure not coping with the volumes of waste generated, health risks for communities, and escalating costs for maintenance. The above factors adversely affect the service delivery of waste management, damage the physical environment and create health challenges to the community members. Despite concerted efforts by the Provincial governments, the SWM services in municipalities have not improved.

The South African Gauteng Department of Agriculture and Rural Development (GDARD), in their report on Waste Collection Standards (2010: 2) attribute several contributory factors to waste management delivery challenges including: a lack of standards in waste management and implementation; the costs of delivering waste management not being quantified; lack of community participation; resources constraints (example; budget and equipment); political buy-in; illegal dumping; increasing informal settlements which emerge frequently; developments (formal) that out-pace the resources on waste management; lack of capacity to monitor and enforce by-laws; lack of inter-municipal communication and information sharing; lack of a Waste Management Information System (WMIS); National and provincial

projects which interfere with the modalities of municipal waste management regimes; no adherence to the South African Occupational and Health Act (Act No 85 of 1993), and on safety measures; waste minimisation and recycling are not prioritised as core service offerings by municipalities.

The cumulative effect of the above factors results in poor SWM service delivery by stakeholders associated with municipalities. This inefficiency and ineffectiveness of waste management service delivery in local government also manifest itself in the form of service delivery protests, destruction of property, affecting the environment physically and ecologically, and endangering human, plant and animal lives.

The service delivery implementation tool of government and municipalities (logic framework) is an integrated M&E system (Govender 2011: 92). The concept of efficiency and effectiveness is linked to the M&E of implementation or service delivery. The lack of service delivery in SWM in municipalities could be attributed to a lack of an effective M&E system. Service delivery and M&E are more like two sides of the same coin.

1.4 LOCATION OF THE STUDY

The study is conducted in the Gauteng province, of South Africa. Gauteng province has three Metropolitan Municipalities, namely; the City of Johannesburg, the City of Tshwane and the City of Ekurhuleni; and two district municipalities, namely; West Rand and Sedibeng. The West Rand District Municipality has four local municipalities under its jurisdiction, namely; Mogale City, Randfontein, Merafong and Westonaria. The Sedibeng District Municipality has three local municipalities under its jurisdiction, namely; Lesedi, Midvaal and Emfuleni. Table 1 below depicts the codes of the municipalities and the category they belong to.

In terms of the South African Local Government: Municipal Structures Act (Act No 117 of 1998: s 2-6), the municipalities are categorised as follows: category A municipalities are metropolitan municipalities with high population densities, multiple business districts and complex centres of economic activities; category B municipalities are local municipalities with low densities and low complexities as compared to metropolitan municipalities; and category

C municipalities are district municipalities who have several local municipalities within their jurisdiction.

Table 1: Gauteng Municipalities, Codes and Categories

MUNICIPALITY	CODE	CATEGORY
City of Johannesburg	JHB	A
City of Tshwane	TSH	A
Ekurhuleni Metropolitan	EKU	A
West Rand District	DC 48	C
Mogale City	GT 481	B
Merafong	GT 484	B
Randfontein	GT 482	B
Westonaria	GT 483	B
Sedibeng	DC 42	C
Emfuleni	GT 421	B
Midvaal	GT 422	B
Lesedi	GT 423	B

Source: The Local Government Handbook (www.localgovernment.co.za)

Figure 1, below, depicts the Gauteng map, which shows the spatial orientation of the different municipalities.

Figure 1: Gauteng Municipalities



Source: The Local Government Handbook (www.localgovernment.co.za)

1.4.1 Gauteng Province and the Profiles of the Four Municipalities in the Study

The Republic of South Africa has nine provinces. These provinces were constituted by the first democratically elected government in 1994. The provinces are: Mpumalanga, Limpopo, Free State, Northern Cape, Western Cape, North West, KwaZulu-Natal, Eastern Cape and Gauteng. Gauteng province is the economic hub of South Africa and contributes about 34.5 per cent to the economy of South Africa (Statistics South Africa 2014a: 2), and also about 45 per cent of the waste generated in the country (South African, Department of Environmental Affairs 2012a: 3).

Geographically, Gauteng Province is the smallest in landmass amounting to about 1.5 per cent (1.5%) of South Africa's landmass. It is highly urbanised and has the highest population of about 12.2 million people from a total population in South Africa of about 53 million people (Statistics South Africa 2014a). Gauteng generates about 45 per cent (45%) of the municipal waste nationally (South Africa, Department of Environmental Affairs 2012b). This high waste generation rate is attributable to the high population, high urbanisation and the highest economic activities generated within the province (Simelani & Mohee 2012: 3). The waste generated per capita is 1.3 kg/capita/day (South Africa, Gauteng Department of Agriculture and Rural Development - General Waste Minimisation Plan 2009: 26), which is higher than other developing countries, which are between 0.5 – 0.8 kg/capita/day (Simelani & Mohee 2012: 3).

In Summary, 48 per cent (48%) of the total waste generated in Gauteng Province is landfilled and about 23 per cent (23%) is recycled (Smale 2017: 8). Aspects of M&E like data gathering, collation, analysis and interpretation across the SWM value chain are lacking. An improved M&E across the value chain of SWM will have beneficial effects in service delivery by providing the needed information for management decision making. This will also assist in long-range planning such that current and benchmarked technologies would be added to the currently used SWM regimes.

1.5 STUDY AIM

The aim of the study is to determine the use of monitoring and evaluation of solid waste management services as a means of enhancing service delivery in Gauteng municipalities. In arriving at the conclusion stated above the study will interrogate subsidiary aspects which are: determining the factors that influence SWM service delivery; the processes that are involved in SWM service delivery; how service delivery is implemented (generic model); and, finally, recommend a viable model for service delivery which will enhance service delivery based on the findings of the study. These findings may not be limited to Gauteng Municipalities only, but may be used in South Africa and beyond.

1.6 RESEARCH OBJECTIVES

The study was conducted to address the following objectives:

- a) To determine the factors that influence the provision of solid waste management services in local government in Gauteng.
- b) Evaluate the processes involved in the implementation of the solid waste management services.
- c) Assess the effectiveness of the monitoring and evaluation systems that are used in solid waste management.
- d) To recommend a model for solid waste management implementation with the required monitoring and evaluation system for local government.

1.7 RESEARCH QUESTIONS

The questions that will be addressed in the study are as follows:

1. What are the challenges and the factors that influence the provision of solid waste management services?
2. What are the processes that are involved in the implementation of solid waste management services?
3. How effective is the solid waste management monitoring and evaluation system?

1.8 RESEARCH METHODOLOGY

Research methodology involves the processes and procedures that the researcher undertook in answering the research questions that are enlisted in the previous section.

1.8.1 Paradigms

The researcher needs to locate the research within the four generally known paradigms, namely; positivism (and post-positivism), interpretativism, pragmatism and transformative emancipation. Positivism and post-positivism paradigms pertain to the deductive logical thinking and is associated with pure sciences (Neuman 2011: 95). Positivism uses numbers to explain social phenomena. Neuman (2011: 102) and Bryman (2012: 33) to some extent, perceive interpretativism (constructivism or constructionism) as the use of words to interpret or explain social phenomenon. Interpretativism is a popular method in social sciences and in other related fields. The pragmatism paradigm uses both the positivism and interpretativism paradigms. The innovation of the pragmatism paradigm is in using the strengths of both positivism and interpretativism such that the research problem is approached from both fronts. The transformative emancipation paradigm is associated with the pragmatism paradigm; the differentiating feature is that it addresses social justice related dimensions. This paradigm came as a result of the prevailing paradigms not being able to address issues like gender and political related issues (Neuman 2011: 114; Zandamela 2014). This study is

based on a pragmatism paradigm to ensure that the issues are fully researched and accordingly reported.

1.8.2 Research Design

Research design is conceptualised as a logical time-tested model or framework which is predictable and can be verified and understood by all practitioners in the academic and other disciplines (Bryman 2011: 46, Govender 2013: 7). Bryman (2011: 46) further explains the research design as a global plan that is designed for the collection and the analysis of information. In the subsequent sections the research design is dealt with in more detail.

Research design is made up of two streams, namely; experimental and non-experimental (Welman, Kruger and Mitchell 2005: 92). The experimental is made up of classical and quasi-experimental. On the other hand, the non-experimental studies are made up of the longitudinal, cross-sectional and the case study design. This study is premised on the non-experimental and a case study design.

1.8.3 The Research Methods

This study uses mixed methods where both the quantitative and qualitative methods are used. The mixed methods approach has become widely used due to the limitations of using quantitative and qualitative methods separately. The mixed methods procedure, therefore, has adopted the strengths of both qualitative and quantitative methods while limiting the weaknesses inherent in each method.

1.8.3.1 Method Sequence

In the case where the qualitative method precedes the quantitative method it is called the exploratory sequential research or confirmatory sequential research (Creswell 2013: 224; Teddlie and Tashakkori 2009: 127). In the case where the quantitative method preceded the qualitative it is either a descriptive or an explanatory sequential research. In instances where

the qualitative and quantitative methods are used simultaneously it is called a concurrent study. Concurrent studies could be explanatory, descriptive or exploratory. The advantages of a concurrent study are that the triangulation and complementarity of data can be measured throughout the research process starting from the data collection stage.

In this study a concurrent explanatory, descriptive and to some extent exploratory approach, is used to answer the research questions. The emphasis whether it is explanatory, descriptive or exploratory is dependent on the question and the responses that were gathered.

1.8.3.2 Weight apportionment

In the mixed methods procedure the qualitative and quantitative methods could be given different weightings or priorities depending on the phenomena under investigation. In this study the methods, qualitative and quantitative, were given equal weightings with neither being the dominant method.

1.8.4 Literature Review

Primary and secondary data was used in the study so as to get a global perspective of the subject matter. The primary data was gathered from the survey questionnaires and from the semi-structured interviews that were conducted with selected respondents within the unit of analysis. Secondary data was sourced from journal articles, books, videos, policy documents, legislation and newspaper articles.

1.8.5 Target Population and Sample

Welman, Kruger and Mitchell (2005: 52); Bryman (2012: 187) and Neuman (2011: 246) define a population as a collection of elements or units of analysis which comprise the entirety of the elements within the study. The unit of analysis or element is the singular member of the collective within the population (Welman, Kruger and Mitchell 2005: 52). The sample on the

other hand is a small representative of the population that closely represents the population elements or the units of analysis.

The respondents in the study were middle and senior managers who are within the solid waste management departments in their municipalities. There are very few solid waste management managers, either middle or senior, in municipalities. As a result, all available managers within the four selected municipalities were invited to participate. Therefore, the population and sample are the respondents within the four municipalities that were selected for the case study design that is used in the study.

1.9 LIMITATIONS OF THE STUDY

The study was limited by the availability of respondents due to solid waste management departments in municipalities being severely understaffed. Notwithstanding the above, a significant number of managers took part in the study. The costs associated with the study were limited to travelling and logistical arrangements. Time was determined by the availability of the respondents who took part in the study. There were no risks associated with either the time or costs in doing the study other than the manageable aspects noted above.

1.10 DELIMITATIONS OF THE STUDY

This study only includes two metropolitan municipalities (City of Johannesburg and Ekurhuleni) and two local municipalities (Emfuleni and Mogale City) in the Gauteng Province. The study is also limited to the service delivery issues and challenges emanating from only solid waste management services and the associated monitoring and evaluation modalities.

1.11 ETHICAL ISSUES

Ethics is about moral principles or a code of conduct; and researchers have a moral obligation to explain to respondents whether they are aware or not about the purpose of the study under investigation (Neuman 2011: 143). Bryman (2012: 135) expands on the ethical issues stating that the researcher needs to be cautious about harm to the respondents, consent, invasion

of privacy and deception in some other instances. The Ethical Certificate for this study is appended in Annexure E.

In this study, permission to conduct the study was sought from the South African Local Government Association (Annexure A), The National Department of Cooperative Government and Traditional Affairs (Annexure B), and from the Municipal Managers or City Managers. In the case of a municipal-owned entity, permission was sought from the Chief Executive Officer. Permission and consent were sought from the respondents to the study before data collection was commenced.

1.12 ANONYMITY AND CONFIDENTIALITY

The respondents were given a letter explaining the anonymity and confidentiality guarantees in participating in the study. The only information disclosed in the study is on the identification of the municipality or the entity involved, and relevant biographical information without naming the individual.

1.13 CLARIFICATION OF TERMINOLOGY

The terminology and concepts used in this study are shown below for ease of reference.

- **Categories of municipalities (South Africa, Local Government: Municipal Structures Act (Act No 117 of 1998))**

In terms of the South African Local Government: Municipal Structures Act (1998) municipalities are categorised according to their sizes, functions and governance structures. The categorisation of municipalities is detailed below (South Africa, Local Government: Municipal Structures Act 1998: s8-10).

- Category A municipalities are municipalities with highly dense populations characterised by high economic activities. Metropolitan municipalities are those in this category.
- Category B municipalities are local municipalities within the boundary of district municipalities.

- Category C municipalities are district municipalities with several local municipalities within them.
- **Integrated Development Planning (IDP)**

The integrated development plan (IDP) is a five (5) year strategic planning document or business plan that is used in the municipalities (South Africa, Local Government: Municipal Systems Act 2000: s25). This document is undertaken in terms of a legislated process called the IDP process wherein the vision, mission, values, strategic objectives, strategies, targets and projects are details for the duration of the plan (South Africa, Local Government: Municipal Systems Act 2000 s26).
 - **Service Delivery Budget and Implementation Plan (SDBIP)**

This is the annual plan or an operational plan of the IDP. It is through this plan that the performance management system of the municipality is designed and all employees are held accountable to the municipality (South Africa, Municipal Finance Management Act (Act No 53 of 2003): s53 (1)(c)(ii)).
 - **Performance Monitoring and Evaluation (PME)**

Monitoring and evaluation pertains to the tool that is used by management and governors in tracking delivery (Govender 2011; 102). In South Africa it is based on results-based management or the logical framework where the dimensions used to track performance are inputs, process, outputs, outcomes and impact. Inputs, process and outputs are within the realm of traditional management while the outcomes and impact are directly at the realm of results-based portion of the model (Govender 2011: 108).
 - **Monitoring**

Monitoring is the day-to-day process where the continuous flow and continuous negative feedback of information is gathered and analysed so that incremental changes and re-positioning are effected to influence a change initiative (Babbie 2016: 354). Monitoring is done using indicators throughout the delivery of the programme or project and involves checking if the set indicators give a detailed account of the targets that are set during programme initiation.

- **Evaluation**

Evaluation refers to a pre-determined periodic assessment of the value or objectives of the project or programme. Whilst evaluation is done at selected intervals in the programme, the overall evaluation is done at the end of the programme and geared towards giving an overall assessment whether the ultimate objectives have been met (Macdonald *et al* 2012: 10; UNEP/SETAC 2009: 1).

- **Waste Management (WM)**

This is the management of waste as understood from a municipal context which is the provision of service to solid waste material, hazardous waste and sanitation management. Hazardous waste refers to material that are harmful to human health and sanitation has to do with liquid waste material (South Africa, Gauteng Department of Agriculture Conservation and Environmental 2006: vi). The solid waste materials are dealt with in the subsequent section.

- **Solid Waste Management (SWM)**

Pertains to waste which is in solid form and this includes: general; organic; e-waste; construction; and end-of-life vehicles (South Africa, Department of Environmental Affairs 2011a: 18). General waste is the normal household waste that is generated from household operations. Organic waste is the waste that is a by-product from food left-overs in households and restaurants. E-waste is the electronic goods that are discarded after their useful lives. Construction waste is the waste that is generated from construction activities. End-of-life-vehicles are scrap vehicles and complete vehicles that are discarded after their useful lives.

1.14 OVERVIEW OF CHAPTERS

The structure of the study is provided below.

1.14.1 Chapter One – Introduction and Overview of the Study

Chapter one provides an introduction to the context, the locality of the study, research problem, purpose and the research questions, as well as background information relevant to the study.

1.14.2 Chapter Two –The South African Solid Waste Management Services and Practices.

Chapter two deals with the literature review of the legislative framework that sets out the municipal system in South Africa. The chapter then narrows down to deal with waste management in South Africa, the current practices, models and frameworks that are applicable. The chapter ends with a broad synopsis of the four Gauteng municipalities, that are part of the study, and are explained giving their demographic profiles.

1.14.3 Chapter Three – Local Government, Systems and Chaos Theory, and Monitoring and Evaluation

Chapter three reviews the literature on the framework that sets up the local government system in South Africa. Broad theories on strategic planning and management, as are applicable in the public sector, are reviewed. The theories dealt with include, the broad rational theories, systems theory, complexity theory and chaos theory. Monitoring and evaluation is dealt with towards the latter part of the chapter. The chapter also introduces solid waste management as one of the service delivery responsibilities entrusted to municipalities.

1.14.4 Chapter Four – The African and International Practices in Solid Waste Management

Chapter four deals with the literature on waste management regionally and internationally, the current practices, models and frameworks that are applicable. The theoretical, practical

and applications of waste management practices are dealt with in the chapter. The chapter ends with the latest thinking and trends in the solid waste management domain.

1.14.5 Chapter Five – Research Methodology

Chapter five deals with the research design, the strategy adopted in the research and ends with the interpretation of the data gathered in the study. The mixed methods approach is explained in detail as a method where qualitative and quantitative approaches are used to buttress each other and hence strengthen the research output.

1.14.6 Chapter Six – Data Analysis and Findings

Chapter six presents the qualitative data in an analysed format, identifying all variables and challenges in data collation and interpreting. Quantitative data and the analysis methodologies are also presented and interpreted in this chapter. The results, in line with the research purpose and the research questions, are interpreted and given meaning in answering the research questions.

1.14.7 Chapters Seven - Conclusion and Recommendations

Chapter seven provides a consolidation of the research findings, areas and themes that emerge from the research, explains the conceptual framework and concludes with recommendations for further research.

1.15 CONCLUSION

The chapter detailed the current situation pertaining to service delivery issues in municipalities in Gauteng province. Municipal solid waste management is identified as the

core service that the study will focus on. The chapter introduced the aim of the research, the research objectives and the questions that the research is meant to answer. The problem statement and the relevance of the study were also provided in the chapter. Ethical considerations (Annexure E) and terminologies that are used in the study are enlisted for ease of reference. The chapter ends with a brief summary of all the chapters in the study.

CHAPTER TWO

THE SOUTH AFRICAN SOLID WASTE MANAGEMENT SERVICES AND PRACTICES

2.1 INTRODUCTION

This chapter introduces the concept of waste looking at the current definition of waste and juxtaposing it with the emerging concept of waste. The current thinking, methodologies and the processes of handling solid waste management in South Africa are also discussed. The chapter ends with a review of the scientific and technological exposition of solid waste management.

2.2 A DIFFERENT PERSPECTIVE OF WASTE OR THE WASTE ECONOMY

2.2.1 Waste or a Natural Resource?

Chandak (2010: 14) defines waste from the perspectives of the twentieth century (20th century) and that of the twenty-first century (21st century). The two definitions are as follows:

- Waste management (20th century thinking) – is about ‘how we get rid of waste efficiently with minimum damage to the public health and environment?’
- Resource management (21st century thinking) – is about ‘how we handle our discarded resources in ways which do not deprive future generations of some, if not all, of their value?’

The two definitions are about the same concept but approached and interpreted differently. In the first definition waste is explained from an environmental preservation perspective. This perspective of defining waste contributed to crafting the United Nation’s Millennium Development Goals (MDGs) and later the Sustainable Development Goals (SDGs). In the 20th century understanding of waste, it is more of a ‘nuisance’ that has to be dealt with in a way that does not harm humans and the environment. As this is a generic understanding of

waste, this study will to a larger extent, be focused on this dimension but advance the 21st century thinking paradigm.

In the second definition 'waste' is explained as a natural resource like any other resource that a country has to protect, trade with, and use for the country's economic growth. In this understanding of 'waste', the resource competes with other resources within the economy and exists in an identifiable sector that may be called the 'waste economy'. In the waste economy; its contribution to the GDP is distinguishable; the resources are clear and compete with those of mining and with those in manufacturing; jobs are created; and the sector growth is quantifiable. The other important aspect of the 'waste economy' is that it does not exist as a spin-off from environmental practices in MDGs or SDGs. It will be shown in subsequent sections of the study that countries which have a scarcity of natural resources, like China (People's Republic of China), have prioritised and used these secondary resources to propel their economy, instead of negotiating for expensive original natural resources.

2.2.2 South Africa's Solid Waste Management Policies and Current Thinking

The Integrated Pollution and Waste Management Policy (IP&WMP), gazetted by the South African Department of Environmental Affairs and Tourism in 2000, and its operational strategy called the National Waste Management Strategy (South Africa, Department of Environmental Affairs and Tourism 2011a) are key in driving waste management in South Africa (Simelani & Mohee 2012: 2). IP&WMP identifies the challenges that would confront South Africa in the twenty first century and specific strategies adopted to deal with future eventualities. The National Waste Management Strategy (South Africa, Department of Environmental Affairs and Tourism 2011a: 21), and Simelani & Mohee (2012: 2) to some extent, identified eight mandatory areas that municipalities should focus upon to optimise efficiency in waste management. The eight areas are:

- Integrated Waste Management plan (IWMP) and Industry Waste Management Plans (IndWMP);
- Waste Information system;
- General waste collection;
- Waste minimisation;

- Recycling;
- Waste treatment and disposal;
- Capacity building; and
- Education and awareness.

The National Waste Management Strategy (NWMS) is not helpful to municipalities on how they have to institute M&E which would assist in data collection and in evaluation. The same lack of guidance on instituting M&E also applies to the Government-Wide M&E System (GWM&E). The GWM&E places the responsibility on the accounting officer to implement an institutional M&E system. The GWM&E also requires that the institutional M&E system be aligned to the GWM&E. It is not surprising to find different state institutions having varied results and challenges in M&E implementation.

Service delivery and M&E (logic framework / SPAM) are seen more as two sides of the same coin in terms of the GWM&E (South Africa, The Presidency 2007: 2). The South African Presidency – Policy Framework for the Government-wide Monitoring and Evaluation System (2007: 2), in defining M&E, uses the logic framework (SPAM) components namely; inputs, activities, outputs, outcomes and impact, as components of an M&E system. This means that the incapacitation of M&E directly results in weaknesses in service delivery.

2.2.2.1 Integrated Waste Management Plan (IWMP)

The IWMP is a mandatory requirement in terms of the South African National Environmental Management Waste Act (Act No 59 of 2008) which requires municipalities to put in place an IWMP as custodians of waste management service delivery entities in the country. The IWMP preparation guidelines were written by the Department of Environment Affairs and serve as a basis for the preparation of a municipality's IWMP. The Guidelines detail areas that the IWMP should cover, namely:

- Type of waste generated by the locality;
- Description of the services rendered in the area;
- Minimisation strategy advocated;
- Re-use strategy;
- Recycle strategy;

- Recovery strategy;
- Treatment and disposal strategy;
- Number of communities not catered for in the services rendered;
- Alternative delivery methods; and
- Performance assessment written in terms of the South African Local Government: Municipal Systems Act (Act No 32 of 2000).

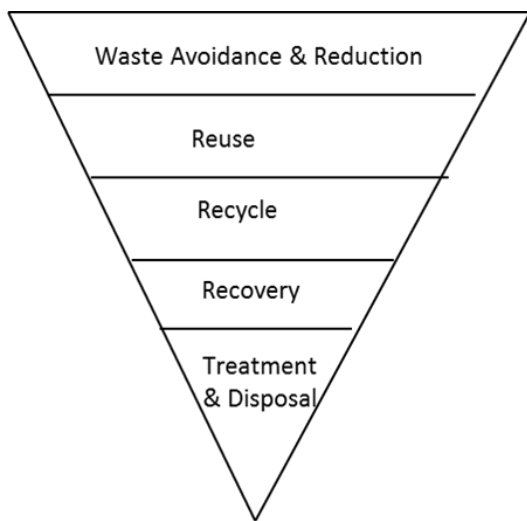
The IWMP when designed in municipalities, becomes the policy, the strategic plan, the resource allocation document, the M&E (logic framework) document and the guide to the implementation plan. The technologies and the implementation regime are also covered in the IWMP.

The M&E component of the IWMP should be based on the institutional M&E system (South Africa, The Presidency – Policy Framework for the Government-wide Monitoring and Evaluation System 2007: 2). The service delivery on IWMP will be limited to the strength of the M&E system established in the institution. Regrettably, municipalities have not cascaded and institutionalised M&E to lower levels making the institutions efficient and effective in service delivery.

2.2.2.2 South Africa's Waste Management Approach (Reduce, Re-use and Recycle model)

Originally, the Reduce, Re-use and Recycle (3Rs) model was adopted by the UN Congress in 1972, further endorsed in the Rio declaration in 1992 and publicised worldwide as a correct model such that the issue of the environment is given prominence by all member states (United Nations Educational, Scientific and Cultural Organization n.d.). In subsequent years the 3R model found expression in the Millennium Development Goals as number seven (7) priority which was recorded as: 'to ensure environmental sustainability'. In 2015 the South African government through the Department of Environmental Affairs and Tourism (DEAT) revised the 3Rs (Reduce, re-use and Recycle) model and the current model is shown in Figure 2 below. The worldwide sanctioned 3Rs model (reduce, re-use and recycle) is the system that is used in the South African solid waste management (South Africa, Gauteng Provincial Department - Integrated Waste Management Policy 2009; UNEP 2013: 3; DEAT 2012: 4; National Environment Management: Waste Act 2008).

Figure 2: South African Waste Management Approach - 3Rs Model



Source: South Africa, Department of Environmental Affairs (2012: 4)

Figure 2 depicts the waste management hierarchy that the South African government has adopted as a strategy in dealing with waste (Gauteng Provincial Department Integrated Waste Management Policy 2009; UNEP 2013: 3; DEAT 2012: 4; National Environmental Management: Waste Act 2008). This hierarchy is adapted from the global waste management hierarchy adopted in the United Nations as a standard and an approach for environmental sustainability or the Sustainable Development Goals (SDGs).

The priority is given to the top of the triangle and this decreases in priority as the triangle tapers towards the bottom. The highest priority is given to avoidance of waste before it is generated together with reducing waste which could not be avoided. The second highest priority is re-using the waste material in one form or the other. Ordinarily, community members and small businesses contribute by using some of the waste material as inputs in their businesses, hence contributing in re-using waste material. The third highest is recycling material. Materials like glass, paper, cardboard, plastics, metals, and building materials can be recycled and used again in the production processes of several industries. Recovery, which is second from the bottom, is a process where material or energy can be recovered from the waste matter. The lowest in the list of priorities is treatment and disposal. In the two stages waste is treated before disposing of it to the landfill site. It is planned that very little waste ends up in the landfill sites because the landfill site has a limited life-span. The negative

impact is on environmental issues associated with waste when soil and underground water are contaminated by leachate from the landfill site.

The South African Waste Management Approach (3Rs Model) which is depicted in Figure 2 above overlooks important concepts which include, among others, the M&E of solid waste. The overlooked concepts are detailed in section 2.2.2.3. below. A proposed model that incorporates these overlooked aspects is explained in Section 2.2.2.5.

2.2.2.3 Critique and Shortcomings of the 3Rs Hierarchical Model

Prioritisation

The prioritisation in the hierarchical model puts more emphasis at the beginning of the SWM value chain and decreases in priority towards the landfill site. This may be true in developed countries where businesses (at the manufacturing stage) play a major role and communities (at the separation stages) also participate actively. Unfortunately, this proves not to be true in the South African situation. Targets that were set in the Polokwane Declaration in 2001 were not met, and these same targets were set a decade later in the South African National Waste Management Strategy (2011: 6, 7). This shows no willingness and commitment from the stakeholders in contributing positively to the SWM situation.

Municipalities enter the value chain during the collection of waste from households and at disposal. Considering that businesses and the communities are not bound to prioritise the hierarchy, the prioritisation in the developing countries should run counter to the current understanding of the model. In the developed countries there is a scarcity of manufacturing resources. Resultantly, they have put in place strict legislative frameworks that tracks and penalises defaulters. The cumulative effect of the two stimuli makes it imperative for the private sector to comply. In the developing countries, on the other hand, there is no pressure for businesses in terms of resource scarcity or stringent legislation, hence the laxity in taking SWM seriously.

Monitoring and Evaluation (M&E) within the 3Rs Hierarchical Model

The hierarchical model does not take into account the M&E or service delivery issues. The model assumes that the thinking and prioritisation should fit all situations. Whilst most

countries use the M&E or logic framework as a delivery model, logically time frames and resource allocation are key in the tool.

Wicked Problem or Chaos Perspective

Municipalities operate in a terrain of social and human systems and these systems are by their nature complex and messy. This complexity also applies to SWM and its operations. The hierarchical model is also complex which covers the entire value chain of the SWM. The understanding of the dynamics of a wicked problem or chaos theory concept is important in explaining the mechanics of the model (Xiang 2013: 1; Govender 2011: 40).

The challenge with the hierarchy is that there are no timelines or time frames towards achieving the planned objectives. Each and every country is expected to try and deliver based on its own plans and objectives. In the case of South Africa each and every municipality would try and deliver based on their expertise, knowledge, skills and capacity. This makes implementation disproportionate across municipalities and based on a myriad of permutations. If the delivery on hierarchy is diverse, as it is, and with no coordinated facilitation role, it makes it difficult for the country to assess the progress achieved during delivery.

The hierarchical model does not take into consideration the complexity of implementing across countries with different dynamics, challenges and complexities. It is against this background that this study focusses on chaos theory or complexity theory as a basis for assessing SWM service delivery in municipalities.

Assumption about Stakeholder (Public) Participation

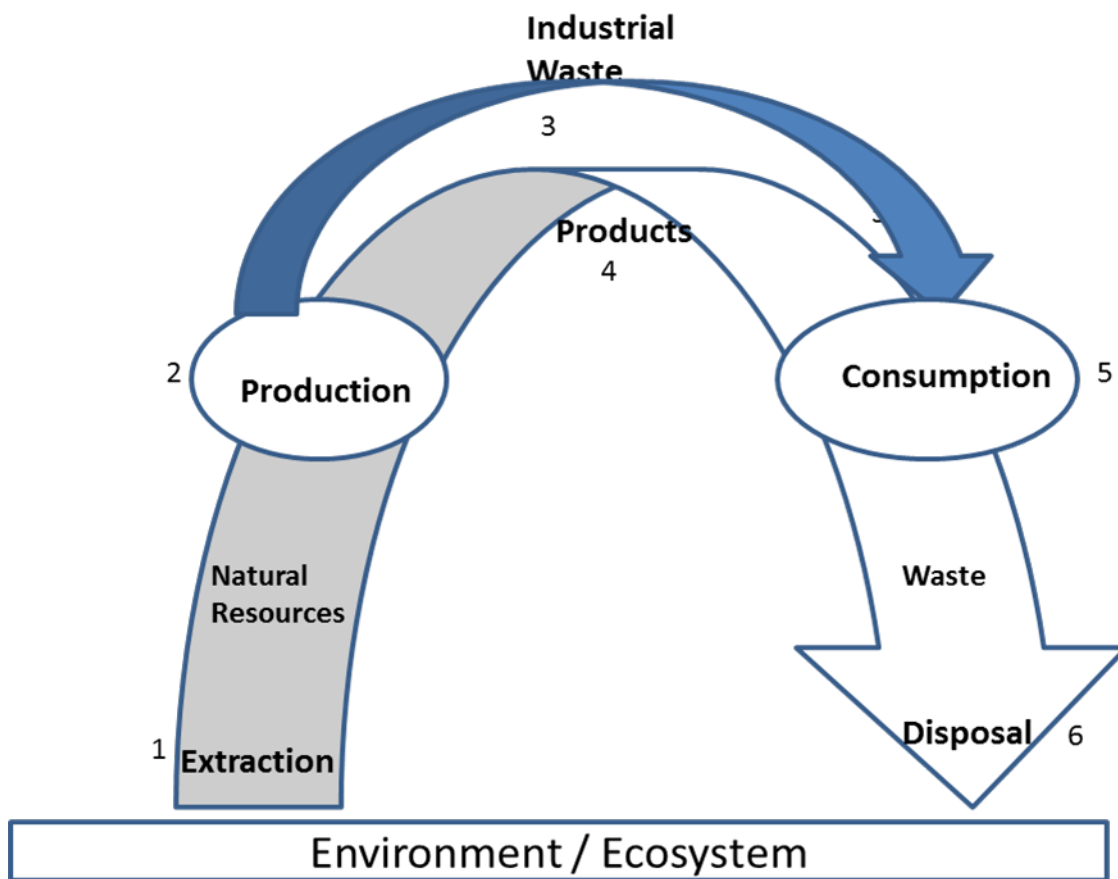
Some of the dimensions of the hierarchical model like reducing waste generation, re-using waste, recycling waste and separation of waste depend primarily on the businesses and the households. The assumption made is that these key stakeholders will play their roles in the value chain.

If there is no legislative framework that assists in persuading or coercing the stakeholders to contribute positively in SWM, there would not be any progress in curtailing the flow of waste towards landfill sites. The dimensions that are prioritised in the hierarchical model are outside the control of municipalities.

2.2.2.4 Practical Application and Depiction of the Hierarchical or 3Rs Model

UNEP (2013: 3) depicted a simple application of waste management from the extraction of raw material, and to conversion of the raw material to usable product, the consumption of raw material and up to the disposal of raw material in a landfill site as waste. Figure 3, depicts how waste moves in a lifecycle model without the intervention of the 3Rs intervention. The numbered sections, 1 to 6, are areas where intervention can be effected if change is needed to the system.

Figure 3: Lifecycle Model of Waste Generation Without 3Rs



Source: Adapted from UNEP (2013: 3) and Shangai Manual (2011: 13)

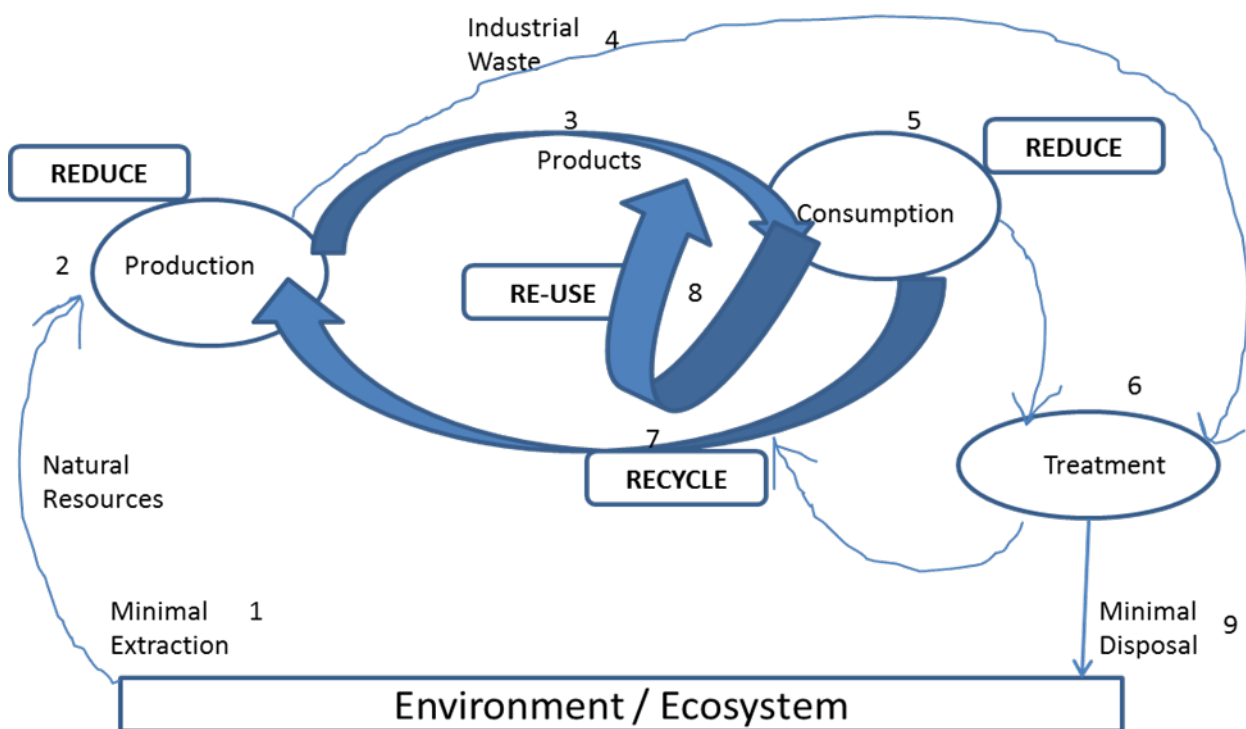
Figure 3 shows a model of waste management from a lifecycle approach where waste is traced from natural resources extraction, moving the resource towards conversion to

products, consumed by the public, and disposing of the products after use (UNEP 2013: 3). This is an idealistic lifecycle of waste where the waste flows unhindered towards disposal.

In the model, the solid waste process flows predictably from extraction to disposal in a systematic and logical manner. In reality, the situation is more complex and unpredictable even though overall the bulk of the waste generated from the extraction (1) ends up at disposal (6). The assumption in this model is that service delivery or M&E would flow logically along the depicted value chain. It is concepts like complexity, unpredictable processes and M&E which the model does not highlight as important considerations in the SWM delivery.

Figure 4 below depicts the 3Rs model with interventions at strategic points with an objective of positively influencing the solid waste value chain.

Figure 4: Lifecycle of Waste with Intervention of 3Rs



Source: Adapted from UNEP (2013: 3) and Shangai Manual (2011: 13)

In the model depicted above (Figure 4) there is intervention at the extraction stage (stage 1) such that only the necessary amount is taken to production (stage 2). Two streams of waste emanate from the production stage (stage 2) and these are industrial waste (stage 4) and products to consumers (stage 3). Industrial waste (stage 4) is curtailed significantly because

it moves directly into the treatment stage (stage 6) and if not curtailed further it adds to the disposed waste (stage 9). The larger amount from production stage (stage 2) moves towards consumption (stage 5). A significant portion from consumption is diverted to re-use (stage 8) and another portion diverted to recycle (stage 7). Only a very small amount proceeds to treatment (stage 6) and ultimately to disposal (stage 9). It is clear from Figure 4, that the bulk of the material or potential waste should be drastically re-circulated back to the system around recycling (stage 7), re-use (stage 8) and products (stage 3). If this circular motion (denoted by the thicker arrows) is not strengthened, the bulk of the consumed products and by-products will move towards treatment (stage 6) and ultimately to disposal (stage 9). This would be typical to Figure 3, where waste moves without interventions.

In the South African situation, as in other developing countries, there is no efficiency and effectiveness in the re-use and recycle stages such that the majority of the consumed products and by-products move directly into disposal. Over ninety percent (90 per cent) of the consumed products move directly into the disposal or landfill site (South Africa, Department of Environmental Affairs (DEA) - National Waste Information Baseline Report 2012: 15). Strengthening the recycle and re-use loops, which depend on the public or consumers, will have positive spin-offs to waste management and to the environment. The World Wildlife Fund (2017: 22), quoting the Council for Scientific and Industrial Research, stated that:

‘...the energy wasted in South Africa every year to produce food that’s not eaten is estimated to be enough to power the City of Johannesburg for about 16 weeks. The wasted water in this produce would fill over 600 000 Olympic-sized swimming pools’

The loop which involves the private sector, stages 1 and 2 in Figure 4, are not directly under the control of the municipalities but are dependent on sectors that may be focussed on profits and less on waste curtailment.

A feasible and realistic SWM service delivery model should be focussing on the current reality wherein 90 per cent of the waste is disposed at the landfill site (DEA National Waste Information Baseline Report 2012: 15). The South African government, municipalities specifically, have little control along the solid waste value chain until at the tail-end which is the landfill sites. A proposed model of looking at the current situation is shown below. In this

model, called Municipal Operational Solid Waste Management Model (MOSWMM), the focus is on areas where the municipality has leverage. The MOSWMM is shown as Figure 5, below.

2.2.2.5 The Municipal Solid Waste Service Provision Mechanisms

A proposed model which suits the current South African dynamics in SWM is depicted in Figure 5 below. This model is called the Municipal Operational Solid Waste Management Model (MOSWMM). The SWM Conceptual Model prioritises the opposite end from the currently used hierarchy and acknowledges waste as a resource to be managed like any other useful resource in the economy. The SWM Conceptual Model is within a stakeholder participation framework where all aspects and stages are informed and influenced by stakeholders. Monitoring and Evaluation encompasses the entire system using the Systemic Performance Analysis Model (SPAM) and individual performance management systems.

Figure 5: The Proposed Municipal Operational Solid Waste Management Model (MOSWMM)

such that the entire SWM conceptual Model is informed, influenced and enabled by stakeholders.

Monitoring and Evaluation (M&E)

Monitoring and Evaluation (M&E) enhances service delivery. The MOSWMM system would have measurable goals and milestones which would indicate areas of laxity and under-delivery in good time so as to institute remedial actions. Monitoring and Evaluation (M&E) encompasses the entire MOSWMM system underscoring the importance of M&E in SWM.

Summary of the MOSWMM

The heart of the MOSWMM model, the internal SWM Conceptual Model specifically, is in working the system from the back towards the front, harvesting energy or combustion to generate useful products. Part of the waste could be diverted to recycling and re-use but these routes would not take a significant portion of waste. Combustion is able to handle as much waste material as is possible, as long as it is sent in that route. The primary aim of combustion would be to generate electricity. There are, however, other products that this process can produce as primary products or by-products. These include: generating heat; oils; fuels; fuel related products; and residues that can be channelled back to the production and other processes (Thermochemical Conversion of Biomass to Biofuels via gasification 2015; Generating Electricity by Burning Biofuels 2015; World Energy Resources: Waste to Energy Council 2013; How a waste-to-energy Plant Works 2012; Pyrolysis and Gasification 2006). If harvested efficiently, the electricity that could be generated from waste could contribute significantly to the power generation in the country.

The major advantages of harvesting energy are:

- Generating electricity and heat;
- Alleviating waste from moving towards the landfill site;
- Avoiding landfill gases (methane and carbon dioxide); and
- Assisting the country actualise the waste hierarchy model.

The driving force in the model is the '21st century' definition of waste where waste is seen as a resource to be managed like any other useful product (Chandak 2010: 14). Finally, the

SWM Conceptual Model is encapsulated within a Stakeholder Participation framework which in turn is also enveloped within an M&E framework.

2.2.3 Waste Management Operations in South African Municipalities

There are three waste management service provision mechanisms that are used in the South African municipalities. These three service provision mechanisms are, among others: internally managed service; privatised; outsourced; and the corporatised model or municipal-owned entity (South Africa, Local Government: Municipal Systems Act 2000: s76).

2.2.3.1 Internally Managed Services

The first model is the one used by predominantly small and rural municipalities who have limited resources. In this model the municipality handles the waste management internally (South Africa, Local Government: Municipal Systems Act (Act No 32 of 2000): s76 (a)). Municipalities have to build the capability, capacity, acquire the technological know-how and have the requisite skills to effect delivery of SWM. The strengths of this mode of delivery is that the services are centralised and easy to manage. Scaling and communication within the sections or departments are within reach and controllable.

Shortcomings of the Internally Managed Services

The disadvantage of Internally Managed Services, among others, is the shortage of skills and the scarcity of resources needed to delivery services. The efficiency and effectiveness of internally managed departments are dependent on the speed within the entire institution because services are internally managed. The South African Local Government: Municipal Systems Act (Act No 32 of 2000: s76) prescribes the delivery modality of internally managed services, but does not mention the need for an M&E system necessary to manage service delivery. Although a performance management system for individuals and the entire municipality is mentioned, a project based and delivery focussed M&E system is not envisaged (South Africa, Local Government: Municipal Systems Act (Act No 32 of 2000): s38)).

2.2.3.2 Privatised or Outsourced

In this mode of SWM delivery the municipality outsources the delivery of service to private companies. Even though the municipality can outsource the service, the accountability of SWM service delivery rests with the municipality whilst the responsibility moves to the private company. In this arrangement the municipality would enter into a service level agreement with the private company and agree on systems that the municipality would use to monitor the delivery of service by the private company (South Africa, Local Government: Municipal Systems Act (Act No 32 of 2000: s76 (b) (v)).

Outsourcing can be on one aspect of the value chain, such as the collection of waste, or several aspects within the SWM value chain. In this model the municipality helps the private vendor by billing the community (in monthly statements) for the services rendered and repaying the vendor in terms of the agreement between the municipality and the private sector company.

Criticisms of the Outsourced Model

Critics of this model believe that the private sector, in the drive to reduce costs, tends to abuse the employees because they are contracted to the private company and the municipality has no control over the situation. The other disadvantage of this model is that the municipality loses the SWM expertise over time such that at the end of the contract, it becomes difficult for the municipality to take over the SWM service delivery.

Monitoring and Evaluation (M&E) is not envisaged in the outsourced service delivery mechanism, but only the performance management system is encouraged (South Africa, Local Government: Municipal Systems Act (Act No 32 of 2000): s38)). A performance management system as envisaged in the South African Local Government: Municipal Systems Act (Act No 32 of 2000) is about individual performance monitoring, whereas the M&E system is high level and strategic in character. Outsourcing is a project based delivery mechanism where the municipality oversees the delivery through a third party. The lack of M&E is a shortcoming to this mode of service delivery.

2.2.3.3 Corporatisation or Municipal-owned Entities

Corporatised or municipal-owned entities are entities which are owned by a municipality or any public entity, who have the leverage of competing and acting as a private sector entity while wholly-owned by a municipality or a government institution. The flexibility that is bestowed on municipal-owned entities makes them ideal entities to achieve efficiencies and effectiveness in service delivery. Although the corporatised or municipal-owned entities operate as independent entities with their own board of directors, the entities are still wholly owned by the municipality (South Africa, Local Government: Municipal Systems Act (Act No 32 of 2000): s76 (b) (i)).

The Johannesburg Metropolitan Municipality has a municipal-owned entity (MOE) that operates and competes with the private sector in the waste management sector. Recovery of costs and the profit motive are the driving forces behind the survival of the municipal-owned entity (MOE). Municipal-owned Entities (MOEs) are able to assist the municipality financially because they have flexibility and speed in service delivery.

Ordinarily, the corporatised entities should be able to acquire scarce skills, expertise, capacity and capability faster than what is achievable when done within the municipality. This has proven true in the case of Pikitup (Johannesburg SWM entity). Pikitup is a well run entity which is managed and run efficiently because the entity is able to source the required skills set, relevant expertise and experience to manage the entity professionally.

Criticism of the Corporatised Model

At times, MOEs behave as if they are independent of the municipality that owns them. This has led to battles between internal municipal staff and the employees of the MOEs in terms of reporting. An additional shortcoming is the politicisation of appointments of board members of the MOEs, as well as the boards operating to the exclusion of the municipalities. The Mayor of the Johannesburg Metropolitan Municipality, Councillor Mashaba, criticised Pikitup senior members of staff for reporting exclusively to the Pikitup board, to the exclusion of the municipality (Cox 2017; Naidoo 2017).

As in the other service delivery mechanisms used in municipalities, M&E is a shortcoming in the corporatised mechanism of service delivery. Instead, only the performance management system is highlighted as a key delivery component in the entities (South Africa, Local Government: Municipal Systems Act (Act No 32 of 2000): s38).

2.3 THE MUNICIPAL OPERATIONAL WASTE MANAGEMENT APPROACH

2.3.1 Background

In 2011, South Africa generated about 108 million tons of waste (Urban Earth: 2012). This waste stream comprised the following categories: organic waste; hazardous waste; agricultural waste; mining waste (largest by volume); and industrial waste. Urban Earth (2012) further stated that South Africa generated over 9 million tonnes of food waste annually, and this waste emanated from restaurants, households and from agricultural produce which do not make the grade for supermarkets. Of the 108 million tonnes, about 98 million tonnes (90.7 per cent) of the waste was taken to the landfill site. The constituent parts of the 108 million tonnes were as follows: 59 million is general waste; 48 million is unclassified waste; and 1 million being hazardous waste. Only about 10 per cent of the total waste was recycled (DEA National Waste Information Baseline Report: 2012: iii).

The per capita waste generation rates of most developing countries are about 1 per cent and projected to grow over time as urbanisation continues (Simelani & Mohee 2012: 2). In the case of developed countries, the per capita generation rate is about 2.7 per cent. Simelani & Mohee (2012: 3) cited that in the year 2001 the factors that contributed to the waste generation rate in South Africa were: population growth; urbanisation and economic growth. The same three factors were still the driving factors for waste generation in 2012 in the Gauteng province.

Godfrey (Radio Metro interview 2015) from the Council for Scientific and Industrial Research in South Africa, stated that South Africa's waste management practices and regime are about 15 years behind those in the developed world. She intimated that South Africa needs to improve in data collection and in other waste management practices in order to narrow the gap in SWM service delivery compared to the developed countries. Therefore, this study is significant as it focuses on the monitoring and evaluation (M&E) of SWM which would contribute positively to service delivery.

2.3.1.1 South Africa's Solid Waste Management Services

Municipal waste management deals with the handling of solid waste, which could be generated, from industries, retail, and households (DEA National Waste Management Strategy 2011: 18). In the National Waste Management Strategy (2011: 18) the value chain of waste management starts with the collection of the waste from the source. This waste is transferred from the source to a treatment process or treatment plant. The process that follows is the recycling of the waste material, the recovery of the resources and ends with disposal of the by-products.

In the South African context, waste management is the competence of local government in terms of the South African Local Government: Municipal Structures Act (Act No 117 of 1998): 33)) and the South African Local Government: Municipal Systems Act (Act No 32 of 2000): 76)). The primarily goals of municipal solid waste management (MSWM) are stipulated in the DEA National Waste Management Strategy (2011: 13). The areas of focus among others include:

- protecting the health of communities;
- environmental sustainability;
- employment creation; and
- adding to economic productivity.

At the heart of the sustainability of any waste management model is community participation. The involvement of stakeholders is crucial in the maintenance and sustenance of the waste management value chain. The involvement of the community towards the delivery of SWM is not effective unless it is coupled with an effective M&E system. Monitoring and evaluation is at the fulcrum and is seen as being the flip-side of service delivery. This underscores the importance of M&E in SWM service delivery.

2.3.1.1.1 Service Provided by Municipalities

In terms of the DEA National Domestic Waste Collection Standards (2011: s7) and the South African Gauteng Department of Agriculture and Rural Development (GDARD) – Waste

Collection Standards (2010: 6) it is the responsibility of the government, municipalities specifically, to provide waste management services to the communities.

The generic municipal value offerings or services are:

- RCRs – refuse collection rounds;
- Street cleaning and litter picking;
- Illegal dumping clearing (Tippers and tractors);
- Commercial and bulk collection; and
- Landfill dumping.

Of the five major service offerings, the RCRs occupy the bulk of time and resources because this involves residential collections that are large in numbers as compared to the other categories. The commercial and bulk collections may be few but the amount of waste generated is also larger and in some instances even higher than residential waste.

However, in spite of the two guiding documents namely; DEA National Domestic Waste Collection Standards (2011b) and the Gauteng Department of Agriculture and Rural Development (GDARD) – Waste Collection Standards (2010) emphasising other areas like reduction, recycling and recovery of waste, the emphasis is still on waste collection. This preoccupation and the deployment of resources in waste collection limits development that could have had more impact in other SWM areas. This could be attributable to the narrow focus on the output instead of on the impact to the entire municipality.

The solid waste service (SWS) delivery or the solid waste (SW) value chain is therefore limited to waste collection activities. The M&E of the entire SWM system is therefore weak or unavailable to guide performance management and future planning.

2.3.1.1.2 One Waste Collection per Week

One key indicator for waste management is the number of households not receiving solid waste services. The Gauteng Department of Agriculture and Rural Development (GDARD)

has made it mandatory for municipalities to collect waste at least once per week in a locality (GDARD – Waste Collection Standards 2010: 7). The collection per week is used as a measure of progress in rendering basic services to the communities within each of the municipalities.

Making one collection in a week is easily achievable in residential urban areas where there is accessibility and roads are developed. In these areas each household may have readily accessible bins that are easily collected by municipal trucks on a weekly basis. However, in informal settlements, where there are no roads, accessibility becomes a challenge for the municipality to deliver the waste collection service. Compounding this challenge is the number of residents within the informal settlement who are not accounted for in the municipality's databases. This impacts on the solid waste human resources and capital resource allocations.

2.3.1.1.3 Specialised Technologies in SWM in South African Municipalities

Very few municipalities have ventured into specialised method of waste conversion into useful or commercial means. Almost all municipalities are aware about some of these technologies but all remain as plans with no concrete steps to implement (South African Cities Network 2014: 5).

Biogas Generation

Tshwane Metropolitan Municipality in Gauteng is using the biogas as fuel for their vehicles to run some of the buses and waste management trucks (Ndlovu, Euston-Brown, Ferry and Giljova 2007: 3). Although, the project is still at its early stages, practices that could be learnt from Tshwane Metropolitan Municipality would be useful to other municipalities when they initiate their biogas generation.

Electricity Generation

Most municipalities are exploring the idea of generating their own electricity using solid waste, but none have started as yet. It is only in the Johannesburg and Ekurhuleni Metropolitan

municipalities where concrete plans are beginning to take shape, but in smaller municipalities this still remain as a plan for the future (Bronkhorstspuit Biogas 2007: 3).

2.3.1.2 Solid Waste and its Contribution to the Economy

A little over R15.3 billion is spent in managing the waste economy, which is around 0.51 per cent of the Gross Domestic Product (South Africa, Department of Science and Technology 2014: 11). When compared to the percentage (2 per cent) contribution of waste to the United States of America's GDP, this shows that there is more that South Africa's waste sector can contribute to the economy of the country. The waste sector in South Africa employs about 60 000 - 90 000 individuals predominantly in the informal sectors (South Africa, Department of Science and Technology 2014: 7); manufactures about 1.4 million tonnes of plastic waste; recovers about 280 000 tonnes (20 per cent); and exports about 18 920 tonnes (Urban Earth 2013).

Godfrey (Radio Metro Interview 2015) stated that municipalities are not effective in charging for the services rendered especially in the landfill sites. According to Godfrey 'landfill is still cheap, landfill technologies are not encouraged and explored other than depending on the age-old method on dumping waste into a hole in the ground' (Radio Metro Interview 2015). Both wet and dry wastes are not separated at source as a result it becomes difficult to separate when they are already combined. Waste loses value when it is combined, especially when paper and cardboard are already wet. This non-separation is the major reason why the value of waste is reduced which results in waste being dumped in the ground without value being added to it.

A detailed account of South Africa's general waste statistics for 2011 is included in Table 2 below.

Table 2: Statistics in Table 2: General Waste in South Africa in 2011.

General Waste	Generated Waste (Tonnes)	Recycled (Tonnes)	Percentage (%)
Municipal Waste (non-recyclable)	8 062 934	No data	0
Commercial and Industrial	4 233 040	3 259 411	77
Brine	4 166 129	No data	0
Organic Waste	3 023 600	1 058 260	35
Construction and Demolition	4 725 542	756 087	16
Paper	1 734 411	988 614	57
Plastic	1 308 637	235 555	18
Glass	959 816	307 141	32
Metals	3 121 203	2 496 962	80
Tyres	246 631	9 865	4
Other	36 171 127	No data	0
TOTAL GENERATED WASTE	59 171 127	5 852 484	Approx. 10%

Source: DEA National Waste Information Baseline Report 2012: 15

The total generated waste given in Table 2 above is less than the national figure of 108 million tonnes because it excludes about 49.1 million tonnes, which comprises hazardous waste and unclassified waste, which are not part of this study. Even when including the two categories namely; hazardous and unclassified, the average of recycled material is about 10 per cent.

Table 2, above, also shows that about 10 per cent (10%) of the waste generated by municipalities is recycled. If approximately 10 per cent general waste is recycled, a logical assumption is that about 90 per cent (90%) is landfilled. The hierarchy of the waste model adopted internationally, and also by South Africa, proposes a situation where very little waste is landfilled. A waste management situation as depicted by the current state in South Africa has many dire consequences such as: underground water contamination; uncontrollable landfill gases that escape to the atmosphere; and scarcity of landfill space because of waste depleting the storage space.

Waste recycling is dependent on the private sector. The role of government in matters of recycling is limited to a facilitating role. The private sector by nature only prioritises what makes business sense to them and must have a profit motive; the issue of national importance may not feature prominently when their business strategies are crafted. National waste management strategies and policies may be designed to encourage stakeholders in the sector, but the actual implementation may not happen because that is dependent on individual companies varying priorities. The other overriding factor may be that it is the responsibility of government, or left to municipalities specifically, to deal with the waste in the country. That does not encourage or foster initiative within the private sector and communities to take waste matters seriously. The preoccupation and active role of the private sector and communities is to place the waste outside of their yards and then it becomes the municipality's responsibility. Having placed their waste outside their yard then should give these parties (private and community) the right to judge and blame the municipality for delivery of service.

Due to the significance of solid waste in terms of the economy, society and the physical environment, SWM and solid waste service delivery should be monitored very closely. Therefore, this study is relevant because M&E and SWM services delivery will not happen readily unless a focussed approach is undertaken.

2.4 THE CURRENT SCIENTIFIC AND TECHNOLOGICAL APPROACHES TO SWM

2.4.1 Scientific Outlook to dealing with Waste Management

2.4.1.1 Waste Generation Equation and Associated Variables

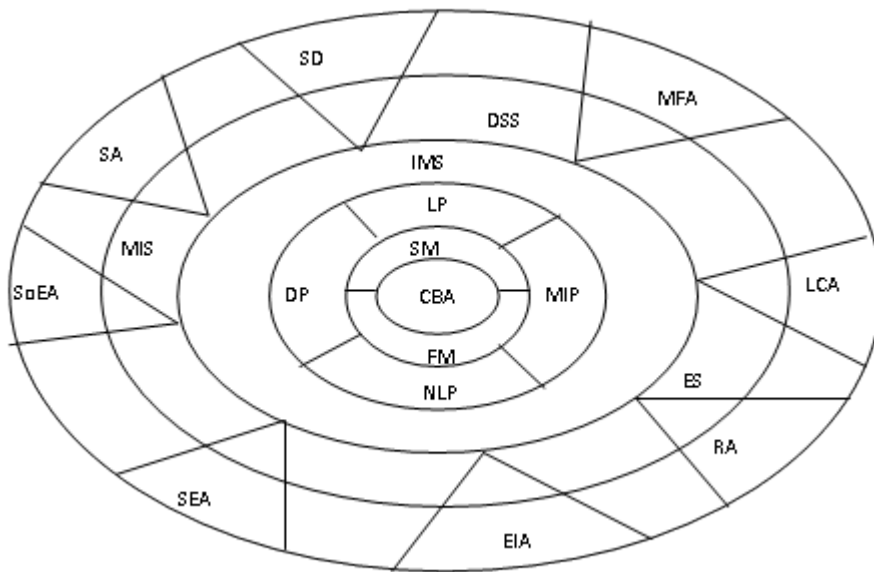
Waste management has various variables that are inherently linked with waste generation. Variables that have a direct proportional relationship with waste generation include population growth, economic growth, migration patterns, growth domestic product [GDP] (gross geographic product, GGP), the affluence of a society, income levels of society and rapid urbanisation (United States Environmental Protection Agency 2016; United Nations Environment Programme (UNEP) 2013; Phiri, Godfrey and Snyman 2012: 173,175). The

challenge with waste generation and the relationship with the variables mentioned above is that while most of the variables are encouraged, waste increases alongside them (and is directly proportional). The master-stroke is to make this relationship inversely proportional because while most of these factors are positive and encouraged, the down-side is that they lead to increased waste volume.

2.4.1.1.1 Systems and Engineering Models for Waste Management

Pires, Martinho and Bin Chang (2011: 1034) presented a framework (Figure 6) that is adapted from systems engineering models to explain the current global waste management thinking. In the framework (Figure 6), six concentric circles which have five (5) models built on it, nine (9) tools of analysis and four (4) expert or decision support systems (DSS) are woven into a single model or framework. This model or framework is built on complexity theory and systems thinking theory (Pires, Martinho and Bin Chang 2011: 1043). By using this framework, one can understand the current thinking and direction of SWM in Europe and in other countries. Many countries use and prefer one or more of the tools and models within the framework sometimes without being aware of the underpinning thinking. Some of the frameworks and tools may be used in developing countries, but the challenge may be in the understanding and the use thereof as a deliberate and focused strategy.

Figure 6: Complexity and Systems Management Model



Source: Pires, Martino & Bin Chang 2011: 1034

<u>Models</u>	<u>Tools</u>	<u>Decision Support/ Expert</u>
CBA – Cost based analysis	MIS – Management information system	LP – Linear programming
FM - Forecasting models	SD - Scenario development	NLP – Nonlinear programming
SM - Simulation models	MFA – Material flow analysis	MIP – Mixed-integer programming
OM - Optimisation models	LCA - Life cycle assessment	DP - Dynamic programming
IMS - Integrated modelling system	RA - Risk assessment	
	EIA – Environmental impact assessment	
	SEA – Strategic environmental assessment	
	SoEA – Socio-economic assessment	
	SA - sustainable assessment	

Source: Pires, Martino & Chang 2011: 1036

In their framework, Pires *et al* (2011: 1034), depicted systems engineering models, systems assessment tools and decision support systems that form the core of the currently used frameworks across the solid waste management spectrum. Ordinarily, in the management of waste, governments may use these systems models, systems tools and decision supporting tools unaware of the logic and flow that one has to engage in order to get optimum benefit from the linkage. To those who are aware, the challenge is getting the right fit so that optimisation becomes the normal by-product of the synergy (Vasiljevic-Shikaleska 2014: 105).

2.4.1.1.2 Systems Engineering Models

Pires *et al* (2011: 1036) clearly stated that even though it was their thinking in grouping the areas as in their framework, they do understand that other scholars could view and group them differently but the core of their categorisation may remain unchanged. The five key areas that were considered broad enough to encompass other subsidiary aspects were; cost benefit analysis (CBA), forecasting models, simulation models, optimisation models and integrated modelling systems.

Cost benefit Analysis

Neuman (2011: 26) asserts that a cost benefit analysis is one of the main models that economists contributed to the social science domain, specifically the applied social sciences. In a cost benefit analysis, one is able to assess social issues and put an economic cost to explain the positives and negatives associated with a decision before adopting or implementing the decision. The cost benefit analysis has found its way into many kinds of analysis even beyond the social science domain. Pires *et al* (2011: 1036) and Vasiljevic-Shikaleska (2014) asserted that the cost benefit analysis is used extensively in waste management at strategic, operational and at functional levels.

The cost benefit analysis has wide usage across many areas in business management broadly. In developing countries, and in South Africa in particular, it is also used in the SWM sphere when conceptualising projects or justifying the benefits that would accrue vis-à-vis the costs that will be incurred to undertake the project.

Forecasting Models

Forecasting is the use of prediction models that help in projecting material, energy and other waste related matter into the future such that finances, human resources and time can be factored into decision making. Forecasting has a greater use in financial matters but is being used in waste management planning and projection (Pires, Martinho and Bin Chang 2011: 1036).

Forecasting in SWM is not commonly used in South Africa, whether for waste generation, population, or any other aspect. Rather, the sector only reacts to the challenges at hand and blends that with hindsight from previous years.

Simulation Models

Simulation models are usually computer based wherein real-life phenomenon are simulated and a mathematical and computer-based model is run to predict eventualities. Mathematical simulations have also found space in waste management (Pires, Martinho and Bin Chang 2011: 1036).

Simulation techniques are not common practise in the South African solid waste management terrain. Simulation techniques require highly skilled and technically competent personnel, but such expertise is unavailable in the municipal environment.

Optimisation Models

Optimisation models are geared towards the improvement of the functionality of certain elements in a system or the improvement of the entire system itself. Similarly, to the simulation models, optimisation models are underpinned by mathematical formulations (Vasiljevic-Shikaleska 2014: 105,106).

Highly sophisticated mathematical modelling like the optimisation modelling are currently not used in SWM in South Africa, nor in other developing countries. If this approach is used, it would enhance the level of understanding of the sector and improve the skills of the practitioners in the sector.

Integrated Modelling Systems

Integrated Modelling Systems are models which may blend several of the models like cost-benefit, forecasting, simulation or an optimisation model. The blending, ordinarily, would include the systems tools which are discussed in the subsequent section (Pires, Martinho and Bin Chang 2011: 1034).

The two systems that will be blended, but only for budgeting purposes, are the cost benefit analysis model and the forecasting model. The forecasting model of a three-year rolling action is a South African requirement that all state institutions have to use whenever they budget. So, this statutory requirement may coincide with the planning for a specific project in SWM. However, this particular integrated modelling may be coincidental in the South African municipal realm, but not as a deliberately utilised system for SWM planning.

Systems Assessment Models or Tools

Generally, the focus of most of the assessment models has a basis in protecting the environment and human health against factors that may have negative impacts on them. It can be argued that the Management Information System (MIS) and the Scenario Development (SD) do not fit within the category of tools as listed by Pires *et al* (2011: 1034). All the tools that Pires *et al* listed have to do with assessment and analysis with the exception of MIS and SD. SD has to do with long range planning which is an area with a range of projecting beyond forecasting.

Forecasting is typically between three to five years range of projecting and SD extends far beyond. Most entities project beyond 50 years using scenario development. MIS is more of model or an instrument than an assessment tool. Using both MIS and SD in waste management adds to the plethora of models that could be used for sustainable development with the primary focus on the environment, the economy and the well-being of the populace.

The rest of the assessment tools, with the exception of MIS and SD, are like the evaluation tools that are used in social sciences (Neuman 2011; 29). Neuman (2011: 29) summarises these tools as belonging to formative and summative evaluation. He goes further explaining that these evaluative tools are used during the project conceptualisation and monitoring stage (implementation stage) and during the evaluation stage (programme completion or review).

Management Information System (MIS)

MIS is a decision supporting system that helps administrators and politicians by providing information that would aide in decision making. Most MIS systems are computer linked which makes them online and timeous. MIS would be beneficial to decision makers when taking decisions that have to do with waste management.

Individual municipalities have got an MIS system that they use for SWM. The versatility of the systems differ according to the needs and capacity of the different municipalities. Currently, the challenge in the entire SWM space in South Africa, and many developing and developed countries, is the collection, collation and interpretation of the data. In South Africa the major challenge is having a national SWM MIS system such that data could be accessed easily.

Scenario Development (SD)

Scenario planning is about coming up with several plausible or realistic futures which are then used as a basis for planning (Holway, Gabbe, Hebbert, Lally, Matthews and Quay 2012: 27; Weeks, Malone and Welling 2011: 27). An early warning system is usually built onto the tracking system such that if any of the scenarios unfolds the tracking mechanism would trigger a warning response.

In the South African landscape, scenario development is currently predominantly developed nationally and rarely in municipalities. In the very few municipalities where scenario planning is used as a tool, it is used for the entire municipality and not specifically for SWM.

Material Flow Analysis

Material Flow Analysis is about measuring the mass, substance or product that flows throughout the system to enable a determination on strategic related issues that pertain to the material flowing. Two key issues are important when one looks at material flow analysis, these are; the system, with its boundaries which encompasses the material; and the material or product that is the subject of interest (Pires *et al* 2011: 1034; Sembring and Vitivattanon 2010: 803). In SWM waste is the subject of interest and is monitored and measured throughout the waste management hierarchy such that efficiencies, effectiveness and impacts are determined throughout the system.

Several authors have looked at MFA as a means of determining and proposing remedial measures from a systemic and mass flow point of view. Material flow is the most common method used in SWM, both in the developed and in developing countries. In the waste hierarchy model or 3Rs, the quantities of waste flowing throughout the value chain is monitored and measured to determine the efficiencies within the system. The current challenge is getting reliable data.

Material Flow Analysis is predominantly the methodology that is used in South African municipalities in measuring and quantifying the material within the waste value chain. Tonnage and description of the waste material are used to identify and categorise the waste accordingly. Currently, the shortcoming is in data collection throughout the waste value chain.

Lifecycle Assessment

The lifecycle assessment (LCA) or lifecycle approach has five distinct steps to it (Vasiljevic-Shikaleska 2014: 115). The first step is usually assumed to be inherent in all assessments. The first step involves the formulation and the clarification of the goals and objectives of the assessment. The second is on the formulation of the plans which will be used to implement the programme to meet the set objectives and goals. The third step is to monitor the process during implementation. The fourth step pertains to evaluation of the programme at regular intervals but with specific evaluation at the end of the programme. The fifth and final step is the review of the programme, checking if all the objectives and goals that were established during programme conceptualisation are met. This step usually links with the initial step such that if the programme will continue, lessons learnt are factored into the goal setting stage to refine future objectives or re-runs of the programme.

The current SWM hierarchical or 3Rs approach is based on the lifecycle approach in that the waste is traced from inception all the way till disposal. In the developed countries they have termed it 'from cradle to cradle'. In this maxim the emphasis is placed on waste at the end of the chain such that it flows back into the system in a circular motion. This means strengthening recycling and re-use of waste such that no waste moves into disposal in the landfill sites. A detailed exposition of the lifestyle approach in management and in SWM; the linkage with M&E applications; and the critiques of the lifestyle approach are detailed in sections 3.9.3 and 3.9.4 of this study.

In the developing countries such as South Africa the common maxim is 'from the cradle to the grave'. This inherently accepts that waste will end up in the landfill site (grave). As a direct consequence, the pre-occupation in developing countries is then about the amount of waste that reaches the landfill site, whereas in developed countries it is about circulating the waste such that it does not move towards the landfill site. Logically, the developed countries use the maxim 'from cradle to cradle'.

Risk Assessment

Risk assessment (RA) is a methodology and an assessment tool where risks associated with projects or within institutions and organisations are analysed, and mitigating strategies are applied to deal with the risk as delivery unfolds (Risk Assessment Procedures 2016). The risk assessment method normally has a five-step process. The first step in the process is about

identification of the risk. The second step involves assessing the gravity or total risk of the project or institution. In assessing the risk two dimensions are used namely; likelihood of the risk happening and the impact it would have to the institution or organisation when it happens. These two dimensions, likelihood and impact, are usually given numerical rankings whose figures are then multiplied to give a risk measure.

An example of the application of the risk measurement is shown below. In the example the two dimensions are ranked between one (1) being the lowest and five (5) being the highest. The calculation for determining the total risk is shown in an example below.

Likelihood = 4, and Impact = 4

Total Risk = $4 \times 4 = 16$

The gravity or total risk in the example is 16, which could be interpreted as a high risk considering that the numbers for total risk would range between 1 and 25.

The third step involves the categorisation of the risk. The categorisation process usually groups risks into strategic, operational, reputational, financial, information technology related and in some instances, risks that are industry specific. This process helps in delineating these risks to departments within the organisation or institution so that they are monitored on a regular basis. The fourth step involves the process of determining ways and strategies of dealing with the risks.

The fifth and final step is monitoring the risks and continuously reviewing the strategies if they are effective or not so that remedial measures could be taken.

Risk analysis is a commonly used tool for assessment in developing countries across all spheres of government including in SWM. It is generally accepted that a risk analysis has to be done before and throughout the implementation of projects including in waste related matters. In South Africa, it is even legislated that a risk assessment for the entire municipality is conducted which should include strategic, operational and functional risks assessment. In this process of conducting the risk assessment for the entire institution, the SWM area is covered as well.

Environmental Impact Assessment (EIA)

Neuman (2011: 31) states that in applied social research there are two main tools that are used extensively. The first is the cost benefit analysis, which he says was a contribution to the social science discourse from the economics section of social science. In this tool social contexts and change theories may be reduced or interpreted from a financial stand point such that decisions to implement or not are based on the financial stance. The second is the needs analysis or assessment. The assessment has many variations to it. Examples of these assessments would include the very assessments as articulated by Pires (2011: 1034) in this section (section 2.4.1.1.2).

The assessments like the life cycle assessment, risk assessment, material flow assessment, strategic environmental assessment, socio-economic assessment and sustainable assessment are all based on balancing the economy, the people and the environment (Sustainable Development Goals). The differences in the other analyses, even though the three areas (economy, people and environment) are dealt with, will be the focus wherein one of the three areas is highlighted and focused upon largely.

The environmental impact assessment (EIA) is an assessment which is undertaken before initiating or approving a program or project where social needs and impacts, environmental aspects and cost benefit aspects are woven into the decision-making process. Common projects that need an EIA would be developments like power stations, water reticulation plants, commercially related initiatives, and many others that may affect the environment and the social wellbeing of the populace.

The EIA process emerged from the United States of America in 1970 and has since become a popular tool which is even elevated to a legal status by many countries throughout the world (Neuman 2011: 31). In some instances, a social impact assessment (SIA) is done instead of the broader EIA (Neuman 2011: 31). The fields of EIA and SIA have specialised to the extent that there are social impact practitioners who belong to local and international social impact organisations whose assessments are elevated to the level of a profession.

Most of the other social and environmental assessments, which are done in subsequent sections, are components of the EIA because it is viewed as the all-encompassing analysis within the social science domain. In the developing countries and South Africa in particular,

the EIA is more of a statutory requirement before any major development is done (South Africa, National Environmental Management Act (Act No107 of 1998: s24 (4A)). In the SWM sphere in South Africa, an EIA is also done before a landfill site is permitted to operate.

Socio-economic Environmental Assessment

The Socio-economic Environmental assessment (SoEA) is a component of the Environmental Impact Assessment (EIA) which is a broader assessment encompassing many dimensions. The SoEA is the same as the social impact assessment (SIA) as explained in the previous section (Pires 2011: 1034). The naming of SoEA clearly explains the three dimensions as social, economic and environmental.

The same three dimensions (social, economic and environment) are explained in detail in the next section on sustainable assessment (SA). The emphasis in SoEA is more on the social dimension where other sub-dimensions like the culture, the health, the migration patterns, the language, and other subtle areas are analysed from a benefit or loss that the community and animals will experience as a result of the development or the intervention. The emphasis of the assessment is usually to buttress the benefits that the affected community will gain as a result of the intervention and mitigate against areas that would negatively affect the affected community.

In the SWM terrain, the SoEA is usually blended as part of the EIA. It is not done as a stand-alone measure that would give any other information other than what is already provided for in the EIA.

Sustainable Assessment (SA)

The concept and word sustainability gained prominence in the social sphere during the early 1980s after the presentation by Brundtland to the United Nations in 1972, in a Commission Report on World Sustainability (Sustainable Development: From Brundtland to Rio 2012). In Brundtland's report, for the first time, economic growth and its imperatives were linked to the environment and the people. Sustainability has since been defined in terms of three dimensions, namely; the economy, the environment and the people (social / equity). The concept was precisely known as Sustainable Development (SD).

Brundtland defined Sustainable Development as 'economic development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs'. Simply put, the definition could be interpreted to mean one should live and enjoy what life and resources have been bestowed on them but not forgetting what tomorrow holds for them and for the future generations.

The report by Brundtland is believed to have been influenced by a study that was done by Meadows in 1972, where he demonstrated that the world's carrying capacity was not limitless. What Meadows argued was that if the population and the resources needed to sustain the population are not factored into the sustainability equation, at some point a catastrophe could result. This catastrophe would be an event where the population would be decreased by forces of nature because the resources would not cope with the number of the population.

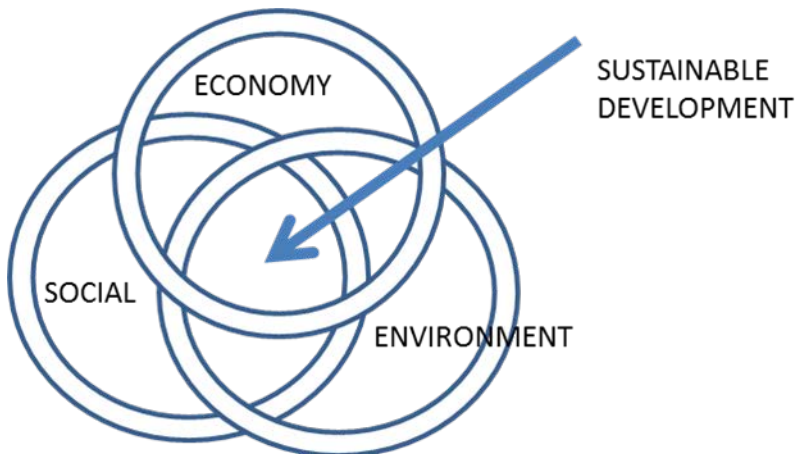
Another perspective of the sustainability concept is presented by Sterk (2015: 9) in the study in 2015. Sterk (2015: 9), quoting C.S. Hollings' seminal presentation in 1973, explains the concept of resilience to mean 'robustness' and 'sustainability' of an ecosystem. What is apparent is that the concept of sustainability may have been understood by earlier academia as resilience. Sterk (2015: 9) goes further to state that Hollings, for the first time, related the concept of resilience (sustainability) to 'engineering' and to 'ecological' systems. The 'engineering' concept of resilience related to predictable, logical and linear behaviour of ecosystems (Systems thinking). In this mode the system could be controlled or influenced by human interventions. The 'ecological' concept, on the other hand, is explained as a resilient system whose behaviour patterns is unpredictable, non-linear and random (Chaos or complex systems). The concepts of Systems Theory (thinking) and Chaos Theory (systems) underpin this study and are discussed in section 3.4.

In SWM space sustainable development has since become a major part because the sector involves natural resources, products which later becomes waste, and the waste which may pollute the environment and is sometimes harmful to humans, fauna and flora. In South Africa the EIA is used precisely to factor-in dimensions that deal with sustainable development. A clearer depiction of the relationship between the environment, the economy and the people is depicted as a sustainability equation in the section that follows.

Sustainable Development Equation

Sustainable development is at the intersection of the economy, the environment and the people (equity / socially). A delicate balance is needed to sustain development. Figure 7, below, depicts diagrammatically this delicate balance.

Figure 7: Sustainable Development Framework / Model



Source: UN-Sustainable Development 2014; UNEP 2013 and Shanghai Manual 2011.

Sustainable assessment as a tool of analysis, therefore, analyses a situation with the three dimensions (economy, environment and social) at the centre of the assessment. Waste generation and waste management are also closely associated with the sustainable development objectives and goals.

Strategic Environmental Assessment (SEA)

The Strategic Environmental Assessment (SEA) tool emerged in the 1980s as an assessment and management tool to aide decision making (Pires *et al*/2011: 1034). This tool has gained prominence like the EIA in that most countries have also adopted it as a legal requirement before decisions are made. Unlike the EIA which is more project linked in assessment, the SEA is used at a higher or strategic level in government. It is used when government have to make decisions on legislation, policies, programmes and regulations. As in other assessment tools, SEA also looks at the social, economic and environmental domains as a point of reference. Variations of SEA seem to now focus on the cultural and related aspects as part of the overall assessment.

Strategic assessment is not a common feature in the SWM domain in the developing countries, including South Africa. In the municipality realm, the tool that comes close to the SEA is the Integrated Development Plan (South Africa, Local Government: Municipal Systems Act 2000: s23 (i)). This tool is a strategy framework that covers many areas over and above those detailed in the SEA. The Integrated Development Plan focusses on the following areas: institutional analysis, leadership guidelines, economic analysis, socio-economic analysis, technical analysis, community and stakeholder analysis, social analysis, legal framework analysis, and environmental analysis. The SWM is covered as part and parcel of the Integrated Development Plan analysis.

2.5 CONCLUSION

The chapter introduces the concept of waste which is perceived as a public 'nuisance' and another perspective where waste is seen as an input resource in production. The South African models on SWM; the legislative framework; and SWM practises are explained extensively and citing Gauteng as a case in point. Examples of the lifecycle management of solid waste are shown giving a perspective of the 3Rs (reduce, re-use and recycle) strategy and its applicability in solid waste management. The chapter ends by giving the scientific and technological approaches to SWM applicable internationally.

CHAPTER THREE

SOUTH AFRICAN, LOCAL GOVERNMENT, SYSTEMS AND CHAOS THEORY, AND MONITORING AND EVALUATION

3.1 INTRODUCTION

Chapter three gives a broad understanding of the historical background of local government, the role of local government, and some fundamental principles that underpin service delivery issues that are incumbent upon municipalities to deliver to the communities. The theories that underpin strategic planning and delivery such as rational, systems, complexity and chaos are discussed. The chapter ends with monitoring and evaluation as it is applied in the municipal context.

3.2 INTRODUCTION TO SOUTH AFRICAN LOCAL GOVERNMENT

3.2.1 Inception of Local Government in South Africa

The democratic dispensation of South Africa was ushered in 1994 after national and provincial government elections. The South African Constitution, (Act No 108 of 1996) was adopted and set out three spheres of government, namely; national, provincial and local government. In addition, the South African government has prioritised twelve (12) outcomes as delivery measures across the entire spectrum of service delivery. The twelve outcomes, in listed order, are: basic education; health; safety; employment; skills; economic infrastructure; rural development; integrated human settlements; local government; environment; internal and external relations; and public service (South Africa, Department of Performance Monitoring and Evaluation 2012: 11). Local government is outcome number nine (9) in the list of priority outcomes.

Local government in South Africa, which is the sphere focussed upon in this study, is set up in Chapter 7 of the Constitution of South Africa (Act 108 of 1996) as an independent sphere of government whose objectives are to:

- provide democratic and accountable government for local communities;
- ensure the provision of services to communities in a sustainable manner;
- promote social and economic development;
- promote a safe and healthy environment; and
- encourage the involvement of communities and community organisations in matters of local government.

The Constitution of South Africa (1996) and the White Paper on Local Government (South Africa, Department of Provincial and Local Government 1998) envisioned a local government sector that is developmental and that integrates the community in the discourse of delivering services to the people. The developmental aspect of local government elevates local government from a position of merely serving as a service provider and a regulator, into a player that participates actively in the development of economic, spatial, human, and many other aspects of development.

There are four outcomes that are envisaged in undertaking the development focus of local government (South Africa, Department of Provincial and Local Government - White Paper on Local government 1998: 26). These are: the provision of basic services and infrastructure to the communities; integrating cities, towns and rural areas; creating a viable and vibrant local economic environment; and empowering and redistribution of the benefits accrued by the municipalities to the communities they serve. All the four outcomes operate within a national framework where social justice, gender and racial equality, nation-building, and the protection and revitalisation of the environment are the overarching principles (South Africa, Department of Provincial and Local Government - White Paper on Local Government 1998: 26). The South African Department of Provincial and Local Government – White Paper on Local Government will henceforth be referred to as White Paper on Local Government.

Therefore, the delivery of solid waste management services needs to include community participation and M&E to ensure accountability by local government.

3.2.2 The Principles of Local Government in South Africa

3.2.2.1 Developmental Governance

The fundamental principles of local government are based on the White Paper on Local Government (1998: 8) which states that the focus of local government should be developmental. The definition of developmental local government is when local government puts the communities it serves at the centre of its focus on service delivery (White Paper on Local Government 1998: 8). The White Paper on local Government (1998: 23) mentions four characteristics of the developmental local government as: delivering services so as to maximise the social and economic impacts to society; coordinating and integrating the public and private sector to the benefit of the community; making development accessible to all stakeholders; and providing leadership and vision in the process of empowering the communities especially the disadvantaged communities.

3.2.2.2 The Local Government Structure and Services

South African local municipalities are 257 in number and span the entire Republic of South Africa. The municipalities are grouped into three categories namely; category A, B and C, in terms of the South African Local Government: Municipal Structures Act (1998: s2, s3). Category A are metropolitan municipalities and there are eight (8) in number; category B are the local municipalities which are 205 in number; and category C are district municipalities which are 44 in number (South Africa, Constitution 1996: s155; South Africa, Local Government: Municipal Structures Act 1998: s2, s3).

The basic services rendered by municipalities are: water; electricity; sanitation and waste management. It is only on electricity where all municipalities depend on Eskom, a state entity that provides electricity, to provide services to the public. There are, however, other services that the municipalities provide over and the above the basic services. These include: provision and maintenance for graves; traffic management; environmental related matters; health related matters; and many others. These additional services are provided concurrently with the Provincial departments in terms of Schedules 4 and 5 of the Constitution of South Africa (1996).

3.2.2.3 Cooperative Governance

The Constitution of South Africa (Act No 108 of 1996) set out three spheres of government: namely; national, provincial and local government. The Constitution further asserts the spheres as unique, interdependent, and interrelated (White Paper on Local Government 1998: 37). Cooperation among the three spheres of government is fostered so that there is seamless service delivery to the public (South Africa, Intergovernmental Relations Framework Act No 13 of 2005). Intergovernmental relations are fostered through policies, legislation, processes, programmes, channels and structures. The White Paper on Local Government (1998: 37) lists the following key drivers to cooperation or intergovernmental relations, among others:

- developing mutuality and cohesion in delivery mechanisms;
- coordinating activities and strategies;
- effectively and efficiently using the resources (human, capital and equipment);
- clarify roles and responsibilities in delivering services to the public;
- promote and facilitate decision-making;
- enable free-flow of information;
- align government priorities to plans, budgets and programmes; and
- avoid in-fighting between and among the spheres of government.

The cooperation within the sector is not limited to the three spheres of government but extends horizontally as well where different local municipalities cooperate and interact in their service delivery mandates. This cooperation may not be limited to local municipalities only, but may include district municipalities as well. Other municipalities develop relations with municipalities internationally and all in the spirit of cooperative and intergovernmental relations.

Therefore, good intergovernmental relations should enhance SWM services and assist in service delivery through a well-structured M&E system.

3.2.2.4 Service Delivery in Local Government

The White Paper in Local Government (1998: 74) dictates that local government needs to address the imbalances that were created prior to 1994 by rendering basic services to the people in the form of water, sanitation, refuse removal and roads. Municipalities are expected to build capacity and the requisite skills to be able to deliver sustainably, efficiently and effectively. The White Paper on Local Government (1998; 74) does not dictate the delivery model or how the municipality should position itself to deliver, but leaves it to the municipality to assess the situation and use the most feasible model. The delivery options should be guided by the following principles, among others (White Paper on Local Government 1998: 74):

- accessibility of services to communities;
- affordability of services;
- quality of services and products offered;
- integrated development and services;
- sustainability of services;
- value-for-money;
- promoting competitiveness of local commerce and industry; and
- promoting democracy.

The delivery options or models advanced by the White Paper on Local Government (1998: 75) include: doing it themselves by building capacity; corporatisation (municipal-owned entities); public-private partnerships; partnerships with community-based organisations and non-governmental organisations; contracting out the service; lease and concessions (public-private partnerships); and transfer of ownership (privatisation). A further exploration of service delivery in municipalities is dealt with in subsequent sections.

The value system for service delivery is called the Batho Pele principles [People first] (South Africa, Department of Public Service and Administration 2014: 1; Hemson 2007: 13). These principles were adopted by government in 1997 as principles that should be adopted and applied across all spheres of government when government render services to the public. In these principles the government opens up to the public so that the public can judge and measure if the public sector is living up to the promises made (South Africa, Department of

Public Service and Administration 2014: 1; Hemson 2007: 13). The Batho Pele principles are summarised below:

- Consultation – all stakeholders have to be consulted about the nature, quantity and quality of service to be rendered to them in order to determine the needs and expectations of the end user;
- Service standards – citizens must be told the level and quality of public service they will receive so that they know what to expect from government;
- Access – All citizens should have equal access to the services to which they are entitled;
- Courtesy – Citizens should be treated with courtesy and consideration when they are provided service;
- Information – Citizens should be provided with full, accurate information about the public services they are entitled to receive;
- Openness and transparency – The citizens should be told how the department is run, how much costs will be charged, who is in charge, who is the head of the unit and how appointments are made;
- Redress and handling complaints – establishing a mechanism for recording public dissatisfaction; and
- Value for money – public service should be provided economically and efficiently in order to give the citizen value for money.

Other governance principles include: demonstrable results; upholding the Bill of rights; and efficient public service. These values and principles guide the behaviour standards of the public servants in discharging their duties to the public. While there is empirical evidence of evaluating the Batho Pele principles in some public sector departments, these principles have not been used to monitor and evaluate SW service delivery.

3.2.3 Current State of Local Government

Municipalities, especially local municipalities, have challenges when it comes to service delivery to communities. This has manifested itself in the form of service delivery protests,

and in the with-holding of payments to municipalities in other instances (City Press 2016; Statistics South Africa 2016; Africa Check 2015). The reasons and explanations that are advanced include; lack of skills and capacity by municipal officials, scarcity of resources (funding, human capacity and equipment), corruption and fraud, lack of knowledge management, and the lack of systems (Auditor General of South Africa 2016; Govender 2011: 38, 86).

3.2.4 Current State of Local Government on Solid Waste Services

Solid Waste Services (SWS) which is one of the four major services offered by the municipalities is equally affected by the factors that hinder service delivery in municipalities. SWS stands out in that it provides more of an obvious and visible indicator in that everybody can see the state of service delivery by the dirt and the hygiene state of the community. The South African GDARD Report on Waste Collection Standards (2010: 2) cites waste management related challenges in Gauteng municipalities as; servicing informal settlements which are increasing at a rapid rate, lack of support from political principals, illegal dumping, lack of policy enforcement, and the decreasing landfill space within Gauteng Province.

3.3 SERVICE DELIVERY IN MUNICIPALITY

The concept of service delivery in the public sector is broad and varies from stakeholder to stakeholder. The municipalities, as part of the public discourse, are no exceptions to that discourse. The main stakeholders who have lent a significant weight in determining service delivery are the Auditor General of South Africa (AGSA), the municipalities and the public. The different approaches and perspectives of interpreting service delivery by the three stakeholders are detailed below.

3.3.1 Auditor General of South Africa's Perspective of Service Delivery

The Auditor General of South Africa's (AGSA) mandate is to audit government departments and government entities in terms of the Public Audit Act (Act No 25 of 2004). The AGSAs mandate is to look at compliance related issues in determining the findings which also includes service delivery related aspects. The three areas that form part of the AGSAs are: financial statements, performance (pre-determined objectives) and governance (Role of AGSA 2012: 2). In the determination of findings that relate to service delivery, the AGSA assesses the achievements based on the targets. The percentage achievement of the plans and the percentage compliance then becomes the determination of whether service has been rendered according to the plans submitted.

However, it is possible that the AGSA can give an institution a clean audit but make a finding that the public is unhappy and causing unrest. The reason for such an anomaly could be that the institutions may comply in every measure assessed by the AGSA, only to find that the public is not satisfied with the delivery that they see or experience on the ground.

The Auditor General of South Africa (AGSA 2014, 2015) and Govender (2011: 38, 86) stipulate the root causes for lack of performance in municipalities as:

- Systems, processes and procedures are ineffective and inefficient;
- Poor knowledge and institutional memory management;
- Shortage of skills;
- Shortage of analytical skills and strategy management principles; and
- Lack of innovation and creativity.

These are among the prominently cited challenges that municipalities grapple with on an on-going basis, adversely affecting service delivery broadly including waste management service delivery.

3.3.2 Municipality's Perspective of Service Delivery

In terms of the South African Local Government: Municipal Systems Act (2000: s23 (1)) the municipality must prepare a 5-year Integrated Development Plan (IDP) and annual plans

(Service Delivery Budget and Implementation Plans - SDBIP). The annual plans (SDBIPs) have baseline, indicators, targets and a budget for the year (South Africa, Department of Co-operative Governance and Traditional Affairs - Performance Management Made Simple 2016: 133, 134). The SDBIPs are prepared in a logic framework format.

Roduner, Schalappi, Agridea, Egli and Zurich (2008: 8) define the logic framework or results-based framework, as an integrated framework for M&E. In this integrated framework (M&E) all aspects of service delivery, namely: inputs; process; output; outcome and impact, are looked at systematically. They further explain that municipal service delivery is in fact the output part in the logic framework. Municipal service delivery, from a municipal perspective, is therefore the output in the M&E framework. The logic framework is further discussed in detail in section 3.9.2.1.6.

The municipality also prepares and adopts a performance management system (PMS) for the institution (South Africa, Local Government: Municipal Systems Act 2000: s38 (a)). Management then cascades the objectives and targets to individual employees covering all aspects of the SDBIP. Management then monitors and evaluates the employees in terms of their agreed performance contracts. At the end of the financial year management measures the achievement of the objectives in terms of the targets achieved.

The same targets are used by the AGSA in assessing service delivery rendered by municipalities. Indicators are key components in assisting the process of determining the achievement of the predetermined objectives. Service delivery in the municipal context is also evaluated using the performance management system of individuals. The expectation is that if employees are able to deliver on their individual objectives, then that should translate into the delivery of the institutional predetermined objectives, which should translate into service delivery.

3.3.3 Public's Perspective of Service Delivery

The public's perspective and perception of service delivery is a complex issue that is based on the public's expectations of the service and the public's perception of the service received (Pycraft, Singh, Phihlela, Slack, Chambers and Johnston 2010: 506). Pycraft *et al* (2010: 506)

state that there is a 'gap' that exists between the 'expectation' and the 'perception' from the public's point of view. If the expectation is higher than the perception, then the service (quality) will be perceived as poor. Equally, when the expectation is lower than the perception, then the service (quality) will be perceived as good. There are instances where the expectations are equal to the perceptions and in this case the resultant ranking would be fair.

Pycraft *et al* (2010: 507) noted four areas which presents the 'expectation gap', these areas are: specification gap; quality of service gap; internal quality versus actual quality gap; and actual quality versus communicated image gap.

Specification Gap

The 'specification gap' is the disjuncture between the municipality's understanding of the specifications of service delivery, which may differ from the specifications that are understood by the public. The differences in understanding of the final result would mean that the municipality may apportion itself a high service delivery score only to find that the public gives it a lower score for its service delivery.

Quality of Service Gap

The manner in which the municipality understands and explains the 'quality of service' also differs from the service quality that is expected by the public. The municipality may be looking at the service quality from a technical and technocratic manner, whereas the public's view of service quality being diametrically different from that perceived by the municipality. This challenge arises as a result of capacity, capability and resourcing issues.

Internal Quality versus Actual Quality Gap

Pycraft *et al* (2010: 507) also noted that the 'internal quality' measure that the municipality uses to measure service rendered is different from the 'actual quality' that is measurable at the delivery point. Bringing this back to our study, this would mean that from the problem identification, to the Theory of Change (TOC), moving to a Systemic Performance Analytical Model (SPAM) model, and finally to implementation; the actual service delivery may differ from the planned outputs and outcomes.

Actual Quality versus Projected image

Finally, the 'actual quality' of service rendered is not the same as the communicated 'image' of the service rendered. This is purely a communication challenge that the municipality may be able to rectify.

It is clear that service delivery may appear differently depending on the assessor's point of departure. The two constituencies whose points of view are noted and quoted regularly are the AGSA and the public. The AGSAs findings on service delivery are based on the logic framework (results-based management) and the M&E frameworks used in the municipalities. The public's perception about service delivery, on the other hand, is multi-faceted as shown by Pycraft *et al* (2010: 506, 507) and is translated finally into unrest and service delivery protests. This study will be based on the service delivery perspective from the municipality's point of view.

3.3.4 SWM Service Delivery as a Wicked Problem

Xiang (2013: 1) and Govender (2011: 40) state that municipalities are social systems that operate in a chaotic and dynamic environment. This makes logically constructed solutions difficult to implement because solutions to the perceived problem are themselves inputs to other problems in the system. Xiang (2013: 1) and Govender (2011: 40), citing a seminal presentation by Ritter and Webber in 1973, refer to this dynamism as a wicked problem which is explained as a social problem which has the following characteristics:

- The challenge of defining the problem itself because of the diversity of interest in the stakeholders;
- The solution is difficult to ascertain because the consequences of the perceived solution may be innumerable to quantify;
- Solutions of wicked rules are perpetual and cannot be stopped when the process has initiated;
- The planner has no second re-run of the process, it has to be correct first time;
- There is no pilot run to test the problem because each problem is unique every time a run is made;
- They recur and can only be softened but cannot be solved in their entirety;

- Solutions are irreversible and multiply as the process unfolds;
- The breadth and depth of the problem is unknown which makes M&E difficult to pre-determine;
- Problems are complex and multi-dimensional; and
- Cause and effects are not proportional; and
- Decisions are not scientific or logical like true-or-false, but based on good-or-bad.

The characteristic of a wicked problem clearly shows that these are synonymous with the chaos theory concept which is discussed in section 3.4.2. An example of the wicked problem in solid waste management in South Africa is the case in KwaZulu Natal where communities were complaining about a smelly landfill site.

The community of Hillcrest have been complaining about a foul smell emanating from the landfill site managed by Enviroserv. Enviroserv has about 37 years experience in the solid waste management space and operates about seven (7) landfill sites in Southern Africa. Five hundred affidavits from community members were collected and sent to the Department of Environmental Affairs citing illnesses that have ensued because of the foul smell. The illnesses that are cited as a result of the smell are: headaches, respiratory illnesses, nosebleeds, sinusitis, new asthma diagnoses, nausea and eczema. Broughton (News24 2017) intimated that doctors, specialists and school principals noted a marked increase in the number of patients in allergic rhinitis, asthma, upper and lower respiratory infections and episodes of bronchitis. A teacher in Ingane Yami Children's Village said that she has suffered 11 migraines in two months and the children at school have episodes of nose bleeds that cannot be explained (News24 2017).



Picture taken from <http://www.iol.co.za/news/smelly-kzn-landfill-site-faces-closure-7620095>

The Department of Environmental Affairs gave Enviroserv an ultimatum and threatened to revoke the licence in four days. A criminal case was subsequently opened and the National Prosecution Authority (NPA) involved in the matter. A protest action was arranged by the Hillcrest community (pictured above). The poorer communities of Dassenhoek and KwaNdengezi said they had tolerated the foul smell for 15 years but action is now happening because the affluent Hillcrest community has been experiencing the smell for about a year in their case.

Enviroserv says it is handling hazardous and household waste. Ordinarily, hazardous waste should not be handled in the same landfill site with household waste. The company says they have spent R10 million to revamp the landfill site by: covering the leachate, fitting carbon gas extractors, fitting a filtration system and installing real-time air quality monitoring.

This example clearly articulates the chaos perspective of the wicked problem in solving the solid waste service delivery. A lack of M&E resulted in a multitude of complaints and amplified a situation which cannot be systematically determined beforehand. If the Department of Environmental Affairs manages to revoke the licence and close the landfill site the 'new' problem would be the challenge of finding another landfill site. The community that successfully lobbied to close the landfill site may be in a worse off situation. Unemployment

issues may arise from the Environserv employees and those stakeholders who recycle material directly on the landfill site. Criminality may escalate as a result of unemployment of some of the persons who lost their income.

3.3.5 The South African Waste Management Legislative Framework

3.3.5.1 Constitution of the Republic of South Africa (108 of 1996)

The Constitution of the Republic of South Africa (1996) is the paramount document of the state. All other legislations are geared towards giving effect to the provisions of the Constitution. Section 156 (1) (a) when read with Schedule 5, specifically, details the obligations of local government (municipality) in delivering services to the community. Waste management is one of the primary responsibilities that has to be rendered to the populace.

3.3.5.2 National Development Plan of South Africa (2030)

The National Development Plan (NDP) is the South African country-wide strategy document giving its vision of the country for the year 2030 (The Presidency - National Development Plan 2012). The key objectives of the NDP are: the reduction of unemployment, reduction of inequality and alleviation of poverty. The NDP articulates strategies, targets and plans that have to be undertaken to address several identified issues leading to the year 2030.

The issues identified in the NDP include: delinking economic growth with environmental degradation; building capacity to gather reliable and transparent data across sectors; moving towards a low carbon emitting country; and positioning the energy sector towards appropriate technologies while maintaining sustainable economic growth and development.

A major shortcoming of the NDP is that while it dissects several sectors and sub-sectors and gives detailed plans, there is nothing on waste management. Almost, all the sectors discussed have waste components that could be used positively and strategically, but this has been overlooked. Only broad mention of environmental consciousness and carbon related concerns are mentioned several times without focussing a section or a paragraph on waste management.

3.3.5.3 Environmental Conservation Act (Act No 73 of 1989)

This legislation deals specifically with the controlled utilisation and conservation of the environment. Areas that the Act focuses on include; ecological processes and preservation of biotic diversity, promotion of sustainable conservation of species, general protection of the environment from change initiated activities (intended or unintended) and remedial and mitigation measures when human beings are affected by the intended developments.

3.3.5.4 Occupational Health and Safety Act (Act No 85 of 1993)

This Act aims to give guidance on the processes, procedures and policies on dealing with hazardous and dangerous substances. Among others, the Act details procedures and processes on:

- Handling hazardous chemical substances;
- General care and responsibilities when handling these substances;
- Control and exposures in instances of fumes;
- Protection and maintenance of equipment that are used; and
- Transportation and storage of these hazardous substances.

3.3.5.5 National Water Act (36 of 1998)

This Act details how water resources have to be treated. Waste water is also put at the centre of the discourse. Among others, the Act encourages the prevention of effluent from being discharged into clean water resources; encourages the control of storm water to be channelled appropriately with appropriate measures put in place to deal with it; the location of waste management sites and locations to be considered carefully; policies and strategies to be in place to guide the implementation of the legislation; and penalties and sanctions for deliberate offenders of the policies and strategies to be put in place.

3.3.5.6 National Environmental Management Act (Act No 107 of 1998)

This Act was designed to guide the institutions in their dealings with environmental governance related matters focussing on the processes, procedures and administrative matters. Co-operative governance is seen as a key dimension that must be encouraged in the implementation of the Act. The enforcement regime is also highlighted in the management of the Act, especially for those parties that are found to be in breach of the legislation.

3.3.5.7 Local Government: Municipal Systems Act (Act No 32 of 2000)

This legislation provides the basis for local government (municipalities) towards becoming developmental as is envisaged in the Constitution of Republic of South Africa (Act No 108 of 1996). This Act provides for the core principles that underpin local government, the mechanisms that will be utilised in running the institutions and the procedures that will be used as well. The primary role of local government (municipalities) is the provision of universal access to services by communities within their area of jurisdiction.

This Act specifies the services that must be provided, like water, sanitation, waste management, electricity, burial sites, roads, and many other essential services. On the workings of local government, the Act stipulates an enabling framework as to how the planning should be undertaken and the periods for different activities within the plan (Integrated Development Plan). Over and above, the Act guides local government on matters of performance management, resource allocation, organisation management and the legislative powers that local government possess.

The legislative powers of local government would include the setting of by-laws, policies, setting tariffs, credit control and debt control measures. The Act also details how the institution relates with other spheres of government, the participation of communities in the system and partnerships that local government can undertake.

3.3.5.8 White Paper on Integrated Pollution of Waste Management Act (2000)

This legislation was in response to the global trend where the focus was on managing natural resources efficiently and effectively. The focus of the legislation was to change the national way of thinking where the focus in managing waste and pollution was more reactive and focussed on the end of the process – called end of pipe treatment. The premise of the legislation was to move the focus towards the beginning of the process where prevention and minimisation of waste and pollution were advocated as the best practices to alleviate challenges down the process (end of the pipe). This legislation was in line with many other legislative tools where 3Rs (reduce, re-use and recycle) were advocated as best practices.

3.3.5.9 National Health Act (61 of 2003)

This Act deals with the prevention of pollution of water resources that are used for human consumption, regulation of communicable diseases and related illnesses, waste in its broader sense and the offences that parties who breach the stipulations of the Act may be charged with.

3.3.5.10 National Environmental Management Waste Act (Act No 59 of 2008)

The Act provides for a legislative framework with the focus on human health and the environmental degradation that may result if more care is not taken in dealing with waste management. Among others, the Act clarifies the:

- institutional arrangement;
- the national norms and standards to be adhered to;
- waste management measures;
- licensing and control of waste management activities;
- national waste information system; and
- compliance and enforcement.

3.3.5.11 Waste Tyre Regulations (31901 of 2009)

This legislation provides for the mechanism for managing waste tyres that are produced and disposed of after the useful life of the tyres. The Act provides for the 3Rs, namely; reduce,

re-use and recycling. It also provides for the responsibility to be moved to the producers in limiting and managing the tyres throughout the value chain so that the resources used are kept to a minimum.

3.3.5.12 Other Guiding Documents within the Waste Management Sector

3.3.5.12.1 National Waste Management Strategy (2011)

This strategy was a National response to the impending challenge that was facing South Africa with waste management. The strategy was all encompassing and targeted all facets of waste from generation to disposal. This concept was generally known and conceptualised as handling waste from the cradle to the grave. All issues, methodologies and techniques available were to be explored such that waste is dealt with from generation, separation, collection, transportation, recycling, recovery, treatment and disposal.

In addition, the South African Department of Environmental Affairs (DEA) National Waste Management Strategy (2011a: 15) listed several challenges that the local government sector has to deal with, these include:

- The volumes of waste increase alongside the increase in population;
- The volumes of waste increase as the economy increases;
- Insufficient and dilapidated recycle infrastructure;
- Waste management is still reflective of the past imbalances;
- Insufficient resources across the waste value chain (namely; generation of waste, collection, transference, recycling and disposal of waste).

3.3.5.12.2 National Domestic Waste Collection Standards (2011)

The domestic waste collection standards are instituted as a result of section 7(10) (b) of the South African DEA National Environmental Management Waste Act (Act No 59 of 2008). These standards are set as a base for waste collection services such that it is a 'clean, and acceptable place to live and work in, affordable to communities and is a sustainable waste collection service' (South Africa, DEA National Domestic Waste Collection Standards 2011b). The standards are enforced because waste is associated with the quality of life of the

population. If waste collection is not regulated it could have adverse health and environmental consequences.

3.3.5.12.3 Polokwane Declaration on Waste Management (2001)

The South African Department of Environment Affairs and Tourism hosted a Waste Summit in Polokwane (South Africa) in 2001. Most waste stakeholders committed as follows:

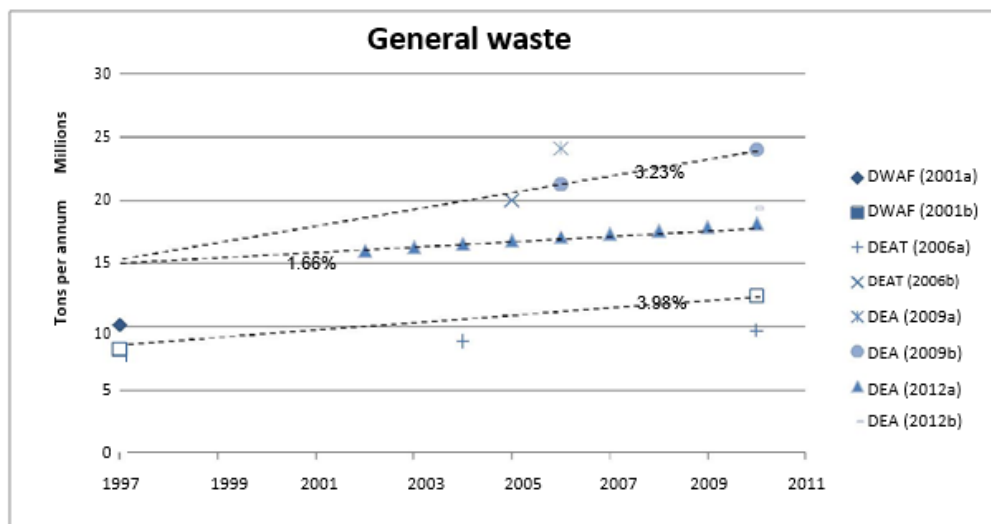
- To reduce waste generation would be reduced by fifty percent (50%) in 2012;
- To reduce waste disposal would be reduced by twenty-five percent (25%) in 2012;
- The sector will work towards zero waste by 2022; and
- Municipalities in South Africa should develop Integrated Waste Management Plans.

The myriad of legislations, policies and strategies make it difficult for individual municipalities with limited capacity, finances and expertise to understand and implement them precisely. This has the potential of creating unintended results of stalling the implementation and service delivery to the stakeholders.

The 2001 targets that were set to be achieved by 2012, namely; '50 per cent reduction of waste generated' and '25 per cent reduction of waste disposed', were not achieved by 2012. The Department of Environmental Affairs (2012a: iii) in the National Waste Information Baseline Report stated that in 2011 South Africa generated 108 million tonnes waste, of this amount 98 million tonnes were disposed of. This showed that 90.7 per cent of the generated waste was disposed of, which showed a reduction of 9.3 per cent. This was far from the 25 per cent reduction that was earmarked in the year 2001. Equally, there was no tangible reduction in the generated waste as planned instead the waste generation in South Africa increased steadily from 1999 till 2011 after which the Department of Environmental Affairs issued the National Waste Baseline Report of 2012 (Department of Environmental Affairs 2012a: 16). The waste generation from the Department of Environmental Affairs report (2012a: 16), shown in Figure 8, graphically show increasing waste generation trends from various sources and all showed a consistent increase from the year 1999 until 2011. The different datasets were from the Department of Water Affairs and Forestry (DWAF), the

Department of Environmental Affairs and Tourism (DEAT) and from the Department of Environmental Affairs (DEA).

Figure 8: General Waste Statistics of South Africa from 1999 to 2011



Source: Department of Environmental Affairs - National Waste Baseline Report (2012a: 16)

3.3.5.12.4 Gauteng Provincial Integrated Waste Management Policy (2006)

The South African Gauteng Provincial Integrated Waste Management Policy (GPIWMP) is a policy instrument that gives effect to the Provincial strategies on waste management. The policy acknowledges the use of the Logic Framework Approach (LFA) as an important government accepted tool to plan, apportion resources and monitor the process.

The Gauteng Provincial Integrated Waste Management Policy sets out the vision, principles and the strategic goals in achieving an integrated and environmentally-sustainable waste policy for the province (South Africa, Gauteng Department of Agriculture Conservation and Environment 2006: 4). Underpinning the policy are National imperatives such as (South Africa, Gauteng Department of Agriculture Conservation and Environment 2006: 4):

- Sustainable development – three priority areas which are environment, social and economy;
- Integrated environment management using Best Practicable Environment Option (BPEO) – using the best technologies, processes and methods;

- Polluter Pays Principle – shifting the responsibility to polluters and penalties levied on those practices;
- Cradle to Grave responsibility – monitoring the waste value chain from inception (generation) until the last stage which is disposal;
- Precautionary principle – pre-empting the worst case scenarios and legislating for possible eventualities; and
- Involvement of interested and affected parties (IAPs) and relevant stakeholders – involvement of all stakeholders in the waste value chain.

The Gauteng Provincial Government has enlisted fifteen (15) objectives to implement the policy (South Africa, Gauteng Department of Agriculture Conservation and Environment 2006: 4). These objectives are:

- Integrated Waste Management Planning – by municipalities and other state organs;
- Roles and Responsibilities – is about the different roles of the three spheres of government (National, Provincial and Local), private sector and the households;
- Waste Information Management – implementation of the National Waste Information System (NWIS), the reporting and the responsibility of Gauteng Department of Agriculture, Conservation and Environment (GDACE);
- Institutional Development – state organs that are part of SWM delivery, organisational designs and best practice models like the Logic Framework Approach (LFA) and Best Value Performance Indicators (BVPIs);
- Capacity-Building – technical focussed recruitment, training and job creation;
- Alignment with National Legislation – National prescripts of waste management, handling, transportation, treatment and disposal.
- Funding – full cost accounting of payment of services rendered, enforce Polluter Pays Principle and incentivising stakeholders to participate in the SWM;
- Avoidance and Substitution – encouraging waste generators to minimise and reuse waste as inputs instead of using ‘new’ raw material;
- Waste Reduction and Minimisation - adoption of realistic targets for minimisation, generation, avoidance, substitution, recovery, reuse and supplying to the sector;
- Waste Recovery and Recycling – to encourage source-separation, manual and mechanical separation and waste exchange;

- Waste Collection and Transportation – regulation of waste transportation in collaboration with relevant stakeholders and encourage alternative waste transportation modes;
- Waste Processing – encourage waste recycling and other methods of waste recovery;
- Waste Treatment and Disposal – regulating landfill sites, indiscriminate dumping, and treatment and disposal;
- Environment Management – encourage and enforce environmental prescripts in collaboration with the relevant stakeholders; and
- Selected Waste Streams – prioritising waste streams according to the industry sector it originates from such that the relevant sector Department is involved in SWM.

Apart from the vision, principles, goals and objectives, the overriding themes in the policy are: IWM planning; Waste Information Management; capacity-building and 'cradle to grave'. These themes are in line with international prescripts of waste management like the Montreal Protocol Treaty (1999) and Kyoto Protocol (1997). All these protocols emphasise the importance of environmental and societal protection during economic productivity activities.

3.4 PRINCIPAL THEORIES INFORMING THE STUDY

3.4.1 Systems Theory and Local Government

Amagoh (2008: 2), quoting Skyttner (1996: 7), defines system theory as a system that is made up of two or more components; the components being interlinked within the system; the behaviour of the entire system cannot be determined on the basis of either component but by the interaction of the components. Senge (2006: 7) defines system theory as a concept where the overall patterns of an unfolding situation are understood so that changes can be effected to influence the system.

Systems thinking is a methodology of testing ideas in social sciences in a similar way to that which engineers would use to test mechanical problems (Hellstrom 2013; Govender 2011: 129; Senge 2006: 7). Systems approach is a thinking process which looks at the whole process or mechanism to understand how the different parts of the entire system work

together. The conceptualisation of the IDP could be traced to systems thinking and its underlying systems theory. The aspects of systems theory that are applicable in our study are discussed in the subsequent sections.

Accordingly, a systems approach to the IDP will be discussed and in later sections a complexity theory frame of reference will be built on top of systems thinking. This will be taking into account the dynamic and complex situation within which local government operates. This research then uses one of the complexity group of theories built on top of systems theory, called Chaos Theory. The conceptual framework of the study is also built around this theory.

Critiques of Systems Theory

Amagoh (2008: 4, 5) cites several criticisms of systems theory. Firstly, systems theory is tailored for natural organisms which follow a life-cycle of birth, growth, maturity and death. The use of systems theory in man-made systems which do not have a life-cycle may not be appropriate. Secondly, the power ascribed to management to be able to control the system is overstated. Management can only control within small confines of the entire system. Thirdly, the boundary of the system cannot be fixed as assumed in conceptualising the system. Ordinarily, systems theory pre-supposes a clear and delineated boundary which is not necessarily confined in real life situations. Finally, systems theory is often used in natural (weather, stock markets, etc.) and human systems (organisations, institutions, etc) which stretch beyond the realm of linear thinking. These systems, natural and human systems, are complex and with wicked dimensions which cannot be easily predicted in a linear format. This study is premised on chaos theory to cater for the complexity and the wicked nature of the SWM service delivery in the four different municipalities and the M&E in the municipalities.

3.4.2 Chaos Theory

Chaos theory can be defined as a process or phenomena where small changes in the inputs (minute or sub-components) results in dramatically increased changes in outputs, outcomes and impact (Haran 2011; Urry 2006: 6). The cause and effect relationship, as in systems thinking, is still applicable the difference is that the effects are extremely high proportionally.

Chaos theory, although within the complexity theories, is traced from general systems theory (GST) by the addition of a positive feedback mechanism, which caters for the complex environment (Haran 2011; Sapolsky 2010; Weathers 2010; Urry 2005: 6). The dimensions that are added are: creativity, innovation, self-organisation, learning organisation, scenario planning, metaphors / images, self-replicating and patterns (Haran 2011; Sapolsky 2010; Weathers 2010; Urry 2005: 5). Urry (2005: 5, 6) explains the chaos theory perspective as using all aspects of general systems theory (GST) but also incorporating a positive feedback loop. The chaos theory model, therefore, is a depiction of the GST model with the emphasis on the positive feedback rather than the negative feedback loop.

The municipality is a complex system (Govender 2011: 129) and chaos theory is a relevant premise in dealing with solid waste management service delivery instead of looking at the delivery from only the systems perspective. A Systemic Performance Analysis Model (SPAM), which is a framework built on the logic framework and encompassing systems and chaos thinking, is used in the study.

3.4.2.1 Characteristics of Chaos Theory Systems

3.4.2.1.1 Butterfly effect

The Butterfly effect was initially introduced by Dr Edward N. Lorenz in a lecture for the American Association for the Advancement of Science 1972. In that lecture Dr Lorenz explained the sensitivity of the initial conditions to the overall character of a chaotic system (Harvett 2013: 194; Sapolsky 2010; Chaos, Weathers 2010). He used the Butterfly as a metaphor questioning if the flapping of the Butterfly in one area of one continent can result in a tornado in another continent. By the flapping of the wings, a disturbance is created which travels over distances, strengthening on its path and resulting in a tornado.

In his explanation Dr Lorenz states that events or components are interlinked such that a small change in a component of a system will effect a change in the components next to it, the change in the next component in turn affects those nearest such that this becomes more of a chain reaction resulting in a significant change over a longer range. This was an illustration of the sensitivity of the initial conditions in the chaoticism of a system (Harvett

2013: 194; Sapolsky 2010; Chaos, Weathers 2010). The Butterfly effect terminology has since been used as a primary definition of chaoticism as a system.

Health concerns as a butterfly stimulus

In the case of SWM in municipalities the butterfly effect could mean small sub-components of the system like: waste not being collected, staff not doing their duties properly, an odd smell from the landfill site, and many other seemingly minor effects. All these cited issues may result in unintended consequences like unrest, health pandemic, court cases against the municipalities and many other severe results.

Performance M&E as a butterfly stimulus

An effective and efficient performance M&E is essential in SWM. A lack thereof could serve as an unintended stimulus which would result in poor service delivery, leading to visually dirty communities. This could lead to further protests and community unrest against municipalities. A stimulus like M&E could lead to devastating consequences in the delivery of SWM to communities.

3.4.2.1.2 Sensitivity to initial condition

In a normal linear system where there is predictability, one can extrapolate subsequent values based on the information that one has (Harvett 2013: 193; Sapolsky 2010; Weathers 2010; Haran 2011). The same extrapolation can be used for values which are further down the line or end-states. Equally, one could use the end-state to project the initial state.

The explanation which applies in systems thinking does not hold true in a chaotic system. One cannot extrapolate a future state based on the current value or current information. Instead, one can only have information that relates to the state that is closest to it (Sapolsky 2010; Weathers 2010). Using the weather pattern as an example, one can realistically extrapolate a weather pattern which is nearest to that day, a day or a week in advance. One cannot realistically extrapolate a weather pattern for a month or a year ahead and the date associated with that. The sensitivity to the initial conditions only applies to the randomness that may be initiated based on the initial conditions; and the end-state that may be attributed to the initial state.

3.4.2.1.3 The Unpredictability and Randomness

Predictability, linearity and uniformity relates to rational thinking (or systems thinking), in the case of chaos systems all the stated principles don't apply (Harvett 2013: 193; Sapolsky 2010; Weathers 2010). One cannot extrapolate an end-state based on the initial conditions or the information that one processes. The system, instead, builds up randomly to a state that may not have been anticipated if linear logical thinking was used as a point of departure.

This is the basis for using chaotic theory in the study because local government operates in a complex system. Systemic thinking where predictability, uniformity and linearity are fundamental does not apply, which makes chaos theory a relevant proposition in analysing solid waste service delivery.

3.4.2.1.4 No repetition of pattern / Aperiodic

In a logical and linear system (in systems thinking) there is a periodic repetitive process which is predictable (Sapolsky 2010; Weathers 2010). One can even come up with a logical scientific equation to explain easily the process. In the chaotic system on the other hand, there is also a pattern but it is not repetitive and one cannot predict through formulation the period at which it will appear. Thus, a chaotic system is non-repetitive and aperiodic.

In SWM municipal employees collect solid waste (refuse) on set days and use the same routine. Every instance that municipal employees collect in the same streets and the same household the situation and set up of bins will be different every time. This shows the aperiodic nature of SWM services.

3.4.2.1.5 Failure of reductionism

Current thinking in the sciences and related fields is based on reductionism which presupposes that to understand a concept or a complex mechanism one has to break it down to its constituent parts and later built it up again to understand its dynamics (Sapolsky 2010). This also presupposes that on building it up (putting it together) one will be able to reproduce and understand the complexity of the part that was broken down. This kind of thinking is not appropriate in a chaos system, in that the end-state does not relate directly to the constituent

parts in a linear formation in the same way as the complexity that each one of the constituent parts contributes to the end-state (Sapolsky 2010; Weathers 2010).

In SWM one cannot expect the challenges and dynamics that happened on a particular day to assist in pre-empting the situation in future days. Strategies that were used to address challenges encountered on a particular day may be applicable for that day only and not be encountered again.

3.4.2.1.6 Variability

In systems thinking theory variability is viewed as a deviation or an aberration from the normal operations. The variation or deviation is viewed as a problem to be solved. In systems thinking any variation is a deviation from the normal linear formulation, hence the preoccupation of standardising operations such that they produce the same results every time (Sapolsky 2010; Weathers 2010). In chaos theory thinking, on the other hand, variability is a normal feature and it is accepted as the nature of the chaos system or social system. Variability is not viewed as something to be solved but just considered as the nature of the system which presents an opportunity to learn and optimise operations (Sapolsky 2010; Weathers 2010).

3.4.3 Observations and Critique of Systems and Chaos Theories

3.4.3.1 Summary of Systems and Chaos theories

Table 3 lists the comparisons of the characteristics of systems and chaos systems. Principles and characteristics of chaos theory are derived from systems theory which explains the similarity in character and interpretation.

Table 3: Comparison of Systems Theory and Chaos Theory Systems

Dimension	Systems Theory (Thinking)	Chaos Theory
1. Cause and effect	Applicable, and are: <ul style="list-style-type: none"> • Uniform • Linear • Predictable 	Applicable, but the <u>effects</u> are exacerbated and multiplied multi-fold compared to the <u>causes</u> , and are: <ul style="list-style-type: none"> • random (seemingly) • Nonlinear • Unpredictable
2. Reductionism	<ul style="list-style-type: none"> • Uniform and vice versa 	Not applicable.
3. Self-similar or Isomorphism	Applicable (debatable)	Applicable, but also applies across infinitesimally small ranges.
4. Sensitivity to initial conditions	Not applicable	Applicable, Initial conditions are crucial in a chaotic frame.
5. Rational thought (Newtonian & Euclidian logic based)	Applicable	Applicable, but goes beyond rational into randomness or higher level order.
6. Differentiation (Advancement of system)	Applicable (maintenance of order is the end all) – debatable	Applicable (Levels unexplained are seen as normal and are not seen as aberration or a problem – called higher level order).
7. Characteristics or Nature	<ul style="list-style-type: none"> • Orderly • predictable, • deals with man-made systems and designs, • historically based. 	<ul style="list-style-type: none"> • Higher level order, • seemingly random, • unpredictable, • about living systems, • about natural systems, • futuristic.
8. Negative feedback	Applicable	Applicable
9. Positive feedback	Applicable, but not emphasised.	Applicable, resulting in a self-perpetuating (self-propelling) mechanism.

Source: Agazarian (2011); Govender (2011); Sapolsky (2010); Weathers (2010); Senge (2006) & Urry (2005).

3.4.3.2 Critique of Systems and Chaos Theories

Systems thinking (theory) is a very common framework which is used beyond its scope. Systems thinking should be only applicable in man-made and linear systems (Williams & Gregory-Williams 2004: 19). Instead, most scholars ascribe systems theory to natural, complex and living systems, whereas that is the terrain where chaos theory is operational. The systems thinking approach and related mechanisms are always biased towards stability and not configured to deal with change or instability (Jayeoba, Ayantunji & Sholesi 2013: 102). The two theories, namely: systems; and chaos; are intertwined such that it is difficult for most scholars to distinguish where systems theory ends and where chaos theory commences (Williams & Gregory-Williams 2004: 19).

3.4.4 Theory of Change

The theory of change (TOC) explains the intended change by explaining the assumptions, process and expectations that underpin the change and the outcomes that are expected in the intervention (Montague 2014; Clark & Anderson 2004). The TOC explains the critical thinking, underpinning theory and a pathway to change (Montague 2014; Clark & Anderson 2004). The TOC depicts a high level story-line that links the cause and effect or 'if...then' logic at a high level. The specifics and resources required to achieve the change are captured in the M&E logic framework. In the current study the SPAM model (TOC) is the logic framework that is used.

In the municipal setup the TOC could be any intervention like policy, programme, legislation, strategy document like the IDP, and many other interventions. In the current study, systems theory (thinking) and chaos theory inform the TOC of SWM. The relationship of the TOC and the M&E (logic framework) is that the TOC is about a conceptual plan with a theory underpinning the planned intervention, while the logic framework gives the details of the plan and the necessary resources that are needed to implement the intervention.

Critiques of the TOC

Valters (2015: 6) and Vogel (2012: 22) cite several shortcomings associated with the TOC. They cite, among others, that the TOC is complex, superficial, bureaucratic, subjective and mechanistic. The application differs every time a different group engages on the project.

Valters (2015: 6) further asserts that it would be difficult to understand the underlying thinking that informed the TOC of a project if one was not part of its development.

Apart from the challenges that are cited in the use of the TOC, it is a tool that enhances the use of the logic framework (SPAM) by assisting in interrogating the assumptions that are used in the logic framework. The TOC also assists in answering 'how' and 'why' in the project formulation (Valters 2015: 5).

3.4.5 Implementation Theory - Extended Normalisation Process Theory

The Extended Normalisation Process Theory (henceforth ENPT) is the implementation theory (service delivery) that is used in the study. Segrott *et al* (2017: 256) and Drew, Chidothiel, Lavy and Goberman (2017: 34) explain ENPT as a theory that pertains to implementation which has four constructs, namely; capacity, capability, potential and contribution. The four dimensions are used as a yardstick to assess implementation within a social setting or an intervention. Capacity pertains to the adaptability or receptiveness of the entity to the intervention that is being undertaken. This may entail a change in norms or culture to accommodate the intervention. Capability is about the usefulness of the intervention in effecting the change that is intended. Potential is about the practitioners conduct and disposition in instituting the intervention in the institution. Finally, the contribution is about the flexibility of the role of the practitioner and the complex situation that is confronted when instituting the intervention.

Drew, Chidothiel, Lavy and Goberman (2017: 34) define normalisation as the pre-determined activities undertaken by the implementers in taking the actual work done to be routine. The activities undertaken during the implementation stage could be thinking, physical or planning. All these activities contribute to the actual implementation or service delivery.

In government and in many institutions, the primary focus is on designing the logic framework (M&E), whereas the logic framework does not deal with the actual implementation or service delivery. The logic framework is an essential tool for M&E but does not give details on implementation or the model that would be used for service delivery purposes. In our study the details of the SWS delivery model whether; municipal owned staff, or public private

partnership, or contracting the services to the private sector, or using a municipal-owned entity, would be addressed from a perspective of the ENPT. The delivery vehicle used by municipalities would be assessed based on the four ENPT dimensions, namely capacity, capability, potential and contribution.

3.4.6 New Public Management

Williams and Lewis (2008: 655), citing Maesschalk (2004) and Hood (1991), define New Public Management (henceforth NPM) as a theory or concept where the public sector entities are gradually transformed towards private sector thinking and practices. This is characterised by the use of private sector tools and frameworks like: benchmarks; total quality management; balanced scorecards; Kaizen; Six Sigma and many others (Williams & Lewis 2008: 255). The primary drive is to infuse professionalism and accountability into the public sector. Kirk, Brower and Duncan (2017: 53) posits NPM as a system where the emphasis is on management in the discourse of service delivery. Govender (2011: 138) states that the drivers for such a move were cost containment, public support, efficiency, effectiveness and performance improvement. This thinking would have resulted in a move away from rules, procedure manuals, rigid thinking and inflexibility.

All the generic NPM principles are applicable in the municipal realm and concepts like M&E and the tools associated with it, namely: logic framework; results-based monitoring; and results-based management, are applicable. In the solid waste management (SWM) service delivery field, NPM concepts are applicable across the board. New Public Management (NPM) is used in the tools applicable in problem identification, theory of change (TOC), M&E (SPAM – Systemic Performance Analysis Model) and in service delivery implementation. The issues and concepts used in solid waste management service delivery are explained in the subsequent section on M&E.

Challenges of Implementing NPM

Soni and Hamid (2017) cite five challenges that are inherent in instituting NPM or public sector management in the South African public sector. These challenges are the complex governance structure, emphasising the organisational structure and its function, lack of

institutional capacity, lack of accountability mechanisms and the decline in social values within society.

The complex governance structure pertains to the chain of command that moves from national government to provincial and finally to local (municipal) level. The institutional capacity refers to the three key institutions namely: legislative, executive and the judiciary. Soni and Hamid (2017) believe that the legislative is the most affected when it comes to the capacity to deliver on its mandate. The lack of accountability has to do with the governance structures which are not able to hold the subordinate structures accountable for the activities they are expected to discharge. Finally, the decline in social values in society has pervaded all aspects of life such that the public institutions are also affected by the decline. The decline in the social values has had the consequence of affecting all the other four challenges cited earlier.

All the challenges cited above can be directly attributed to the lack of performance M&E within the system. Strengthening the M&E would highlight the problem and resultantly reinforce namely; the three arms of government (legislature, executive and judiciary), provide a seamless M&E flow down the government hierarchical structure (national, provincial and municipalities), reinforce the accountability of public officials and the public institutions by continuous reporting and assisting in rebuilding the public trust in public institutions. Dealing with the challenges cited above by using the M&E would finally assist in rebuilding the societal value systems.

3.5 MONITORING AND EVALUATION

Monitoring and evaluation (M&E) pertains to a higher-level management function such that efficiencies, effectiveness, impact and sustainability become the ultimate focus in a project, programme or any undertaking under scrutiny (Govender 2011: 74; Presidency 2007; Lahey n.d.). Whereas general management deals with planning, organising, leading and controlling, M&E elevates the discipline of management by providing more evidence throughout the process for optimisation purposes and presents an opportunity for a review (learning), which could assist in achieving better results in future undertakings (Govender 2011: 74; Presidency 2007).

The basis of M&E could be traced to System Theory or systems thinking in that the inputs (resources) are tracked (monitored and evaluated) throughout the transformation process (activities / processes) towards the achievement of outputs, outcomes and impacts. M&E operates throughout the delivery process and a final measurement done on completion - at the evaluation stage.

This study assesses how the M&E system is used in the waste management, the effectiveness and efficiency of the M&E from a chaos theory point of view. The entire solid waste services value chain is analysed from a logic framework (inputs, transformation, outputs, outcomes and impact) point of view. The model used in the study is the Systemic Performance Analysis Model (SPAM) which is a refined logic framework which incorporates negative feedback and positive feedback loops.

3.5.1 Monitoring

According to the *Reader's Digest Oxford Complete WordFinder* (1993: 983) monitoring is defined as a 'process where an individual or system uses to check and give warning about a situation, operation or any other process under scrutiny'. Continuous checking of the process and warning signals of pending problems are key components of monitoring. The Presidency (2007: 1) defines monitoring as involving 'collecting, analysing, and reporting data on inputs, activities, outputs, outcomes and impacts as well as external factors, in a way that supports effective management'. In the definition used by the Presidency (2007: 1), systems theory is inferred by the use of input, activities and outputs.

The Public Service Commission (2008: 3) defines monitoring as 'a continuing function that uses systematic collection of data on specified indicators to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds'. The Office of the Premier in KwaZulu-Natal (South Africa, Office of the Premier 2012: 5) summarises monitoring quite simply as 'the process of tracking or measuring what is happening'. The Premier's Office goes further stating that 'this includes measuring progress

in relation to an implementation plan for an intervention or programme or projects, activities, strategies and / or policies’.

In summary, key phrases that are crucial in monitoring and inferring from the above definitions, include:

- Continuous or daily tracking and measurement;
- Provision of early warning signs;
- Data collection, analysis and reporting;
- Using the logic framework (results-chain model or results-based management) [inputs, activities, outputs, outcomes and impact];
- Efficiency (or productivity); and
- Indicators to track progress.

Therefore, monitoring is a daily business function affecting service delivery performance of solid waste management.

3.5.2 Evaluation

The South African Presidency (2007: 2) defines ‘evaluation as a time-bound and periodic exercise that seeks to provide credible and useful information to answer specific questions to guide decision making by staff, managers and policy makers’. The South African Presidency (2007: 2) further states that ‘evaluations may assess relevance, efficiency, effectiveness, impact and sustainability’. According to the *Reader’s Digest Oxford WordFinder* (1993: 507) evaluation is defined as a process of assessing, appraising or finding a numerical expression of a valuation. The Public Service Commission (2008: 3) defines evaluation as ‘the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results. The aim being to determine the relevance and fulfilment of objectives, development of efficiency, effectiveness, impact and sustainability’. Another shorter definition from Public Service Commission (2008: 4) puts it as such ‘evaluation is the determination of merit or shortcoming. To make the judgement one needs a standard of what is regarded as meritorious to compare with’.

Key concepts that are captured in the definitions of evaluation include:

- Periodic or time-bound assessment;
- Relevance, effectiveness, outcomes, impact and sustainability;
- Numeric expression of the measurement; and
- Worthiness or the value created.

Neuman (2011: 29) states that there are two commonly known evaluation methods; these are the formative and the summative evaluations.

3.5.2.1 Formative evaluation

Neuman (2011: 29) defines formative evaluation as a process where monitoring is done on a continuous basis with a negative feedback system built onto the system. Clearly, the definition Neuman (2011: 29) explains is that of monitoring and is more of an implementation or implementation evaluation. This definition of formative evaluation coincides with the definition of monitoring which was explained in section 3.5.1 above, where monitoring is explained as a day-to-day process.

3.5.2.2 Summative Evaluation

Summative evaluation looks at the final results or at the end of the process (Neuman 2011: 29). The tail-end of the logic framework is where outcomes and impacts are located. Logically, there are two evaluations that are possible, namely; outcomes evaluations and impact evaluation. 'Impact evaluations examine whether underlying theories and assumptions were valid, what worked, what did not and why' (South Africa, The Presidency 2007: 2). Impact evaluations have since become a big industry in the evaluation sector.

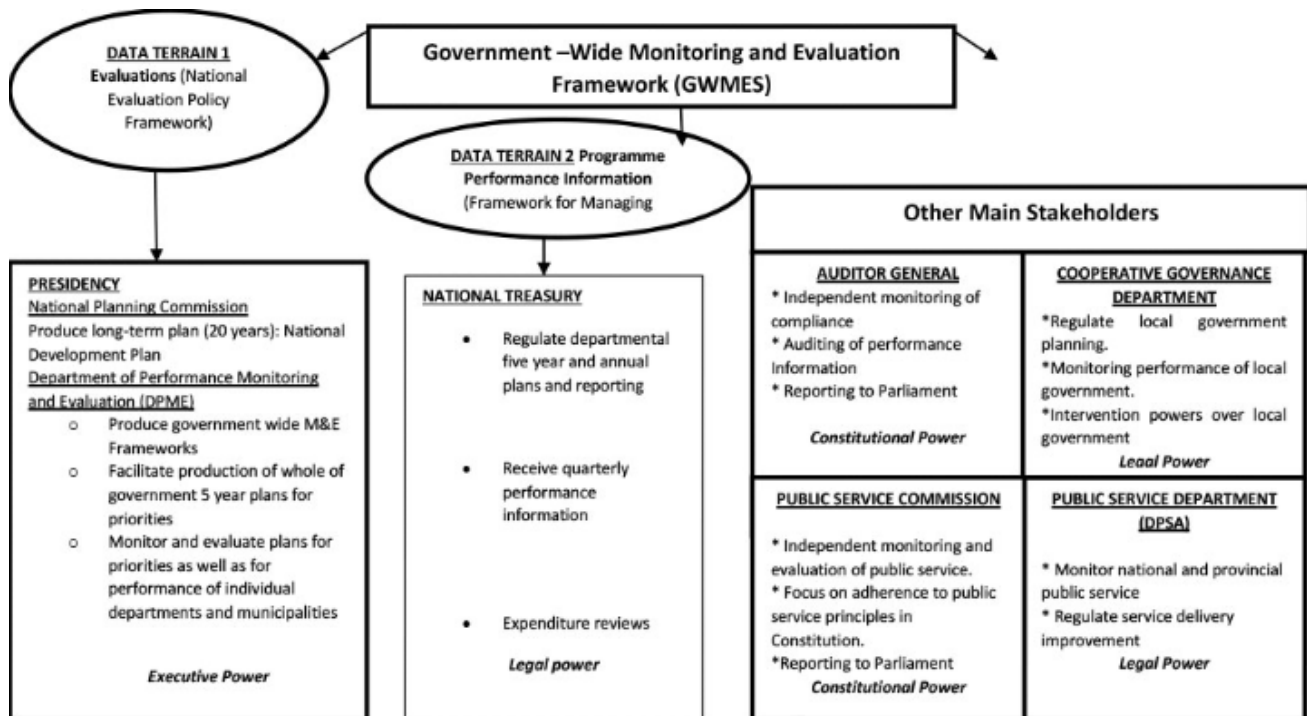
In this study, both formative (monitoring) and summative evaluations are considered as key concepts in the M&E system that should be instituted in municipalities. It is the contribution of the institutionalised M&E that the study aims to determine as well as its impact on SWM service delivery.

3.6 GOVERNMENT-WIDE MONITORING AND EVALUATION SYSTEM

The South African Government's Government-Wide Monitoring and Evaluation System (Public Service Commission 2008: 2), which is driven from the Presidency, was approved by cabinet in 2004 and commenced implementation in 2007. The Government-Wide Monitoring and Evaluation System (GWMES) has three important components to it, these are: the data stream that pertains to the policy formulation (The Presidency), the stream that deals with the actual performance (Treasury), and the third arm that deals with stakeholders where the information is generated (South Africa, The Presidency 2007: 12). These stakeholders are: Auditor General, Cooperative Governance Department responsible local government, Public Service Commission, and Department Public Service and Administration. The Government-Wide Monitoring and Evaluation System is cascaded to provincial governments, where it is further cascaded to municipalities through the IDP.

Figure 9 below, depicts the GWMES framework. The data streams that are fed to the GWMES include: Evaluations (National Planning Commission & Department of Performance Monitoring and Evaluation); Programme Information (National treasury); and other Stakeholders (Auditor General, Cooperative Governance Department, Public Service Commission and Public Service Department).

Figure 9: Government-Wide Monitoring and Evaluation Framework



Source: Public Service Commission 2008: 2

3.6.1 The Objectives and Aims of GWMES

The objectives of the Government-Wide Monitoring and Evaluation System (Public Service Commission 2008: 4; South Africa, The Presidency 2007: 5), among others, is to ‘improve the collection and collation of data; analysis; dissemination and application of information on progress and impact of programmes in order to ensure transparency and accountability and promote service delivery improvement and compliance with statutory and other requirements’; focus on results-based M&E; present an integrated M&E; present streamlined M&E procedures; provide guidance; improve management decision making and organisational learning; and create more attention to monitoring and highlight M&E as an important management tool.

3.6.2 Support Structures of an Effective GWMES

The South African GWMES is built on the principles of provision of infrastructure support, financial and human resources, and public involvement (South Africa, The Presidency 2012: 4). Over and above the stated support measures a few more dimensions are added, and these include: clearer prescriptives; flexibility on information collation and the responsible persons; using Statistics South Africa as the backbone for information collation and interpretation; and building on three indices which are voice and accountability, political stability and absence of violence, and government effectiveness (South Africa, The Presidency 2012: 4; Public Service Commission 2017a; Public Service Commission 2008b: 15).

3.6.3 Critique of the South African GWMES

The challenge or criticism of the GWMES is that the handling of monitoring and evaluation is superficial and underplays their differences. Monitoring and then evaluation are very different processes with different objectives but intertwine at information reporting and synthesis, and this step is effective if there is capacity for analysis and blending the information (Ijeomah 2010: 23). The expertise and interpretation of data seems to be a challenge in getting the M&E system to operate at a higher level. The other challenge is the treatment of efficiency, which is close to productivity, it resides in the implementation stage (inputs, activities and outputs) but in the definition of evaluation efficiency is blended in which creates an anomaly. This demonstrates how interchangeable or loosely the two distinct processes are treated and misunderstood.

Matsiliza (2012: 70) noted public participation as one area which is lacking in the current GWMES. This lack of public participation has a negative impact within municipalities because of their proximity to the community. Kusek and Rist (2004: 25) observed three methods that were used by developed and developing countries to institute their GWMES. The first method entailed a whole government or big bang approach to implementation. The second method was a selective approach to implementation of the GWMES. The third and last model was a mixed approach of the big bang and the selective model.

The big bang approach was used predominantly by developed countries because this approach needed the implementing countries to have prepared; readiness assessment,

resources, capacity, capability and continuous support. All these aspects are needed to cascade M&E down the government chain. Unfortunately, this is the approach South Africa adopted without having assessed the situation thoroughly. Currently, there are still challenges of understanding and implementing the Municipal-wide M&E system (MWMES) which is cascaded from GWMES via the Provincial-wide M&E system (PWMES).

3.7 PROVINCIAL-WIDE MONITORING AND EVALUATION SYSTEM

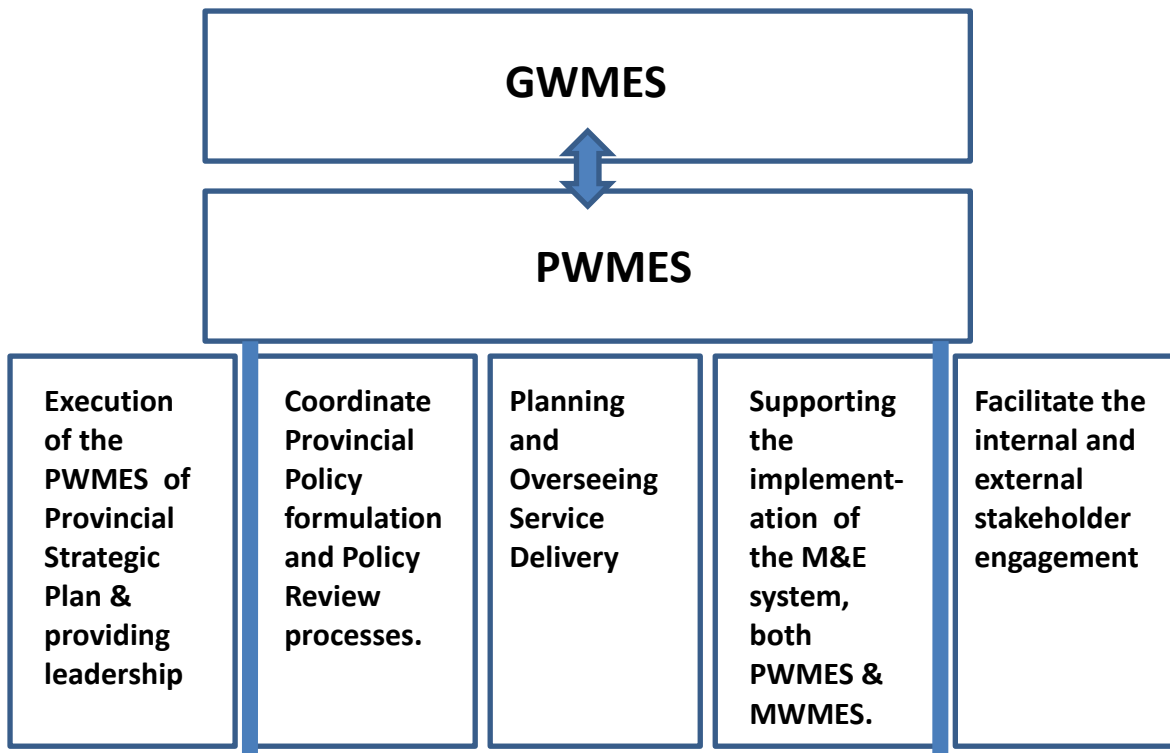
A Provincial-wide Monitoring and Evaluation System (henceforth PWMES) is a system that assists the Premier's office to monitor and evaluate provincial plans, mechanisms, elements and guidelines set nationally (Govender 2011: 106; South Africa, The Presidency – The Role of Premiers' Offices in Government-wide Monitoring and Evaluation: A good Practice Code 2008: 2). According to the South African Presidency – The Role of Premiers' Offices in Government-wide Monitoring and Evaluation (2008: 2), the Premiers of provinces are tasked with making sure that they oversee and put in place five key areas in instituting the PWMES.

The five key areas are:

- Execution of the PWMES of Provincial Strategic Plan & providing leadership;
- Coordinate Provincial Policy formulation and Policy Review processes;
- Planning and Overseeing Service Delivery;
- Supporting the implementation of the M&E system, both PWMES & MWMES; and
- Facilitate the internal and external stakeholder engagement.

These five areas are crucial in the implementation of the PWMES. The Provincial government's PWMES is depicted in Figure 10 below.

Figure 10: The Provincial Government's PWMES



Source: The Presidency – The Role of Premiers’ Offices in Government-wide Monitoring and Evaluation: A good Practice Code (2008: 2)

The execution of PWMES is linked to the GWMES and then cascaded to all areas within the provincial structures. A results-based M&E is fostered across all departments, infusing the technical expertise and incorporating the inputs of internal and external stakeholders.

Critique of the South African PWMES

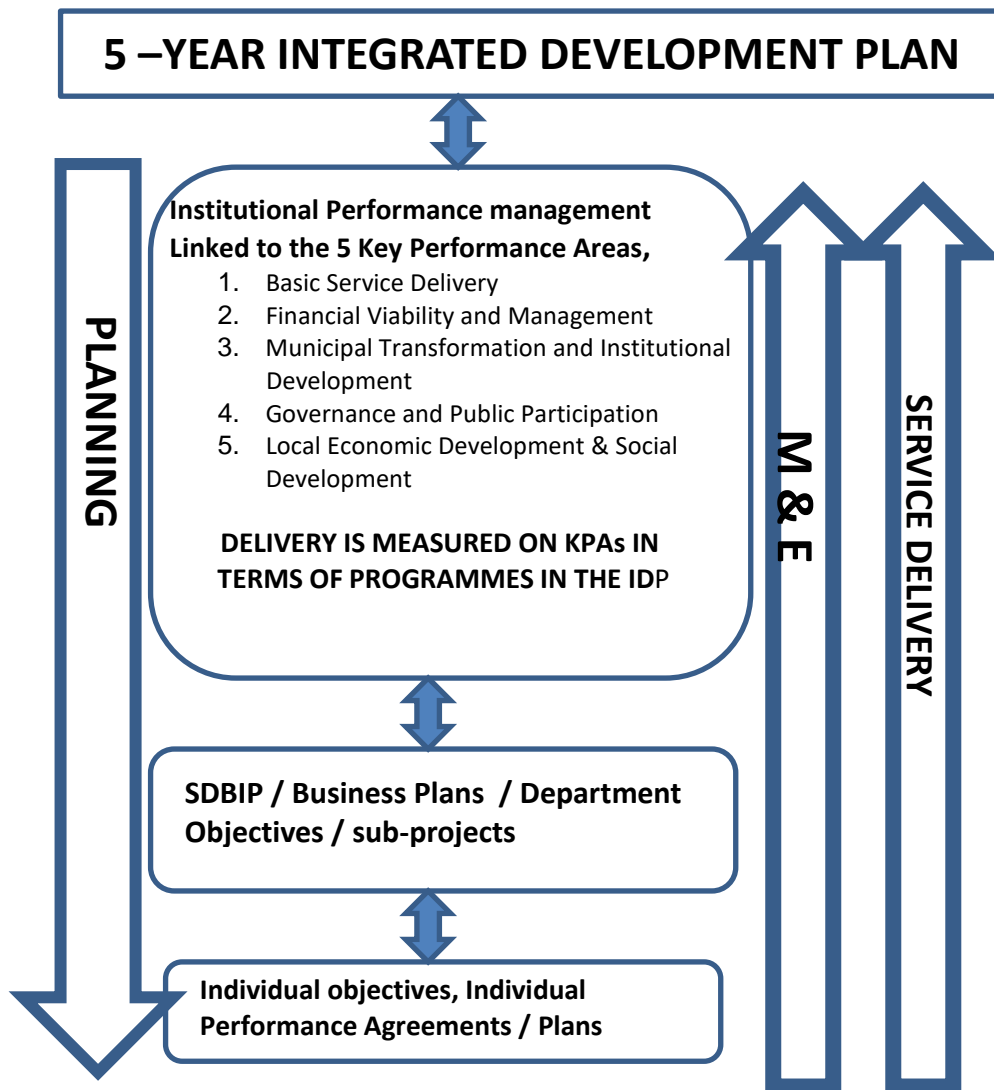
The PWMES is an important conduit between the GWMES and MWMES, any slackness in the implementation affects the smooth transition from National to the municipal terrain. Unfortunately, this has been the situation where clear guidance and support from the province has not been received by municipalities. The PWMES is driven from the Premier’s office while the reporting and accountability of the MWMES is to the Gauteng Department of Co-operative Governance and Traditional Affairs. Any disjuncture in the flow of the M&E system from the national level to municipalities has adverse effects. This disjuncture seems to be the case with the PWMES not being effective between the GWMES and the MWMES.

3.8 MUNICIPAL-WIDE MONITORING AND EVALUATION SYSTEM

Service delivery and performance management in municipalities are interwoven closely such that a weakness in one component results in a weakness in the other. The two components have one area which binds them together, namely the M&E or the logic framework. The Municipal-wide M&E is cascaded from the Provincial-wide M&E system (PWMES), which in turn is cascaded from the Government-wide M&E system (GWMES). In the generic municipal planning framework, planning moves from the higher level (strategic level) towards the lower level (functional level) of the organisation, while M&E and service delivery moves from the lower levels towards the higher level of the institution (City of Johannesburg – Monitoring and Evaluation Framework 2012: 24, 25).

Figure 11, below, depicts a typical MWMES framework which encompasses: a five-year integrated development plan (IDP); cascading planning; the five key performance areas, SDBIB and individual performance plans; M&E moving counter to planning; and service delivery moving counter to planning.

Figure 11: Municipal-Wide Monitoring and Evaluation Framework



Source: Adapted from the City of Johannesburg – Monitoring and Evaluation Framework (2012: 24, 25)

Critique of the Municipal-wide M&E system

Roduner, Schlappi, Agridea, Egli and Zurich (2008: 8) explained the logic framework (Systemic Performance Analysis Model in our study) as an integrated M&E framework. This means that the logic framework is just a representation of M&E. In our study it is clear that M&E and service delivery are intertwined and more like two sides of the same coin. The current situation in the municipal sector has not moved to the extent of interlocking service delivery and M&E. M&E is still perceived theoretically and conceptually and not woven into the day-to-day delivery of service. This is probably because the implementation from the national GWMES was not cascaded and supported with the necessary skills and resources like financial, training and capacity to make M&E seamless. If the process of cascading M&E is not handled properly, considering that there are 257 municipalities, this makes for a

complex or wicked problem situation where different municipalities use different approaches, doing different things, with different challenges, and getting different results.

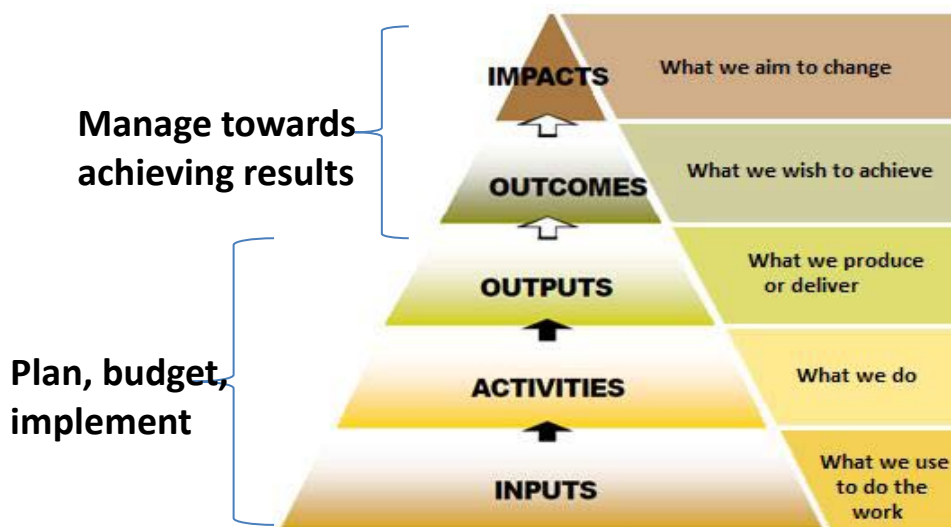
3.9 APPLICATIONS OF M&E IN GOVERNMENT

3.9.1 Results-based M&E

In the South African government’s monitoring and evaluation (M&E) regime, the dimensions that are considered in the model are: inputs, activities, outputs, outcomes and impact (South Africa, National Treasury – Framework for Managing Programme Performance Information (2007: 6). This results-based model or M&E framework is based on the logic framework which was developed by the United States Agency For International Development (UNEP 2013: 8). A detailed exposition of the logic framework is discussed in subsequent sections.

The South African results-based approach to M&E is detailed in Figure 12 below. This is the generic approach that is used across all spheres of governments and in government institutions.

Figure 12: Results-Based Approach or Key Performance Information Concepts



Source: South Africa, National Treasury – Framework for Managing Programme Performance Information (2007: 6)

The results-based framework or M&E framework, shown in Figure 11 above, is sometimes referred to as the results-based management (RBM) or results-chain framework (UNEP 2013: 8; UNDP 2009: 10). In the RBM model the input, process and output are considered to be traditional management where administration has control over implementation and the objective is the attainment of improved efficiencies. In the terrain of outcomes and impact, administration has less or no control over what would be achieved as results. This is because outcomes and impact are dependent on stakeholders such as the public or funders. Improving outcomes and impact lead towards the achievement of improved effectiveness.

It is in the terrain of outcomes and impact which is of particular interest and which has to do with higher level results in the form of objectives or goals, hence the naming of the approach or framework as results-based. It is customary to describe the RMB model as consisting of two phases; namely, implementation phase and the results phase. The two phases of RBM come about when separating the implementation stage (inputs, activities and outputs) and the results stage (outcomes and impact).

The three important dimensions that are crucial in the model are: indicators; uncertainty; and risk (Schmidt 2014; UNDP 2009: 11; Suryudi 2007: 1690). The three areas are discussed below together with characteristics that are inherent in the RBM model.

Critique of the Results-based Management or Key Performance Information Concepts

The RBM or key performance information concept (South Africa, National Treasury – Framework for Managing Programme Performance Information 2007: 6) is based on systems theory (systems thinking). Key features of systems theory are; linear thinking, predictability, orderly, uniformity and mechanical systems (Agazarian 2011; Govender 2011: 93; Sapolsky 2010; Weathers 2010; Senge 2006; Urry 2005). Systems thinking has shortcomings when it is applied in human and natural systems where external influences change the situation unexpectedly.

It is therefore expected that systems thinking will have shortcomings in government and in municipalities specifically. The municipal environment is in the human systems (social systems), complex, unpredictable and multi-faceted. The command and control nature of the logic framework, based on systems thinking, is a shortcoming in the municipal setup and has unintended consequences of stifling learning and inculcating a compliance culture (Govender

2011: 94). Govender (2011: 93, 94), citing Hummelbrunner (2010: 3), posits three failures of the logic framework in the human systems. These are:

- Logic-less – the logic framework is prescriptive and hinders implementers from using their logic and intuition;
- Lack-frame – the framework lacks an in-depth articulation of the intervention such that not all necessary information is captured in the framework; and
- Lock-frame – the framework is rigid and inflexible such that even when the dynamics within the environment changes, the implementers cannot move away from the dictated framework.

It is because of the inadequacy of the generic logic framework (systems thinking) that chaos theory is adopted for this study. This would ensure that complexity is taken as the natural order of SWM service delivery.

3.9.2 Characteristics of Results-Based M&E Model

3.9.2.1 Management System and Performance Reporting System

The results-based (RBM&E) model is a management system used to plan, organise and to manage the resources of the organisation (Schmidt 2014; Macdonald *et al* 2012: 10; UNDP 2011: 2). RBM applies to a project, a programme, and it could be about managing an institution or organisation in its entirety. The other way of looking at the RBM is from a performance management and reporting dimension. Performance management, when using the RBM, comes naturally from the deliverables and the tasks detailed in the plan. Hence, RBM can be visualised as both a management system and a performance management system.

3.9.2.1.1 Uncertainty

Uncertainty comes as a natural by-product of planning, and specifically when the planning is long term. As the range of planning moves from the short term to a longer horizon, uncertainty increases because no matter how good, precise or well informed the plan, it is difficult to predict future occurrences (Syrett and Devine 2012: 2; Zinn 2009: 1). Uncertainty, therefore, becomes one of the importance concepts which become part of the RBM model.

3.9.2.1.2 Risk and Assumptions

Risks and assumptions are more like two sides of the same coin (Harvett 2013: 60; UNDP 2011: 21). In any planning there are inherent assumptions that are made in projecting future events and results. The other side of the same equation is that by assuming that some eventuality or conditions will prevail, this introduces risk to the equation. The risks and assumptions feature as the implementation moves from one element (e.g. input to activities, and activity to output, etc.) to the next. This denotes that as the implementation progresses risks and assumptions are built-in within the system.

3.9.2.1.3 Indicators

Indicators are key in determining if there is progress in moving from input all the way to impacts (Schmidt 2014; Macdonald *et al* 2012: 6; UNDP 2011: 19; Suryudi 2007: 1690). Indicators are crucial when using the generic logic framework of the RBM model. Each of the key elements of RBM: namely; input, activities, outputs, outcomes and impact; have measurements which are the indicators woven into the model. Since the advent of the logic framework, the indicators have been the turning point of making delivery uniform and agreeable among different stakeholders evaluating a project or programme.

3.9.2.1.4 Learning, accountability and adapting

The heart of the systems framework or systems thinking is that the system evolves and advances as the implementation progresses. This is through negative feedback where lessons learned in the initial run are sent back to the systems for self-correction and adapting. Senge (2006: 79) referred to this phenomenon as the learning organisation wherein improvements are factored into the system through the negative feedback mechanism. Apart from learning, other traits that are fed into the system are adaptation, accountability,

inclusiveness, ownership and transparency. Organisational learning helps the organisation or the system to improve on the efficiency and effectiveness.

3.9.2.1.5 Cause and Effect

In the logical framework (or in the RBM), the logic of moving from one dimension to the next (e.g. input to outputs, etc) is built on the logic that if inputs are in place and activities implemented as planned, this would yield the desired outputs (Schmidt 2014; USAID – The Logic Framework 2012: 2). Similarly, inputs could be interpreted to cause the outputs.

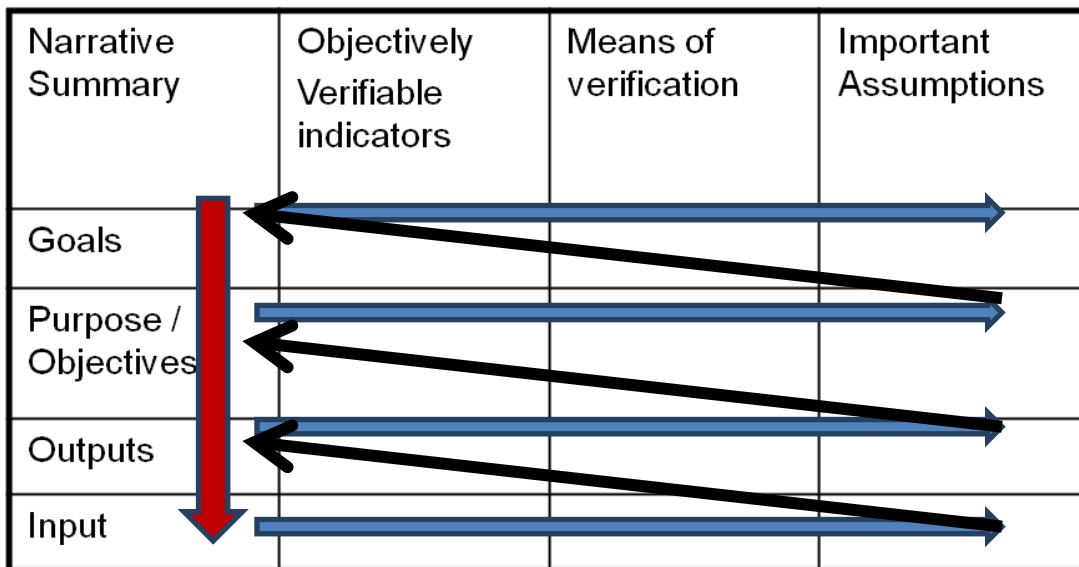
The same analogy could be used to explain the process using 'if...then'. The laudable explanation of the same process is that; if inputs are put in place then one could realistically expect the requisite outcomes from implementation. So, both the cause and effect and 'If...then' logic could be used interchangeably but relate to the same problematic. It is worth noting that the same logical flow is applicable in the RBM model such that the two tools are sometimes used interchangeably.

The cause and effect mechanism serve as a strategy control mechanism that one can use to regulate the system.

3.9.2.1.6 The Logic Framework Approach

The dimensions within the framework are listed in hierarchical order from inputs (at the lower level) to goals (at higher level) of the project or programme (Schmidt 2014; USAID 2012: 2). Figure 13 below, provides a depiction of the logic flow in the framework.

Figure 13: The Logical Flow of the Logic Framework



Source: Adapted from USAID – The Logic Framework (2012:3)

The logic framework has five rows and four columns. The listing of the rows is in hierarchical order from the inputs to the goals which are the highest order. The actual presentation of the project or programme would be initiated from the goals working down towards the input as denoted by the arrow in the diagram.

Moving horizontally, the goals or purposes of the project are measured using verifiable indicators. The inclusion of indicators to the framework was the crucial step in that all the challenges that emerged from disagreements at the end of the projects were eliminated by the inclusion of indicators which are normally agreed upon on commencement of the project. The second column, namely the verifiable indicators, is about the indicators that would be used to measure the results of the project. The third column is on where the indicators would be sought. Usually these indicators could be sought from reports, surveys, and many other verifiable means for getting the data needed to measure the project delivery. The means of verification have to be agreed upon upfront so that there are no disagreements when the project is evaluated on completion.

The final column, which is assumptions, deals with the assumptions that are factored into the entire model. When reading the model horizontally from input towards the right there are assumptions that one makes about the inputs that are needed (Schmidt 2014; USAID 2012: 2; Macdonald *et al* 2012: 10). An example that one could use to demonstrate assumptions is

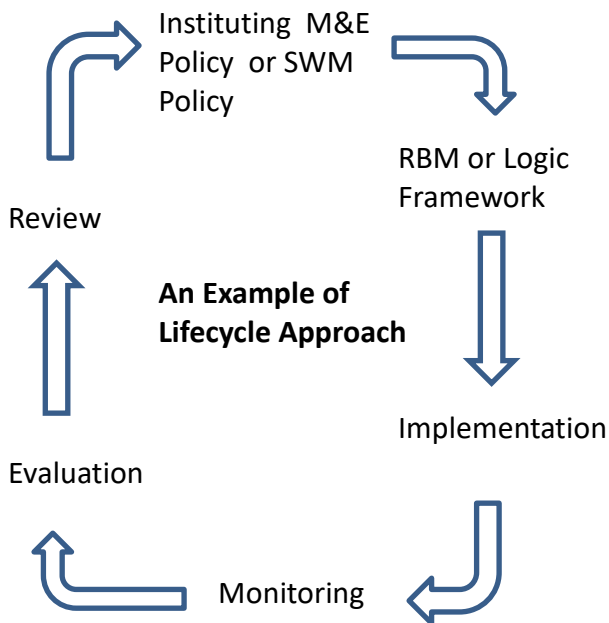
on the delivery of houses. Inputs in this project could be funding, manpower, cement, bricks, water, and many others. Assumptions inherent in this process would include; availability of funds from government; there are no strikes or industrial action on the part of labour; cement factories are able to supply cement – the right quality, timeous and at the right price; bricks are available from the brick suppliers; water is available for the process to commence.

These are but some of the assumptions that are built into the model. When the assumptions do not affect the process, or are in favour of the process moving ahead, then the process moves diagonally towards the achievement of the outputs. Similarly, when the assumptions along the output row are in favour of the process happening, then the purposes (objectives) are achievable.

3.9.3 Lifecycle Approach to M&E

The lifecycle approach is a methodology where the entire process is mapped out and monitored from inception to completion (UNEP/SETAC 2009: 1). The importance of the lifecycle approach is that it applies in instances where the entire process is analysed from inception till the end state of the process. This same approach is applicable in solid waste management where the process is analysed from generation of waste, bringing in all measures to curtail the situation, tracing the waste through production, consumption, separation, treatment, recovery of energy, and finally to disposal. This process is sometimes referred to as tracing a process from ‘the cradle to the grave’. A lifecycle depiction is shown in Figure 14 below.

Figure 14: Management Principles using Lifecycle Approach to M&E



Source: Macdonald *et al* (2012: 10) and UNEP/SETAC (2009: 1)

In the example depicted in Figure 14 above, the cycle begins with policy formulation of the M&E or SWM policy. The RBM or logic framework is designed for the programme with all the necessary frames. M&E is worked into the process for management and performance management purposes. Monitoring is done throughout the delivery of the programme. Monitoring is about checking if the indicators give a detailed account of the targets that are set during programme initiation.

Whilst evaluation is done at selected intervals in the programme, the final evaluation is done at the end of the programme. Evaluation should answer specific questions about the programme and also give an account on the performance of the programme. After evaluation, the programme is reviewed for learning that will be incorporated for the next cycle, or the programme could be folded when it is completed and reports written for posterity (Macdonald *et al* 2012: 10; UNEP/SETAC 2009: 1).

The importance of M&E in RBM or the logical framework is illustrated by several findings which show a direct proportion or dependence of the outcomes and M&E (Schmidt 2014; Macdonald *et al* 2012: 10; USAID 2012: 1). In programmes where there is increased focus on M&E, the outcomes increased proportionally. The opposite is true for programmes where there is little or less focus on M&E, wherein the corresponding outcomes become low.

Critique of the Lifecycle Approach

The lifecycle approach is based on systems thinking which is applicable in mechanism which are logical, predictable and controllable (Agazarian 2011; Govender 2011; Senge 2006). Systems thinking works perfectly in mechanistic or man-made systems like machines. Unfortunately, most instances where lifecycle is used are in complex systems where human and natural systems apply. In these systems there is unpredictability, randomness and nonlinearity (Sapolsky 2010; Urry 2005). The approach that should be applied in the lifecycle approach should be from a chaos theory perspective where complexity and feedback loops are used to deal with the situation.

3.9.4 Relevance of Lifecycle M&E in Solid Waste Management

In solid waste management, lifecycle is also used to analyse waste from generation stage, collection, transportation, sorting, conversion and landfill stage. This process is underpinned by the 3Rs (reduce, re-use and recycle) strategy which was initiated at the United Nations Conferences on Environment and Development in Rio de Janeiro (1992) and reinforced in the Johannesburg Declaration on Sustainable Development Conference in 2002 (Pillai and Shah 2014; South Africa, DEA – National Domestic Collection Standards 2011b; South Africa, DEA - National Waste Management Strategy 2011a; Polokwane Declaration 2011; Shanghai Manual – A Guide for Sustainable Urban Development in the 21st Century 2011: 12). The generic terminology used in waste management discourse, especially in developing countries, is using the phrase ‘cradle-to-the-grave’. The statement used in developing countries explains a process of managing the waste value chain till the landfill site where it is disposed (grave). Developed countries, on the other hand, refer to the process as ‘cradle-to-cradle’, which means looking at the entire waste value chain, converted and circulating the waste without taking it to disposal. In the model of SWM in the developed countries, disposal is not an option.

At the waste minimisation and at waste reduction stages (waste generation stages) the private sector is expected to play a crucial role in reducing the use of raw material and use only what is essential. This is before the generation of the actual waste material like plastics, paper, bottles and metals. If the generation is curtailed at an earlier stage, this is helpful to the entire process because less material will move into the other stages. The reducing stage

is paramount in the entire process. Reducing later assumes that material has already been manufactured which will necessitate the implementation of the subsequent stages of reduction of waste.

Critique of the Lifecycle Approach in SWM

The major criticism of the lifecycle in SWM and its concomitant thinking is that it is based on the depiction of waste as a nuisance or material to be discarded. Waste can be perceived as a resource or product that is useful in economic revitalisation (Chandak 2010: 14). The understanding of waste as a resource to be managed changes the lifecycle or 'cradle to grave' such that the interventions within the stages in the SW value chain may be for different purposes other than getting rid of waste as is understood currently.

3.9.4.1 Efficiency and Effectiveness

The implementation stage or traditional management stage (input, activities and outputs) measures the efficiency of the system. The efficiency has to do with 'doing things right'. Efficiency looks at the processes, policies, regulations, legislation and organisational systems being implemented as detailed in the institutional framework.

Effectiveness deals with the results-management part of the system (outcomes and impact). This focuses on the results or 'doing the right things'. One may be able to do things right (efficiency) which may include irrelevant and superfluous things. 'Doing things right' does not necessarily lead to the desired project outcomes but still work will be done on a daily basis. Effectiveness, on the other hand, will focus on only those things that matter in achieving the results (Okafor 2009: 41; Smirnova 2008: 84). Day-to-day monitoring (efficiency) does not lead to excellent results or outcomes (effectiveness) unless evaluation takes into account what has happened so that the information is fed back (negative feedback system) to the system for rectification or correction.

Both the efficiency and effectiveness are improved through organisational learning. In the organisational learning the negative feedback mechanism is coupled with a positive feedback mechanism such that the entire system operates optimally. Based on the information that is gathered daily (efficiency - monitoring) and the knowledge that is gathered during the periodic stages (effectiveness – evaluation) coupled with prior experience, the two processes lead to

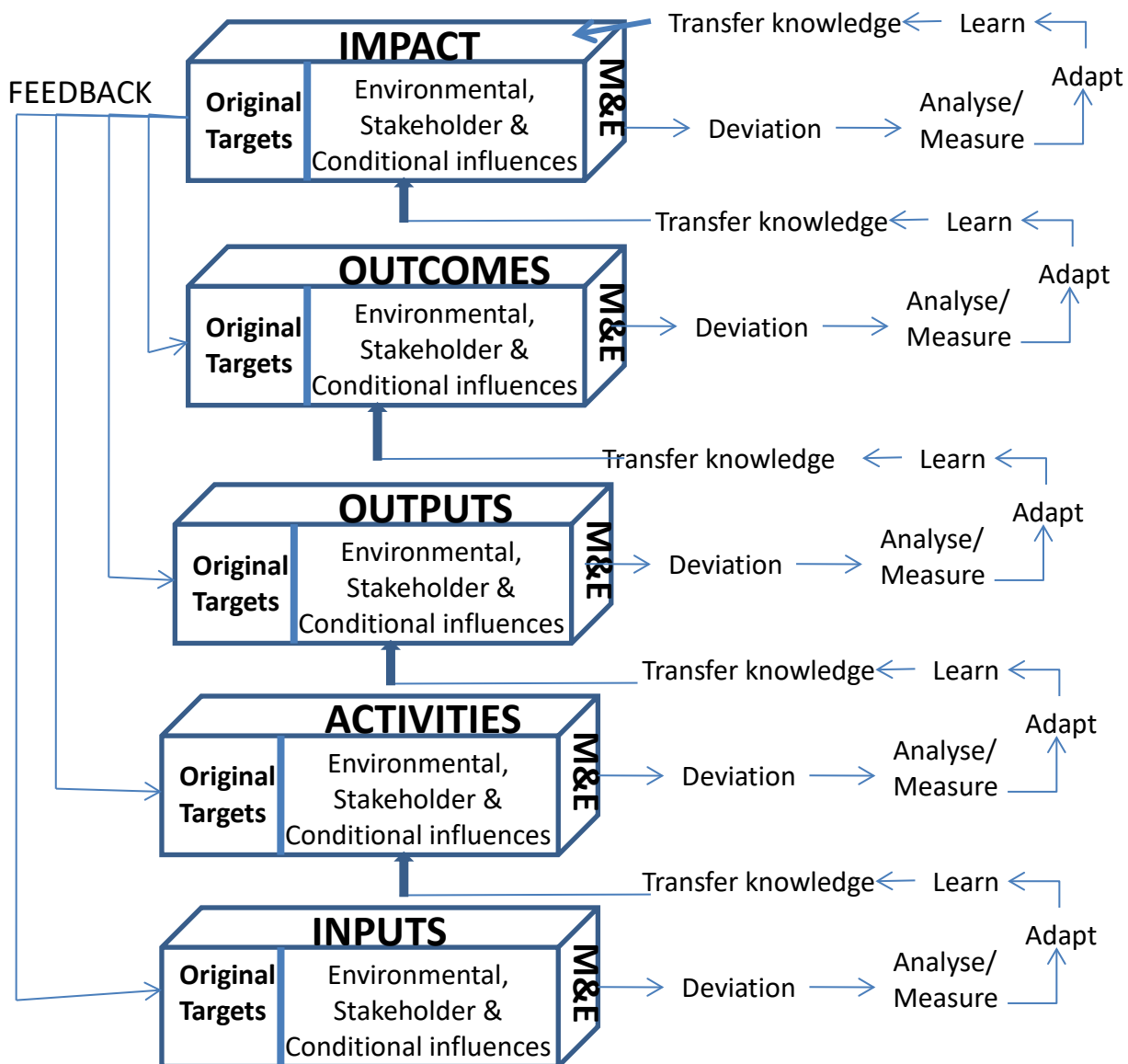
organisational learning. It is the organisational learning that assists in doing things better and accepting new methodologies of doing things.

3.10 M&E FRAMEWORK FROM SYSTEMS AND CHAOS THEORY PERSPECTIVES

This section provides a linkage between the theoretical aspects underpinning the research and practice of waste management services in municipalities. The conceptual framework is based on chaos theory, which is a derivative of general systems theory (GST). The generic general systems theory (GST) has four dimensions, namely: input, transformation (activities), output and a negative feedback loop. The logic framework or the M&E tool, on the other hand, has two dimensions added, namely outcomes and impact. The Systemic Performance Analysis Model (SPAM), which is used in this study, is a refined M&E framework (logical framework) with feedback loops.

SPAM is also adapted to encompass chaos theory by adding the positive feedback loop in the model (Haran 2011; Sapolsky 2010; Weathers 2010; Urry 2005: 5). The diagrammatic depiction of the SPAM framework is illustrated in Figure 14. The importance of the positive feedback loop is its characteristics of self-perpetuation and propelling itself to higher levels (Urry 2006: 6). A self-perpetuating mechanism is a mechanism which uses its own momentum to accelerate every time it has gone through a cycle or a revolution. As long as it is not interfered with, a self-perpetuating loop will continue to move to higher levels of operation. This self-perpetuating mechanism is a key characteristic of chaoticism in the system.

Figure 15: The Systemic Performance Analysis Model (SPAM)



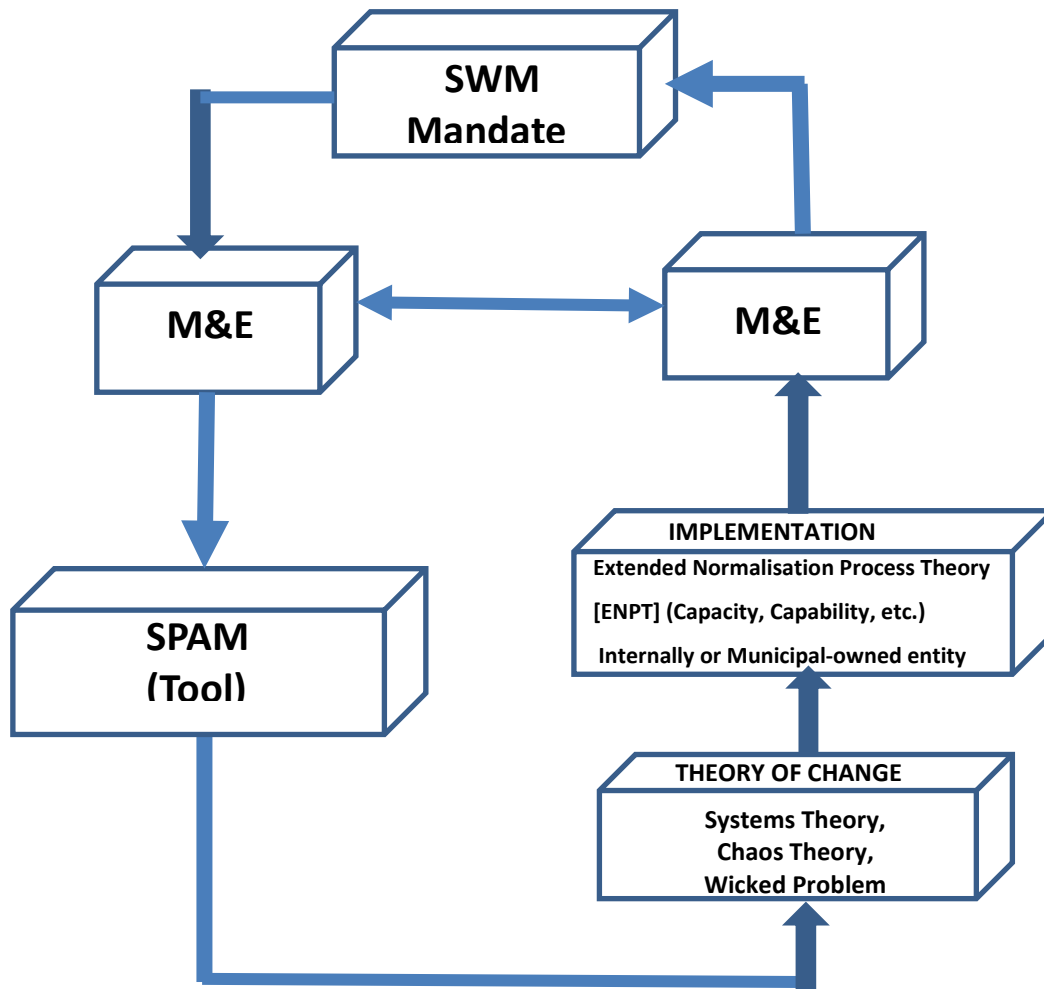
The Chaos Theory framework adapted from SPAM Model: Govender (2011: 108)

The SPAM model shows a detailed link from each component of the logic framework to the next. The link from inputs to activities commences from a deviation; which triggers an analysis; followed by an adaptation and learning; the final step being knowledge transference into the next component, namely activities. The same process is undertaken when moving from activities to outputs, to outcomes and finally to impact.

3.11 MUNICIPAL SOLID WASTE MANAGEMENT (SWM) CONCEPTUAL FRAMEWORK

The conceptual framework of the study that brings together the challenges faced by municipalities in SWM; the theory (chaos) underpinning the study; and the M&E (logic framework or SPAM); and the service delivery component (implementation) are depicted in the diagram below.

Figure 16: Conceptual Framework of the Solid Waste Management Service Delivery



SWM conceptual framework adapted from Montague (2014) and Govender (2011)

The model illustrates the theory of change (TOC) informed by a theoretical basis like systems thinking or chaos theory as conceptualised to address the SWM challenge. This process may lead to policy formulation or planning to initiate the solution. Resource allocation and logic framework (M&E – SPAM model) is designed to manage the programme or project. In the SPAM model implementation happens between the input and output sections. This implementation is informed by the TOC and the implementation theories. The actual service delivery will include a decision for the delivery model that will best serve the community. The

available options are: public private partnerships (PPP); contracting the service to external parties; municipality servicing the public with own staff and resources; or using a municipal-owned entity (South Africa, Local Government: Municipal Systems Act No 32 of 2000: s76).

3.12 CONCLUSION

The chapter commences by discussing the legislative and underpinning principles of local government in South Africa. Literature reveals that local government operates in a complex environment, and has to deliver services effectively and efficiently in this complex environment. Theories that were explored to explain the phenomenon included systems theory, complexity and chaos theory. Because of the complexity of the environment aspects of systems theory are used, but the chaos theory is used as a base to explain the complexity within the sector and with specific reference to solid waste management. A conceptual framework is built from a chaos theory perspective to explain the service delivery challenges. As part of assessing the delivery of solid waste management, monitoring and evaluation is discussed as an important system to assess the progress during and after service delivery.

CHAPTER FOUR

THE AFRICAN AND INTERNATIONAL PRACTICES IN SOLID WASTE MANAGEMENT

4.1 INTRODUCTION

This chapter looks at international conventions and agreements on waste practices, SWM processes and legislative frameworks in some African countries and some international countries. The government structuring that is inherent in servicing the community's needs, with specific reference to Solid Waste Management. Solid Waste Management related challenges are cited in each of the investigated countries ascertain if there are commonalities identifiable. The literature review, finally, assesses if there are emerging common or best practices in SWM handling with a specific focus on M&E of SWM policies, structuring and models (practices) in service delivery.

Sub-Saharan African countries are used in the study; other developing countries; and finally assessing developed countries.

4.2 THE AFRICAN PRACTICES IN SOLID WASTE MANAGEMENT, M&E AND SERVICE DELIVERY

Waste management in Africa, Sub-Saharan Africa specifically, is typical to other developing countries where open dumping is still the dominant form of handling waste followed by sanitary landfill, then other forms like open burning, recycling and any other method of disposing of waste (Simelani and Mohee 2012: 2; Diaz 2011: 2; Chandak 2010). Simelani and Mohee (2012: 2) mention several factors that contribute to the current state of affairs, among others: shortage of data on waste matters; political factors; environmental issues; impeding historical issues; institutional factors (capacity and skills); technological factors; and financial factors.

The major challenge that the bigger African cities; like Johannesburg, Nairobi, Cairo and Abuja, are facing is continued migration (Simelani and Mohee 2012: 2). Urbanisation, migration and economic growth have unintended consequences such as increasing the

waste generation in a locality. Inefficient ways of dealing with waste in many African cities and towns have had the result of being 'seen as unhealthy areas' (Simelani and Mohee 2012: 3). Seeing that the bigger cities in Africa have the same three challenges mentioned above, it is clear that waste management will be a major issue unless other means of dealing with waste are devised

United Nations Habitat (2014: 1) cited that 'about 62 per cent of the urban population in Sub-Saharan Africa live in slums'. Slums or informal settlements are usually overcrowded and with little access by proper roads. This makes it difficult for municipalities to gain access and render services, especially solid waste services. It would come as no surprise if the issue of access to informal settlements is highlighted as one of the contributory factors hindering service delivery in the current study.

Chandak (2010: 13) states that waste management costs in developing countries have been increasing over time such that up to 50 per cent of municipal budgets are taken up by waste management activities, and the bulk of this amount (almost 80 – 90 per cent) is taken up by waste collection activities. The SWM value chain or lifecycle entails many facets (3Rs and others) all of which need funding to work efficiently. If the bulk on the funding available is usurped by one activity this would render the whole system inefficient in the long run.

Looking at the challenges faced by municipalities in Africa, and in Sub-Saharan Africa, the studies done on SWM show that urbanisation and migration will continue to accelerate as more people gravitate towards the cities and urban areas (Simelani and Mohee 2012 3). This continued influx will continue to stretch the resources and capacity on SWM service deliver.

4.2.1 Ghana

The Ghanaian local government structure is composed of metropolitan, municipalities and districts. The cities are further demarcated into waste management districts which are serviced by all the three local government structures. The services rendered to the households are categorised in terms of the income levels, namely; high; middle and low-income groupings. Puopiel (2010: 29) asserts that the primary focus of SWM in Ghana is on collection and disposal. This is despite the fact that the country has accepted the international

prescripts of adopting Integrated Waste Management Planning (IWMP) and the hierarchy (3Rs) of waste management.

4.2.1.1 Waste Management Regulations and Policies

A legislative framework which encompasses public health, solid waste management, sanitation management and environmental, governs the waste management in the country. The legislative framework guides the local government spheres to have waste management departments which will deliver services in conjunction with sanitation departments.

4.2.1.2 Service Delivery model

Service delivery to households is provided in three modes of delivery. These are: franchised (contract); non-governmental organisations (NGOs); and municipality. The franchised model is offered to high income groups who pay the service providers for the service rendered. This service is provided weekly either door-to-door or at kerbside. The NGOs and the municipality provide services to the middle income and the low-income groupings. The middle-income groupings pay for the services but the low-income do not pay because their service is rendered at communal areas or skip bins.

4.2.1.3 Challenges and Practices

According to Puopiel (2010: 28), citing Boadi and Kuitnene (2004), solid waste management in Ghana has several challenges which include: inadequate funding; inadequate equipment to support delivery; poor planning; low coverage of service delivery sites; irregular collection; open dumps; open burning of waste; and water pollution.

Clearly M&E, which is central in service delivery monitoring and evaluation, does not feature prominently in the SWM regime. This assertion is confirmed by Govender (2011: 157) where M&E is cited as a challenge in the entire Ghanaian government sphere. Resultantly, SWM service delivery in Ghanaian institutions would not be in a position to assess the progress and enhance service delivery if data and information is not brought to decision makers.

The involvement of NGOs in SWM as a best practice would benefit municipalities in Gauteng greatly considering that they are within reach of the communities, in addition, NGOs are not driven by financial motives. The involvement of NGO and community-based organisations (CBOs) would contribute significantly in SWM service delivery in Gauteng municipalities.

4.2.2 Rwanda

The Rwandan social structure composes of resettlements, small towns, cities and rural areas. The Rwanda Environment Management Authority (2010: 7) asserts that improvements in SWM occurred in 2005 after the introduction of by-laws which prohibited dumping in non-designated areas. The solid waste management sector is dominated by women who are necessarily involved from a cultural perspective of being the overseers of cleanliness within their households. This cultural tradition has extended to women's involvement in the SWM sector.

4.2.2.1 Waste Management Regulations and Policies

The two important conventions that the Rwandan government has adopted are: the 3Rs (reduce, re-use and recycle) and the polluter-pays-principle (Rwanda Environment Management Authority 2010: 10). The 3Rs or waste hierarchy model is highlighted as the national strategy even though very little inroads are visible in the direction of implementation. The polluter-pays-principle is implemented to discourage polluters from dumping waste in areas which are not designated for dumping.

Municipalities are expected to prepare a 10-year solid waste management plan (SWMP) that will guide the delivery over a longer range. These plans cover aspects in the social, environmental and legal spheres.

4.2.2.2 Service Delivery Model

Municipalities, community-based organisations (CBOs) and a few private sector companies offer SWM services to the populace (The New Times 2013; Rwanda Environment Management Authority 2010: 11). The generic value proposition in SWM is the collection from households and a direct transportation to the landfill site. The key values which are seen as levers in SWM service delivery are: accessibility, affordability, relevance, acceptance and effective service delivery. These are the guiding principles in delivering service to the community. The M&E of continuously being factored into the services rendered by the role players in SWM.

Partnering with CBOs and the private sector is seen as crucial in the success of SWM service delivery to the community. Most of the successes that have happened in Rwanda are attributed to cooperation and participation of the stakeholders in SWM service delivery.

4.2.2.3 Challenges and Practices in SWM

Most of the challenges are associated with problems experienced in the landfill site (Kigali: State of Environment and Outlook Report 2013. 2013; The New Times 2013). The problems include: sporadic fires in the landfill site; leachate which is not monitored; landfill site gases that are not harvested or controlled. The leachate diffuses into the underground water system which results in contamination and potential health hazards. Landfill site gases like methane, carbon monoxide and sulphur dioxide are not only disastrous to the environment but are also flammable.

The polluter-pays-principle is debated and advocated in the South African SWM sector but not much progress has been made towards the implementing of such measures. Gauteng municipalities would benefit greatly if these measures are implemented because stakeholders, especially commercial and industrial, would respond speedily when their practices affect their bottom line. The involvement of women in SWM should also be considered, as the majority of the population in South Africa is female.

4.2.3 Lesotho

According to the Kingdom of Lesotho, Maseru City Policy and Regulation (2008), sanitary and refuse removal in Lesotho was initiated in the early 1970s and the service was offered by government and its entities. It was only in the 1990s that the private sector and other role players became part of solid waste management service delivery (Kingdom of Lesotho, Maseru City - Policy and Regulations 2008).

4.2.3.1 Waste Management Regulations and Policies

Lesotho is signatory to most of the known conventions and international prescripts like:

- Basel Convention on Transboundary Movement of Hazardous waste and Their Disposal. Lesotho ratified this convention on the 29 August 2002.
- Stockholm Convention on Persistent Pollutants (POPs), ratified on 23 January 2001.
- Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Waste within Africa, ratified on 1 June 1999.

National legislation, regulations and policies are also enacted to aid in solid waste management service delivery in municipalities.

4.2.3.2 Service Delivery Model

According to Sello (2015), the Lesotho solid waste management regime is made up of 7Rs. These are: reduce, re-use, recycle, rethink, research, refuse and recover. Apart from the grand 7Rs delivery strategy the actual solid waste service delivery is focussed on collection of waste, sorting of waste and a small component on exporting (Policy and Regulation - Maseru 2008). M&E of municipal waste is done regularly and data is collected and sent to the Bureau of Statistics (Kingdom of Lesotho, Bureau of Statistics 2014: 3). The reported data presents all categories of waste collected in the Lesotho.

4.2.3.3 Challenges and Practices in SWM

The Kingdom of Lesotho, Maseru City - Policy and Regulation (2008) cites the challenges to solid waste delivery, among others, to include:

- lack of capacity in municipalities to manage waste;
- lack of public education and public awareness;
- underdeveloped waste management systems; and
- lack of public private partnerships (PPP) in delivering service, the fore-runner in exporting waste especially in waste-to-energy conversion (WtE).

The South African government and the municipalities could learn from the 7R model, as opposed to the popularly used 3Rs framework. The inclusion of dimensions like 'rethink, research and refuse', could help focus attention to those dimensions as well. Recovery of material in many forms, especially through WtE, could be an effective and profitable proposition to focus on.

M&E of the municipal solid waste collected and disposed to landfill sites is done on a regular basis. The amount of waste that is exported is also documented so that the revenue generated from such activity is notable in the broad scheme of SWM. Gauteng, as the hub of economic activity in South Africa, would possibly be the fore-runner in waste exports to other countries which are dominant solid waste buyers.

4.3 THE INTERNATIONAL PRACTICES IN SOLID WASTE MANAGEMENT, M&E AND SERVICE DELIVERY

Solid waste management legislations, policies, and practices internationally vary from country to country and from region to region. In the study the countries and region whose SWM regime is analysed are: India, Philippines and the European Union.

4.3.1 India

The Indian waste management regime is characterised by the practice of not separating nor grading collected waste; dumping is predominantly at the periphery of the towns; and separation only happens at the landfill sites. These practices are typical of the developing country's practices of handling waste generally (Saxena, Srivastava and Samaddar. 2010: 74; Sharholly, Ahmad, Vaishya and Gupta 2007: 490).

Saxena, Srivastava and Samaddar (2010: 74), and Sharholly, Ahmad, Vaishya and Gupta (2007: 490) state that the inefficiency in solid waste management has affected the communities in several ways. These include: blockages of the sewage system as a direct result from plastics thrown around; mishaps that included blast resulting from some scrap metals that were not handled appropriately; decreased number of migration birds as a result of the contaminated environment; animals dying as a result of plastic ingestion; air pollution as a result of improper methods of incineration solid waste; and some chronic diseases to human beings as a result of direct handling of dangerous waste.

4.3.1.1 Service Delivery model

Service delivery to households and to other stakeholders is provided by municipalities and focussed towards taking the waste to the landfill site (Sharholly, Ahmad, Vaishya and Gupta 2007: 492). The generic focus areas in SWM service delivery are landfilling, incineration, compacting of waste, pyrolysis and 3Rs. Landfilling is prioritised because it assists in job creation; a cheaper means of handling waste; handling all types of waste without separation; and methane gas harvesting in the landfill site. The disadvantages of focussing on the landfill site are: ugly aesthetics surrounding the landfill site; dangerous gases that could lead to explosions if not handled properly; leachate and seepage to underground water sources; and the loss of valuable land when used as a landfill site.

4.3.1.2 Challenges and Practices

According to Sharholly, Ahmad, Vaishya and Gupta (2007: 492) solid waste management in India is still focussed on landfilling because it is the cheaper option of available handling methods. Waste-to-energy (WtE) technologies are more expensive than the landfilling option. Clearly, this makes landfilling the cheapest when comparing with other methods of handling solid waste. Open dumps and open burning of waste still exists in many areas in India.

Govender (2011: 168), in the assessment of the Indian M&E system, cited a report card method of soliciting inputs from the public on service delivery matters which were implemented in India under the supervision of the World Bank. This best practice has not surfaced prominently in SWM delivery in India. This practice could be one of the innovative measures to improve solid waste service delivery in Gauteng municipalities by involving the public in the monitoring and evaluation (M&E) of SWM.

4.3.2 Philippines

The Philippines waste management regime was fast-tracked by the enactment of the ecological Solid Waste Management Act in 2000. This Act provides for the creation of the Solid Waste Management Board for the entire country. The Board's function, among others is: to prepare a 10-year solid waste management plan (SWMP); monitor the implementation of SWM in conjunction with the private sector and NGOs; facilitate revenue enhancement in the SWM sector; and standardise the operations of SWM (collection, transference of waste, storage, processing, recycling and disposal).

4.3.2.1 Service Delivery Model

Torres (n.d.) cites six best practices in the SWM sector which have revolutionised solid waste management in the Philippines. These are: introduction of city level waste recovery facilities; composting material; introducing creative ways of dealing with general waste; segregation at source; looking at creative ways of waste collection from source; and re-looking at the designs of the landfill sites.

At the heart of the SWM regime is M&E which has played a pivotal role in collecting data, collating, processing and analysing data for decision making processes (Torres n.d.).

4.3.2.2 Challenges and Practices

According to Torres (n.d.) the notable challenges are the technical and engineering skills shortage, the regulatory enforcement processes that are ineffective, SWMP which is not fully implemented, and the lack of the political will.

Some of the best practices cited in the Philippines, could be used nationally in South Africa and in Gauteng municipalities to improve SWM service delivery. The measure that could be best used in Gauteng is the separation of waste at household level. Most municipalities in Gauteng are aware of the best practice but have not initiated the process of engaging communities and supplying the relevant support for households. The creation of the National Board on SWM and development of a 10-year SWMP for the entire country would assist the SWM sector greatly. Legislation has been enacted to have a National Bureau on waste management but the process is still at an early stage. The National Bureau should then facilitate revenue enhancement for the provision of SWM and the development of uniform standards across all municipalities in South Africa.

Innovate ways of accessing areas where ordinary vehicles would not be able to gain access is a best practice that could be used by Gauteng municipalities. The use of pedicycles, tricycles and other versatile smaller waste collecting vehicles in inaccessible areas would be useful in Gauteng municipalities. Segregation of waste at household level would also be an enhancer of waste collection and also reduce the waste that ends up in the landfill sites.

4.3.3 European Union

Over the past 30 years the European Union (EU) has been using Environmental Action Plans and legislation as tools to guide member states in the handling of SWM in the region (Hall and Nguyen 2012: 18; European Commission 2010: 4). The primary focus areas were: reduce negative environmental and health impacts; create energy and resource-efficient economies; decouple waste generation from economic growth; shifting the thinking of seeing waste as a nuisance to that of seeing waste as a resource; and encouraging member states to becoming a recycling society.

The EU has also adopted a 5-step hierarchy, which is: prevent; prepare for re-use; recycle; recovery of material or energy; and disposal. Targets were set for the waste streams linking

that to time frames. One of the targets set by the EU for member states is the reduction of municipal waste to 50 per cent by the year 2020. EU member states then factor the target onto their respective country's targets.

4.3.3.1 Service Delivery model

A life-cycle approach was adopted as a service delivery model such that the waste stream is followed from extraction all the way to disposal (European Commission 2010: 6). The life-cycle approach emphasises focus on: extraction of raw material before conversion; production of products from raw materials; manufacturing processes and its waste; distribution of the products; the usage of the products; and the disposal of irrecoverable material. Woven into the life-cycle approach is: energy harvesting, and the circulation of waste and its use as an input resource in production processes.

4.3.3.2 Challenges and Practices

According to the European Commission's report (2010: 2) on solid waste management the challenges that are cited are: the persistent increase in the waste produced; products are still not eco-friendly; member states are still not adhering to regulations and legislation; and household separation is still a challenge.

4.3.4 Emerging Trends and Lessons for SWM, M&E and SW Service Delivery

The South African national government and Gauteng municipalities in particular, would benefit greatly in changing the thinking towards a practical way of introducing the life-cycle approach. Currently, there is discussion on the 'cradle-to-the-grave' concept which is similar to the life-cycle approach. The other best practice that could be adopted is the harvesting of energy from the waste stream. The bulk of the waste could be diverted away from the landfill site towards energy generation and alleviate the challenge experienced in the landfill sites.

The South African SWM regime, and the Gauteng municipalities included, are guided by the Department of Environmental Affairs and Tourism (DEAT). It would assist a great deal if targets on SWM were set by DEAT so that all municipalities worked towards a set target. This

would assist in getting municipalities to focus all resources towards the attainment of the national target. Setting and legislating the target in a form of regulation or policy could focus delivery towards that end. The 2001 Polokwane declaration, which was adopted by all stakeholders in the SW sector, showed that a principle agreement and working on goodwill from the sector partners is not good enough.

A review of the four (4) targets that were set and agreed by the entire SW sector in 2001 (16 years ago) shows that only one target was met. This target had to do with municipalities developing Integrated Waste Management Plans (IWMP). This target was achieved because it was the municipalities who were custodians to this delivery and legislation was enacted to ensure its implementation.

Three targets which were agreed upon in the Polokwane Declaration were not met. These targets were: reducing waste by 50 per cent in 2012; waste disposal to be reduced by 25 per cent in 2012; and the SWM sector to move towards achieving zero waste by 2022. The delivery on the three targets depended on other stakeholders other than government (municipalities) and there was no legislation pushing for delivery. M&E was also not put in place to review progress over set periods of time. Resultantly, even after more than a decade, there has been no discernible progress towards the achievement of the targets. Clearly, compliance measures in a form of legislation should be put in place to force stakeholders to implement future SWM measures as determined by the sector.

4.4 CONCLUSION

The chapter discussed waste management processes, practices and applicable legislative frameworks in African and international countries and regions. Solid waste management practices and processes in developing countries lags behind those in developed regions like in the European Union. The European Union has advanced quite rapidly in terms of technology and practices, while South Africa, like all other developing countries, is lagging behind by several decades (Godfrey 2015). The different models used in the South African context need to be fine-tuned so that they keep pace with broad waste management practices, whilst also incorporating practices of the SDGs.

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 INTRODUCTION

The purpose of this chapter is to give a detailed overview of the research methodology that was used in the study. The chapter commences by giving the philosophical account of the current paradigms, namely, positivism, interpretativism and pragmatism within the appropriate social constructs. The chapter then deals with the research design; the research strategy adopted; and ends with discussion relating to target population, sample, data collection and analysis.

5.2 THE RESEARCH PARADIGMS

Paradigms are based on social interpretation (constructivism), cultural and historical points of view (Creswell 2013: 28; Bryman 2012: 630; Neuman 2011: 94; Mackenzie and Knipe 2006: 2). According to Mackenzie and Knipe (2006: 2) paradigms are important in that they influence the researcher in the way the social problems are studied and the way they are ultimately projected and reflected by the researcher. The different paradigms are dealt with in the sections below.

The commonly known paradigms are positivism, interpretativism and the pragmatism (Creswell 2013: 28; Bryman 2012: 630; Neuman 2011: 94). Positivism is associated with pure sciences and uses numbers (quantitative) as a base for measurement or for explaining phenomena. Interpretativism or the constructivism paradigm is based on interpretation of a phenomena and in this paradigm words or texts (qualitative) are used as a medium of explaining phenomena. The Pragmatism paradigm uses both positivism and interpretativism such that a situation is approached from both the qualitative and quantitative research methods.

This study is approached from a pragmatism paradigm with the mixed methods approach (qualitative and quantitative) used in describing, explaining and exploring the phenomena.

Table 4 below, summarises the salient aspects of the positivism and interpretativism paradigms that informed the study.

Table 4: The Philosophical Components of the Study

Paradigm	Positivism	Interpretativism	Pragmatism
Ontology (The reality)	Objective reality	Perception and Experiences	Objective and also perception, but measurable
Epistemology (Our way or system of testing the reality)	Objective – one reality	Subjective – many realities (they are constructed)	Intersubjectivity (perceptions overlap)
Method	Mono method – Quantitative	Mono method - Qualitative	Mixed methods
Connecting Theory and Data	Deductive (from theory to data)	Inductive (from data to theory)	Abduction (can go either way: theory to data and vice versa)
Inference from the Findings	Generalisable	Content specific or situation specific.	Transferable (either way: quantitative or qualitative precedes the other)

Source: Bowman (2016)

5.3 RESEARCH DESIGN

Mouton (2015: 107) defines research design as predetermined procedures that have to be followed in addressing the research problem. Babbie (2016: 113) further defines the research design as the blue print for the research process such that all subsequent steps and processes of the research should follow. The processes and steps, as noted by Babbie (2016: 114), include research conceptualisation, choice of research method, population and sampling, data processing, analysis and interpretation. Zikmund, Babin, Carr and Griffin

(2013: 64) define research design as the master plan that specifies the methods and procedures for collecting and analysing the needed information.

There are many research designs that have been used to describe, explain and explore social problems. This study was undertaken using a case study design based on four Gauteng province municipalities. Denzin and Lincoln (2013: 169) define the case study emphasising the analysis of a case in relation to the environment, where the selection of the case entails setting boundaries such that a particular case is distinguishable from any other. Neuman (2011: 42) posits that a case study approach could be composed of a single case or multiple cases. The latter part of this definition was used as a basis for this study in that four individual cases were used in the research. Bryman (2012: 66), citing Stake (1995), in the definition focuses on the complexity inherent in the case with respect to the environmental factors surrounding the case under investigation. Lastly, Babbie (2016: 302) explains a case study approach as an approach where the focus is set on a specific aspect on a specific phenomenon.

Bowman (2016), Creswell (2013: 23) and Zandamela (2014) state that there are three commonly used research designs, these are; quantitative, qualitative and mixed methods. The three research designs are discussed in the subsequent sections as they are all applicable in a mixed methods design which is the design chosen for the study.

In the study four municipalities in the Gauteng province were used, namely; City of Johannesburg, Ekurhuleni Metropolitan Municipality, Emfuleni Local Municipality and Mogale City Local Municipality. The four cases were seen to be representative of the broad spectrum of the solid waste management picture of Gauteng municipalities. The research was approached from an explanatory and descriptive premise such that a SWM delivery model could be proposed as a recommendation from the study.

5.3.1 Qualitative Research Design

Merriam (2009: 13) defines qualitative research as an overarching term that explains research that are interpretative in nature. Mouton (2015: 81), Creswell (2013: 165) and Locke, Silverman and Spirduso (2010: 184) define qualitative design as a research for exploration

purposes, which gives a deeper understanding of the underlying reasons, opinions, trends and motivations. It provides insights into the problem and facilitates in developing ideas and hypothesis. Qualitative research attempts to study a situation in their natural setting and with little or no interference from the researcher (Denzil and Lincoln 2013: 6). Govender (2010: 173), citing Blanche, Kelly and Durrheim (2009: 275), states that the power of qualitative research is that respondents use their experiences to explain their settings and environment.

The common characteristics of qualitative research, as cited by Denzin and Lincoln (2013: 3), are the following:

- Data collection methods are unstructured and semi-structured;
- Common methods or techniques include focus groups, individual interviews and participants observations;
- It is not a desktop research and therefore the researcher must engage the participants;
- Sample size is small and depends on the situation used; and
- It is about the point of view of the researcher and the respondents.

The advantage of the qualitative design is the originality of the setting and the expression of the lived experiences of the respondents participating in the study. The disadvantages of this research design are that the researcher is part of the setting, therefore brings into the study biases which may be cultural, ethnic, racial and class (Denzin and Lincoln 2013: 21). Govender (2010: 174) asserts that the profound disadvantage of qualitative research is in its inability to ascertain the truthfulness of a studied phenomenon. The basis for such an assertion is that the findings cannot be expanded and extrapolated for the whole population because it is situation specific. In this study, respondents were interviewed so that they give their opinions, experiences and suggestions about solid waste management practices within their municipality.

5.3.2 Quantitative Design

Niglas (2010: 219), and Merriam (2009: 18) to some extent, define quantitative design as a framework with a focus towards numbers or mathematics in explaining a phenomenon, behaviour or a process. At the centre of the design is the relationship between the independent variable and the dependant (outcome) variable. Bryman (2012: 715), further explains quantitative research design as one which is deductive or objective, helps in formulating the facts and in explaining in greater detail the patterns that are observed. Descriptive research focuses on the association between variables, whilst the experimental focussing on causality. Neuman (2011: 178) describes quantitative research design as a design where the focus is placed on classifying features and modelling the observed to explain the phenomenon.

The common characteristics of quantitative design, as cited by Bowman (2016), are the following:

- Data is gathered in a structured format in a form of numbers and statistics. It is then arranged in tables, figures or any other numerical forms.
- Results are usually based on a larger population which makes it easier to generalise about the population.
- The research findings can be replicated when all conditions to the initial research are observed and the reliability is usually very high.
- The commonly used research tools are the questionnaire and some software programmes designed to gather data. The questionnaires come in the form of online surveys, kiosk surveys, paper surveys, mobile surveys, face-to-face surveys, telephonic interviews, website interceptors and online polls.

The advantage of using quantitative research approaches is the strength of being able to handle large amounts of data, allowing for generalisation of the population. Govender (2011: 173), citing Aluka (2005: 203), states that validity and reliability in quantitative approaches is of a high standard because results are determined objectively.

The disadvantages are that while the quantitative design is able to give a broad picture, it is not able to drill-down and give specific aspects about behaviour and other dimensions identified from a general sense (Zandamela 2014; Govender 2010: 173).

In this study the quantitative approach is used by sending a link to the questionnaire to 18 managers and senior managers in the SWM departments in their respective institutions. Twelve (12) respondents participated in the study by sending their completed questionnaires. The response rate amounted to 67 per cent.

5.3.3 Mixed Methods Design

Teddlie and Tashakkori (2009: 7) defines the mixed methods approach as a design that blends both quantitative and qualitative methods in approaching research questions, data collection, data analysis, and inferences to the data gathered. A key characteristic of mixed methods design, specifically the quantitative component, is the use of visual representation in the form of figures, diagrams, and many other representations. Onwuegbuzie and Combs (2010: 398) define mixed methods design as the use of one or more quantitative data analysis techniques and one or more qualitative data analysis techniques. Denzin and Lincoln (2013: 50), citing Creswell (2007) and Teddlie & Tashakkori (2003), define mixed methods as a procedure where the quantitative and qualitative methods are used in more areas within the research or study continuum. The distinct areas of the study are the research question, data collection, data analysis and the data interpretation stage.

The current study is handled with a mixed methods research approach to overcome the disadvantages that are associated with each of the qualitative and quantitative methods. The use of only the qualitative or the quantitative method would not fully explain the phenomena under investigation.

5.3.3.1 Advantages of the Mixed Methods Research Design

Bowman (2016), citing McMillan and Schumacher (2006: 401), states that in the mixed methods design the researcher is able to explain, give more meaning to the numbers, triangulate data and sources of data, build some complementarity of data, develop concepts, initiate ideas and expand on themes. The researcher is able to handle a wide range of variables, constructs, different research questions and hypotheses in one study (Bryman 2012: 649).

5.3.3.2 Disadvantages of the Mixed Methods Research Design

Creswell (2010: 63), citing Giddings (2006), explains the challenge associated with the need of resources, time and expertise to handle both methods equally and with dexterity. Interpretation of the results could present problems when the two methods are integrated. More time is needed to analyse and synthesise the data. Bowman (2016), citing McMillan and Schumacher (2006: 401), summarise that most studies that are said to be mixed have in fact superficial mixing to an extent that they could simply be seen as either qualitative or quantitative. Ordinarily, a clear mixing especially from research question, data collection and on analysis has to be substantial. In this study the mixing occurs at data analysis and interpretation stages.

Collins (2010: 373) cites four challenges that are associated with mixed methods design. These are challenges associated with: representivity of data selected; generalisation (breadth) and depthness [legitimation]; integration of the two streams (qualitative and quantitative); and the bias or emphasis placed on either of the two streams.

The Gauteng Province has three (3) metropolitan municipalities, two (2) district municipalities and seven (7) local municipalities. To overcome the representivity of data in the study, two metropolitan municipalities (City of Johannesburg and Ekurhuleni) and two local municipalities (Mogale City and Emfuleni) were used in the study. The local municipalities were selected from each one of the two district municipalities so that there is representation across the districts. The City of Johannesburg (Metropolitan) differs from the Ekurhuleni Metropolitan in that the SWM is done by a municipal-owned entity, whereas Ekurhuleni's SWM is done internally. The second part to representivity is in the selection of the sample from the population. The sample used in the qualitative section of the study was selected from the same sample used in the quantitative section. This choice of sample enhanced the representivity from a view point of triangulation and complementarity.

The quantitative method of the study (breadth) is used to enhance the richness in the study, while the four case studies give sufficient depth (legitimation) in the study. The two methods (qualitative and quantitative) were integrated at analysis and interpretation stages. These

stages of integration gave an advantage of being able to triangulate and complement the data streams from both methods.

5.3.3.3 The Research Sequence

The sequence for using the different methods; namely: qualitative research followed by quantitative research or quantitative research followed by qualitative research, depends on the objective of the study. The sequence followed in a study is also used by determining the purpose of the research whether it is intended for explanation, description, confirmatory or exploration (Bowman, 2016; Bryman 2012: 632; Nastisi, Hitchcock and Brown 2010: 320; Collins 2010: 363; Tashakkori and Teddlie 2010: 815; Teddlie and Tashakkori 2009: 120). A detailed exposition of the different objectives is done in subsequent sections.

5.3.3.3.1 Sequential Exploratory Strategy

This is a strategy where the qualitative research method precedes the quantitative research method. In the exploratory research the objective is to find the underlying concepts and constructs in order to formulate a hypothesis or a theory which will then be tested empirically (Mouton 2015: 103; Onwuegbuzie and Combs 2010: 414; Teddlie and Tashakkori 2009: 162). This exploration makes it possible to generalise the findings to the entire population (Mouton 2015: 103; Neuman 2011).

Confirmatory studies or replicatory studies, on the other hand, is when the researcher is well informed about the nature of the research, the expected findings of the research and the theories underpinning the research (Onwuegbuzie and Combs 2010: 414). Confirmatory studies can also be generalised to the entire population because the quantitative research is done at the last phase.

5.3.3.3.2 Sequential Explanatory Strategy

Explanatory sequential research is when the researcher commences with quantitative data, which is analysed and the emerging factors, clusters and outliers are further analysed qualitatively to give more meaning to the observed data (Bowman 2015; Neuman 2011: 39; Onwuegbuzie and Combs 2010: 414; Teddlie and Tashakkori 2009: 162). A variation to the explanatory studies is on descriptive studies. Mouton (2015: 102) states that the differences between the explanatory and descriptive studies lies in the knowledge of the researcher pertaining to the subject matter but both follow the same sequence where the quantitative method is done before the qualitative method.

This study used the sequential explanatory strategy. A structured online questionnaire (quantitative) was sent to respondents in the four Gauteng municipalities in the report. The constructs and factors that emerged from the initial quantitative analysis were followed up in an in-depth semi-structured interview (qualitative). The same respondents in the quantitative (questionnaire) analysis were invited in the semi-structured interview (qualitative).

5.3.3.3 Concurrent Triangulation Strategy

Mouton (2015: 156) acknowledges Denzin (1978) as the originator of the term triangulation and explains the concept as the technique of using quantitative and qualitative methods during the data collection stages of the same research. In instances where the qualitative and quantitative methods are done concurrently, this is referred to as concurrent triangulation strategy (Bowman 2015; Bryman 2012: 632; Teddlie and Tashakkori 2009: 162).

The advantages of using the concurrent triangulation strategy is the mutual reinforcement and uplifting of the weaknesses of either of the methods such that a richer picture emerges out of the results (Teddlie and Tashakkori 2009: 162). Mouton (2015: 157), citing Schuman and Presser (1981), noted that respondents are sometimes reluctant to divulge information, triangulation assists in building a clearer picture when information is lacking from one of the used methods.

5.3.3.4 The Weight or Priority Apportionment

The weight or priority apportioned to the method in a mixed methods design depends on the objective, purpose, and on the discretion of the researcher (Bryman 2012: 632; Onwuegbuzie

and Combs 2010: 415; Teddlie and Tashakkori 2009: 162). In a qualitatively focused mixed methods research, the researcher would prioritise the qualitative method in the design (Bryman 2012: 632; Onwuegbuzie and Combs 2010: 415; Teddlie and Tashakkori 2009: 162). This is regardless of whether the qualitative method preceded or came after the quantitative method. The same is true for a quantitatively focused mixed methods design in which case the quantitative method is given priority.

In this research the qualitative and the quantitative approaches and tools are given equal weight and priority. It is logical in this study to give equal weighting to the methods because the research questions solicit findings which have aspects of explanatory, descriptive and exploratory nature.

5.4 POPULATION, SAMPLING STRATEGY AND SAMPLE SIZE

5.4.1 Target Population

The population in the study is made up of senior and middle managers in solid waste management departments of the four Gauteng municipalities. The number of respondents (senior and middle managers) in the four municipalities within the solid waste management departments is 20. The small number in the population size in the municipalities is due to understaffing and the generally low number of administrators in the SWM departments.

The population in this study is 20, which is made up of the following: City of Johannesburg has eight (8) administrators, Ekurhuleni Metropolitan six (6) administrators, Mogale City three (3) administrators and Emfuleni three (3) administrators.

5.4.2 Sampling Strategy

An online questionnaire was sent to the twenty (20) respondents targeted in the study. The respondents who took part in the survey were further invited for a semi-structured interview

to solicit depth in the factors and constructs that emerged from the survey responses. Three respondents who were not part of the initial survey took part in the interviews.

5.4.3 Sample Size

The population size was small as a result the entire population was targeted in both the quantitative (survey) and the qualitative (semi-structured interview) components of the study. Of the twenty (20) potential respondents, 11 responded in the survey which was the initial part of the study. Fourteen (14) respondents participated in the follow up section of the study which included the eleven (11) that took part in the survey and additional three participants who were available for the semi-structured interview.

5.5 DATA COLLECTION METHOD

Letters were sent to National Department of Cooperative Governance and Traditional Affairs (COGTA) and to the Gauteng branch of the South African Local Government Association (SALGA) to introduce the study and the researcher. The two letters of endorsement were sent to the Municipal Managers or the nominees in the four municipalities that were selected in the study. A senior official coordinated some of the interviewees and in some instances relayed contact details of officials in the SWM departments. An online survey (quantitative) and a semi-structured interview schedule (qualitative) were the means used to capture the behaviours, experiences and attitudes of respondents identified in the study (Buglear 2011: 604; Neuman 2011: 49).

The survey responses were received electronically while the interviews were voice recorded and some notes taken during interviews. To increase participation in the study, the researcher had to constantly telephone and remind the participants of the set interview dates and scheduled times.

5.5.1 Quantitative Data Collection

Contact was made with the potential participants either through a referral from the Municipal Manager or a referral from an interviewed participant. In the telephonic contact, the researcher would introduce himself, the study and the purpose of the study. The discussion culminated in the researcher sending the participants an online link to the questionnaire. After sending the online link the challenge was getting the participants to access and complete the questionnaire. The researcher had to constantly remind the participants to access and complete the questionnaire.

5.5.2 Qualitative Data Collection

In the qualitative part of the study, the researcher used a structured interview questionnaire for the face-to-face interview. During the session, the contents of the interview schedule were explained to the participants, their permission sought for participating and for recording the proceedings. The ethical considerations were also explained to the participants. The interview sessions were recorded and also captured in writing. The interviews took almost an hour per session. At the end of the session the respondent was asked to sign the interview schedule as proof of agreeing to the proceedings. The interview data collected was coded and then interpreted.

5.6 DATA ANALYSIS

The qualitative and the quantitative data sets were triangulated to explain factors emerging from the quantitative component of the study and the themes emerging from the qualitative component of the study.

5.6.1 Qualitative Data Analysis

The qualitative data was captured, coded and arranged into themes. The common themes were further refined into areas that enlighten the components of the study namely: factors that influence SWM delivery; processes that are involved in SWM delivery; and the effectiveness of M&E in SWM delivery. The data was then triangulated and complemented with the quantitative data.

5.6.2 Quantitative Data Analysis

The data from the online Survey Monkey was transferred into an excel spread sheet for preservation purposes in case access to the online database was restricted. The data was then imported to the Statistical Package for the Social Sciences (SPSS) for analysis. Quantitative data analysis was done to elicit relationships and associations between different variables and constructs in the data set.

5.6.2.1 Descriptive statistics

The descriptive statistics was used to give the trends, summaries as well as describe the data set. The demographic profile of the respondents was elicited which included: institution; age; years working in the institution; gender; age; and educational qualification of respondent. The data in the descriptive statistics is presented in graphs and mean values for determining the central tendency of the aspect analysed.

5.6.2.2 Inferential Statistics

The inferential statistics were analysed using the SPSS package for Social Sciences to test and interpret the information presented in the descriptive statistics such that more meaning is inferred from the data. Cronbach's alpha was used to determine the reliability of the scale that measured the different constructs.

5.7 VALIDITY

Zikmund, Babin, Carr and Griffin (2013: 303) define validity 'as a measure or an extent to which a score truthfully represents a concept'. Lipsey and Hurley (2009: 44) define validity in a cause and effect logic. They assert that validity is being sure that the effects which are experienced happen as a direct result of the causes identified. Bryman (2012: 47) explains validity as a measure that pertains to the integrity of the findings of the study. Bryman (2012: 47) goes further and attaches the importance of validity to the instrument that is used to give

a result. Neuman (2011: 212) attaches the word 'true measure' as defining the validity of a measure or a study. Govender (2010: 175), citing Silverman (2008: 210), defines validity as synonymous with the truth. Bryman (2012: 47), Neuman (2011: 212), and Govender (2011: 175) to some extent, place the importance on the assessment instrument which should be exact and not bring error into the measurement.

For the purposes of this study, validity pertains to the causal relationship (cause and effect relationship) and the concept of the 'true measure' of the phenomenon. In this study, both qualitative and quantitative methods were used to complement each other and to minimise potential errors that could be woven into data collection. Using both methods enhanced the validity of the results.

5.8 RELIABILITY

Bryman (2012: 46) defines reliability in terms of the reproducibility of the result for issues pertaining to social sciences. Miles, Huberman and Saldana (2014: 312) in their definition of reliability add terms like 'dependability and auditability'. In their definition they also envisage reproducibility but also factoring the time component to the reproducible result. Merriam (2009: 220) defines reliability as 'the extent to which research findings can be replicated'. Bryman (2012: 169) further explains reliability as an amount of confidence that can be attached to the result such that the result can be generalisable regardless of the instrument (questionnaire, interviews, etc) that is used. Neuman (2011: 208) emphasises the consistency and dependability of the result when defining the reliability of the result when engaging in research.

For the purposes of our study reliability pertains to reproducibility, auditability and dependability of the results. In this research Cronbach's alpha was used to determine the reliability of the instrument used. The reliability of the instrument used was limited to the quantitative data set gathered using the online questionnaire.

5.9 DELIMITATIONS

This study focussed only on four Gauteng municipalities. The first focal area was on solid waste management service (SWMS) delivery issues emanating from the provision of this service offering. The second focal area was on the monitoring and evaluation of SWMS throughout the service delivery value chain. Only administrators who are within the solid waste department or division were part of the study and not the technical staff.

5.10 LIMITATIONS

The study was limited by the costs, time, and the availability of respondents. The availability of respondents proved to be a challenge considering that solid waste management services in most municipalities have very few middle and senior members of staff. So, engaging a manager sometimes presents a challenge in the thinly staffed department. The cost concerns were limited to the disbursements and expenses associated with the travel and other logistical matters that are associated with the study. The time element was purely linked to the availability and time afforded by respondents to participate in the study.

5.11 ETHICAL CONSIDERATIONS

This section refers to the ethical consideration that the researcher should take in protecting the respondents and in reporting honestly the findings of the research (Miles, Huberman and Saldana 2014: 58; Creswell 2013: 58, Bryman 2012: 138; Neuman 2011: 145). The researcher in all instances, when conducting personal interviews, used the following as a guide (Miles, Huberman and Saldana 2014: 58; Creswell 2013: 58; Bryman 2012: 138; Silverman 2011: 418; Merriam 2009: 233; Teddlie and Tashakkori 2009: 201):

- Explain to the respondent the purpose of the research;
- Sought consent from the respondent;
- Explained how the study will be used;
- Explain to the respondent how the respondent's views will be held confidentially;
and
- The respondent's identification not published in the study.

The researcher acknowledged information and data used from various sources such that due regard is given to the authors who have gone before the researcher. There was no personal or conflict of interest that was worth mentioning in the study.

5.12 CONCLUSION

The chapter focussed on the research philosophies, research design and research strategies. The study used a mixed-methods design and the mixing happened with the research questions, at data collection, and at data interpretation stages. The descriptive and inferential statistical tools were used to interpret the data. Using mixed methods was helpful as it enabled triangulation and complementarity in cases where there was ambiguity. The study complied with all the prescripts of academic conduct, namely; confidentiality for respondents, reliability of the data collection method and ethical standards.

CHAPTER SIX

DATA ANALYSIS AND DISCUSSION

6.1 INTRODUCTION

The purpose of the chapter is to analyse the quantitative and qualitative data and discuss the findings based on the data. Twenty (20) respondents were invited to participate in the study. The study was limited to senior managers and middle managers in the solid waste management (SWM) departments in their institutions. In Phase 1 of the study (quantitative part), twelve (12) participants responded by undertaking an online questionnaire. The responses to the online questionnaire were analysed using SPSS software programme.

Phase 2 (qualitative part) of the study involved the invitation of the participants for a semi-structured interview. The twelve respondents in Phase 1 of the study (quantitative) took part in the second part of the study, but four (4) other respondents who were not part of Phase 1 online questionnaire took part in Phase 2, the semi-structured interview sessions. The semi-structured interviews were conducted by the researcher in sessions that lasted about an hour for each respondent.

6.2 QUANTITATIVE DATA ANALYSIS

Questions one to six (1 to 6) of the questionnaire dealt with demographic information of the respondents. The subsequent questions of the questionnaire dealt with specific issues on solid waste management (SWM), service delivery and M&E. A Likert ranking scale was used and the ranking was as follows: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree. The numbering in the ranking does not denote the weight that the respondent apportions to an issue, but it denotes a perception which is then represented or noted by a designated number. Equally, one could use alphabets to denote or capture perceptions, the advantage of numbers is that one can manipulate them better and get averages or movement of perceptions.

6.2.1 Reliability

The reliability of the data was measured using Cronbach's Alpha from each of the cluster of questions that were administered to the respondents. The questions within a cluster were arranged to measure the same theme or issue of interest. A value above 0.70 is normally accepted as a minimum benchmark that denotes a reasonable level of reliability of the measurement or measuring scale used. Cronbach's Alpha is dependent on three dimensions, namely; number of items used in the scale, correlation or direction of measure by items, and the phrasing of items or measurement (Field 2009: 675). Therefore, increasing the items in a scale normally results in an increase in the Cronbach's alpha value. Equally, if only correlated (unidirectional) items are used, this would result in an increased Cronbach's Alpha value (Field 2009: 675).

Table 5: Cronbach's Alpha

Question Number	Wording of Question	Cronbach's Alpha
7	Factors affecting SWM	0.710
8	Issues helping in SWM delivery	0.458
9	Implementing WM (International Discourse)	0.850
10	Implementing WM (RSA Discourse)	0.806
11	Implementing WM (Municipalities)	-0.277
12	Pre-requisites of an M&E system	0.317 (0.475)
13	Drivers of the M&E system.	0.121 (0.508)
14	Implementation of an M&E system	0.821
15	Monitoring of SWM Activities	0.850
16	Evaluation of SWM Activities	0.937

Six questions in Table 5, namely: 7, 9, 10, 14, 15 and 16, had Cronbach Alpha values above 0.70; while four questions (8, 11, 12 and 13) had Cronbach Alpha values below the 0.70

threshold. The four questions, below the threshold, are: issues assisting service delivery; implementation of SWS; pre-requisites for M&E; and drivers of M&E.

Using the three conditions stated by Field (2009: 675) for attaining negative Cronbach's Alpha results, all three conditions may be contributory aspects to some extent. The sample in the study is small and could not be increased because of the nature of the study. The phrasing of constructs may have been reverse coded as well (Field 2009: 676). This is an instance where the 1 (strongly disagree) and 5 (strongly agree) are coded in reverse compared to responses from participants. This is a likely scenario for the construct 'Implementing WM' which had a Cronbach's value of -0.277.

In Section 6.5.2 of this study it emerged that the low Cronbach's alpha value may be attributable to the disparity that the respondents have between 'communication and leadership' and the legislative framework (South Africa, DEA National Waste Management Strategy 2011a). This disparity resulted in the internal inconsistency of the Cronbach's alpha such that a low value is attained. A detailed explanation of this anomaly is discussed in Section 6.5.2.

The condition pertaining to correlated values was tested in questions 12 (Pre-requisites of an M&E system) and 13 (Drivers of the M&E system) that had low Cronbach's Alpha values. This was to ascertain if the elimination of low correlating items would improve the Cronbach Alpha value. On eliminating the low correlating values, the Cronbach's Alpha values improved from 0.317 to 0.475 (question 12 / pre-requisites) and from 0.121 to 0.508 (question 13 / Drivers of M&E). In both instances the improved Cronbach's Alpha values were still below the 0.70 threshold.

6.3 DEMOGRAPHIC INFORMATION OF THE RESPONDENTS

6.3.1 Demographic information of Institutions in the Study

The demographic profile of the institutions that took part in the study is shown in Table 6 below.

Table 6: Institutions that took part in the Study (N=12)

Municipality / Entity	Frequency	Percent
City of Johannesburg	5	41,7
Pikitup	1	8,3
Ekurhuleni	2	16,7
Mogale	1	8,3
WRDM	2	16,7
Emfuleni	1	8,3
Total	12	100,0

The City of Johannesburg had more than 40 per cent (40.0%) representation in the sample. Most of the other municipalities had about two respondents (16.7%) representation in the sample. Except for the metropolitan municipalities, the local municipality had also the district municipality included in the study because strategy and policy on SWM implemented by the local municipality emanates from the district.

Metropolitan municipalities have generally a bigger pool of staff, relative to local municipalities, even though staffing within SWM generally is low. This explains the higher number of representation from the City of Johannesburg.

6.3.2 Information on the Position of Respondents

Table 7, below, presents the frequencies and the percentages for the positions that the respondents hold in their institutions.

Table 7: Positions of Respondents

Position of Respondents	Frequency	Per cent
Technical / Supervisor	1	8,3
Junior Manager	3	25,0
Middle Manager	5	41,7
Senior Manager	2	16,6

Position of Respondents	Frequency	Per cent
Executive Manager	1	8,3
Total	12	100,0

Middle management (41.7%) had the highest representation in the sample followed by senior management which had 16.6 per cent (16.6%) representation. Executive management and technical/supervisory levels, which are the extremes in positions, had the lowest representation (8.3%) in the sample.

The results typically represent the distribution of management within the SWM area. Typically, there is a very small number at executive level usually one individual. This is followed by a reasonable number of employees and middle management and a slightly bigger number at lower levels.

It is worth noting that executive level and senior management could be interpreted as one level depending on the understanding of the individual or the titles in an institution. That also applies to technical/supervisory and junior management.

6.3.3 Respondent's Years in the Current Position

The analysis in this section was about the number of years that the respondents have been to the position that they are holding. This was to determine the experience and knowledge on SWM issues by the respondent.

Table 8: Number of Years in Current Position

Duration in the Current Position	Frequency	Per cent
1 - 3 years	4	33,3
6 years and less than 10	6	50,0
11 years and above	2	16,7
Total	12	100,0

A total of 66.7 per cent (66.7%) respondents have 6 years and more experience in SWM, which shows the depth and knowledge in the sector. This shows the knowledge and reliability of the inputs that the respondents give to the study because they could tap onto their experience within the SWM area.

6.3.4 Educational Qualifications of Respondents

This section deals with the educational qualifications of the respondents. SWM resides in a service orientated and technical field. While it is generally known that employees in the local government sphere lack the requisite skills, the study analysed the qualifications of the participants in the study.

Table 9: Educational Qualifications of Respondents

Educational Qualifications	Frequency	Per cent
Degree	4	33,3
Post Graduate Degree	8	66,7
Total	12	100,0

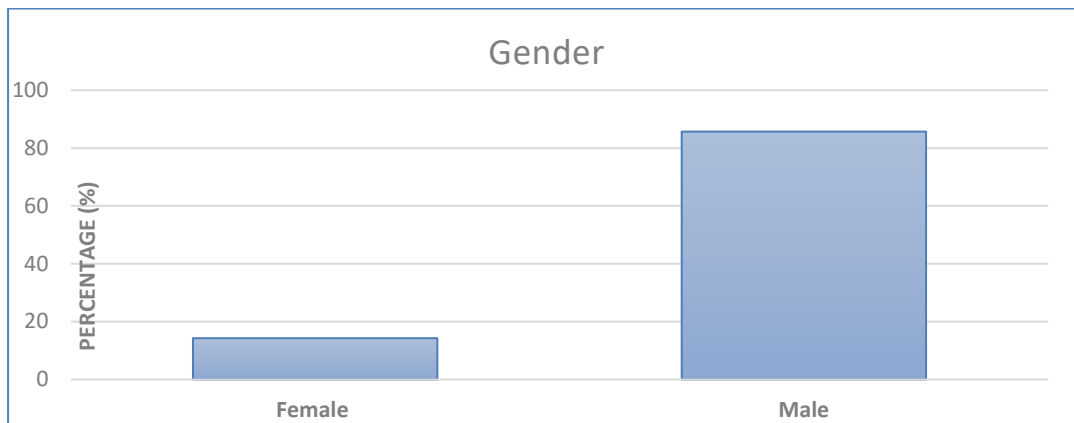
Table 9 presents the frequencies and the percentages of the respondents in the study. About two thirds (66.7%) of the respondents had post-graduate degrees and the balance of respondents having junior degrees.

The quality of respondents who took part in the study is high. The minimum qualifications are a degree, and with senior degrees (66.7%). Combining these qualifications with the experience in the previous section shows the quality of the inputs and results in this study. However, the interviews with management revealed that lower level staff do not have the required expertise and qualifications in waste management.

6.3.5 Gender of Respondents

Figure 17 below presents the gender representation in the study. Gender representivity is one of the major priorities of the South African government and in municipalities as a local sphere of government.

Figure 17: Gender of Respondents



The majority of respondents were males (85.7%) as compared to females who had about 14.3 per cent (14.3%) participation. The trend is similar to the results found in the qualitative section of the study. Generally, the sector is male-dominated and this shows across all strata on management within the SWM divisions in the municipalities. Government’s equity policy advocates for equality in gender across different strata in a organisation.

6.3.6 Age of Respondents

Table 10 below presents the age categories of the respondents who took part in the study.

Table 10: Age of Respondents

Age of Respondents	Frequency	Per cent
26 – 35	1	8,3
36 – 45	8	66,7
46 – 55	3	25,0
Total	12	100,0

About two thirds (66.7%) of the sample participants were between the ages of 36 and 45 years. The age group that followed with 25.0 per cent (25%) was that between 46 and 55 years. The lowest with 8.3 per cent was that between 26 and 35 years of age.

A majority of the respondents in the study are: between 36 and 45 years; with post graduate (senior degrees); and more than 6 years in the SWM areas. This showed that there is a wealth of experience and expertise in the SWM areas of the municipalities. This showed that new ways of doing things could be easily understood and assimilated within SWM departments considering the levels of qualifications and experience within the SWM sector.

6.4 SOLID WASTE MANAGEMENT SERVICES

6.4.1 Factors that Hinder the Delivery of Solid Waste Services (SWS)

Figure 18 below shows the analysis of the factors that contribute negatively towards the delivery of SWS in the municipalities.

Figure 18: Factors that Hinder SWS Delivery

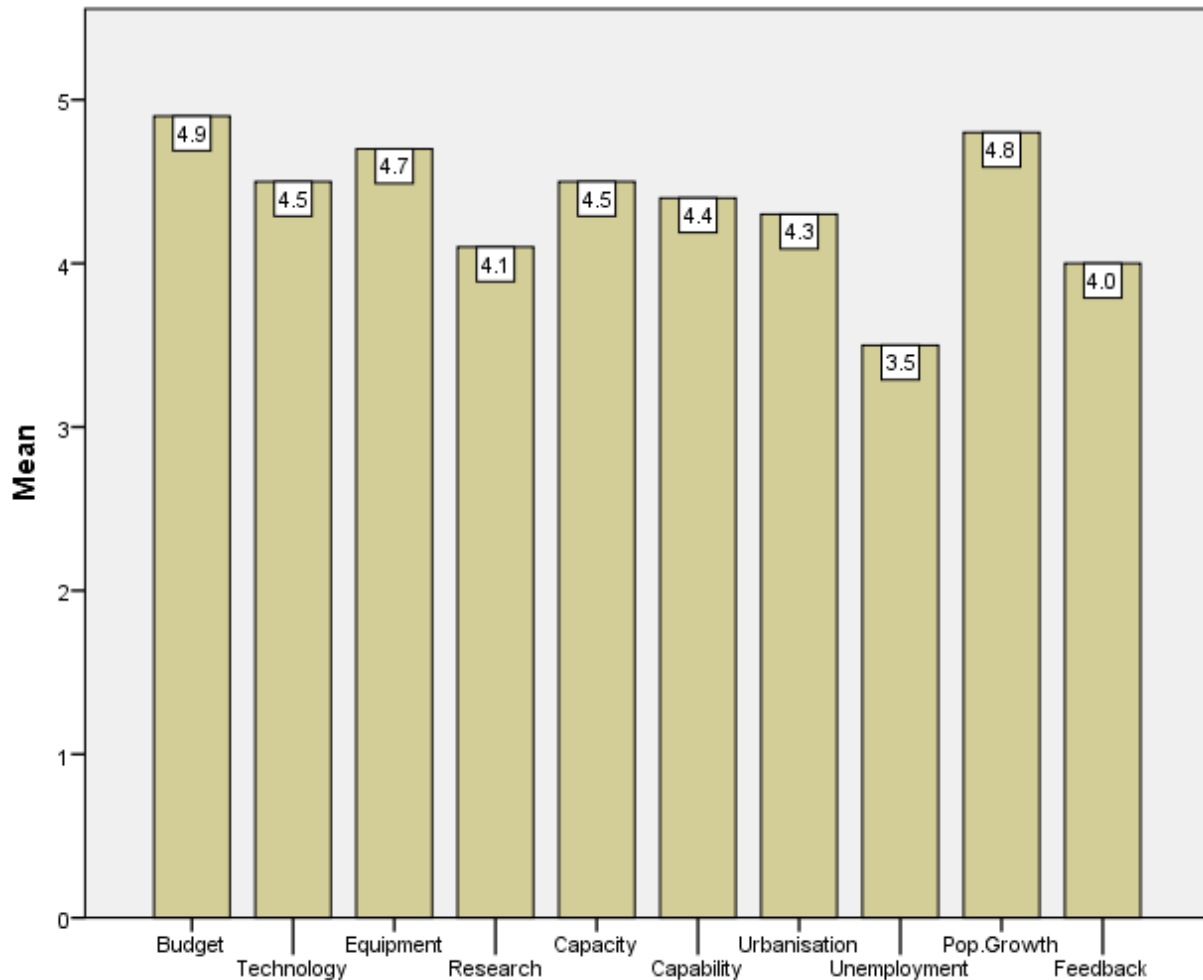


Figure 18 represents the mean values of the ranking (1=strongly disagree to 5=strongly agree) of factors that hinder the delivery of solid waste services to the community. Even though most of the factors scored highly in terms of their contribution towards stalling service delivery, three of them namely; budget, equipment and population growth (4.9, 4.7 and 4.8 respectively) stood above all as major contributors to hindering service delivery. The factor that seems to contribute the least in hindering service delivery is unemployment (3.5).

The same three factors, namely: budget, equipment and population growth featured highly as major concerns from the qualitative analysis. The budget and equipment were more on resource constraints hindering delivery and the unpredictable population numbers stretching the limited resources which are based on old and outdated statistics. Capacity of the SWM departments featured highly as a hinderance even though it was not among the top three factors in the qualitative part of the study. The balance of the high scoring factors like: technology; research; urbanisation; capability and negative feedback, all featured albeit with

different emphasis in the qualitative findings. The findings from the qualitative part of the study complements and triangulates the quantitative findings.

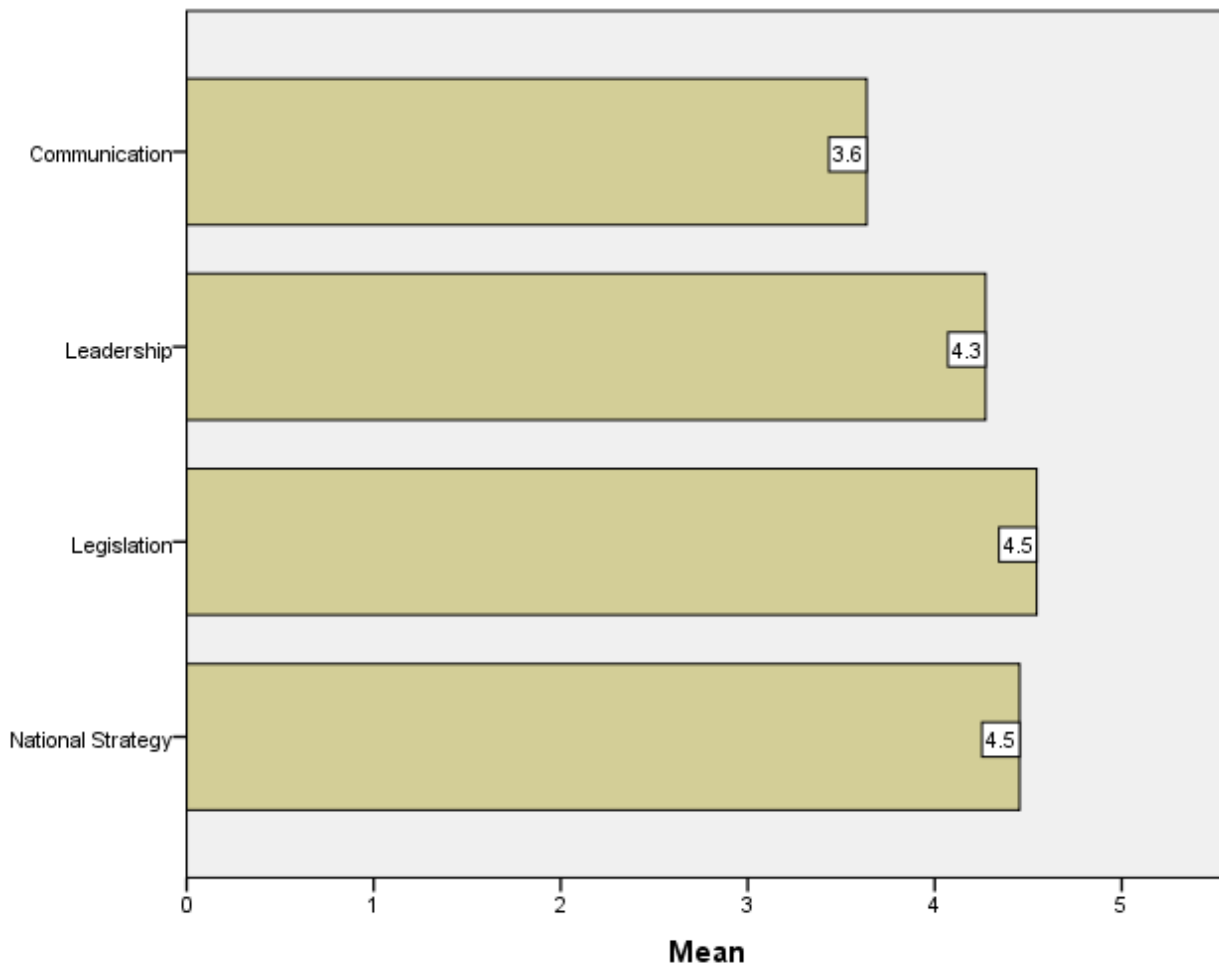
Two factors that need attention is the negative feedback mechanism and urbanisation which are identified in the literature. The negative and positive feedback mechanisms are important in understanding the system and M&E (Senge 2006: 73; Expert Guide to Open Systems 2013). The negative and positive feedback (Chaos theory) coupled with M&E helps in service delivery, specifically in solid waste services (SWS). It is in extending the thinking beyond Systems Theory (negative feedback) to the realm of Chaos Theory (negative and positive feedback) that a broader perspective in service delivery is appreciated.

Urbanisation is closely linked to population growth. In provinces like Gauteng with cities like Johannesburg, and in many other major African cities, population growth through urbanisation will persist for a long time (Simelani and Mohee 2012: 2). Simelani and Mohee (2012: 2) cite the following as other contributory factors to the current sluggish delivery: shortage of data throughout the SWM value chain; institutional factors (capacity and capability); technological factors; and financial related factors.

6.4.2 Factors that Aid the Delivery of Solid Waste Services (SWS)

An analysis of the factors that are helpful in the delivery of solid waste services are detailed in Figure 19 below.

Figure 19: Factors that Assist in the Delivery of SWS



The National Waste Management Strategy and Waste Management Legislation (both with 4.5 ranking) are scored highly as instruments that are helpful in the delivery of solid waste services. Leadership, both political and administrative, come close at about 4.3 as an enabler as well. The least contributor towards delivery is communication from National government all the way down to the municipalities. Communication had a mean value of 3.6 which is just beyond a score of three (3).

The Cronbach's alpha value for the joint instrument showed that the assessment is unreliable. The results from the qualitative part of the study does not confirm a higher than average prominence of the factors. Communication and leadership are not seen as major drivers or contributors towards service delivery in SWM. The legislative framework and the National Waste Management Strategy do not feature at all in the findings of the qualitative section.

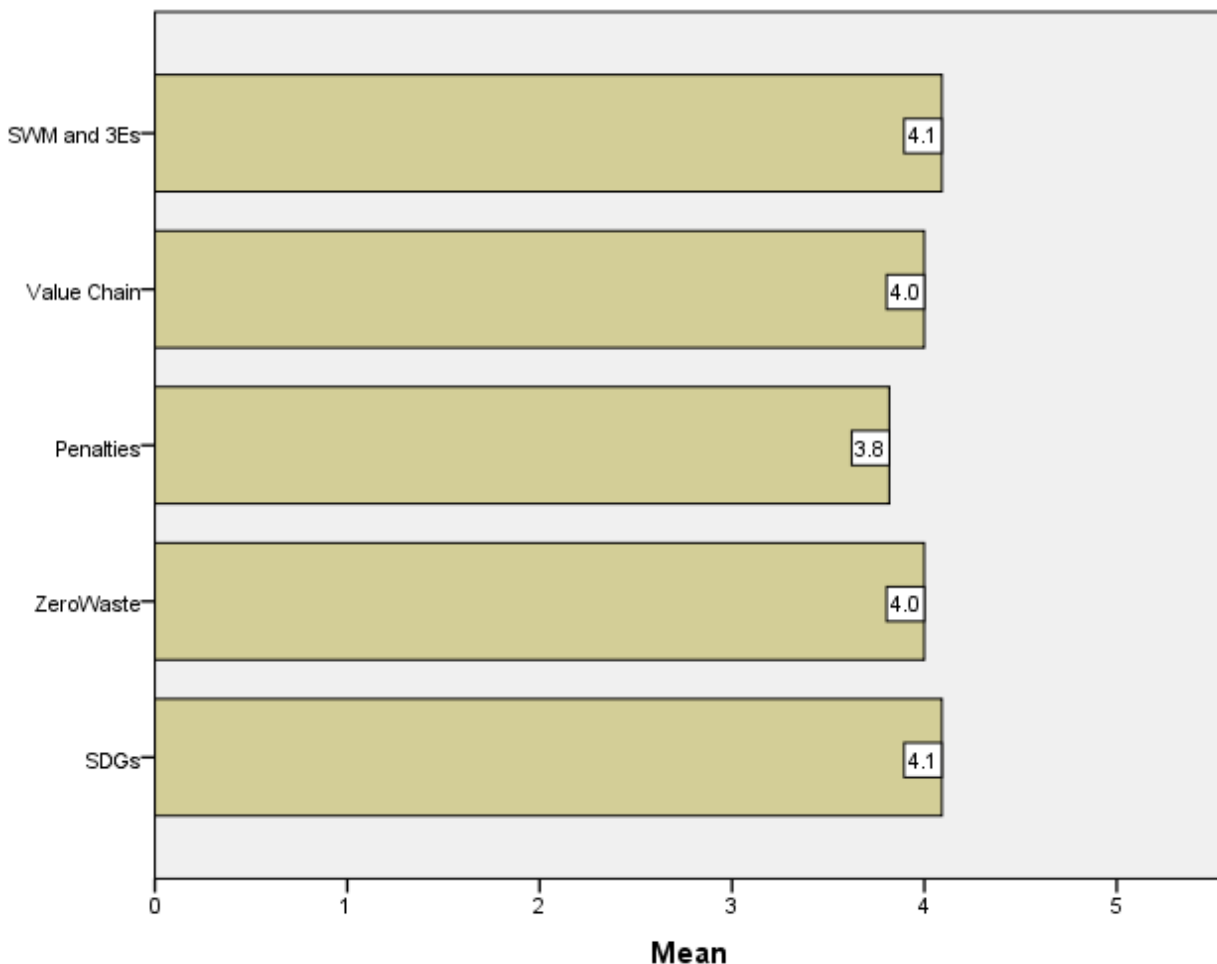
The low reliability (low Cronbach's alpha) of the instrument explains the confusion between what respondents gave and what they intuitively believe.

The qualitative part of the study sheds more light on matters that assist in solid waste service delivery. Communication, horizontally and vertically, is down played such that communities, that are supposed to play a crucial role in SWM matters, are overlooked.

6.4.3 International (United Nations) Advocated Prescripts on Waste Management Handling

This section dealt with analysing the current practices in solid waste management and the international prescripts or conventions that South Africa has adopted as part of handling solid waste management and services.

Figure 20: International Prescripts on Solid Waste Management



The inclusion of the international dimensions when delivering Solid Waste Services (SWS) were ranked relatively highly (between 4.0 and 4.1) across all factors, that include: Sustainable Development Goals (SDGs); Zero Waste generation; Influencing waste value chain from cradle to cradle; and linking SWS with the economy, environment and equity (people / socially). The factor that ranked low (3.8) as compared to others, is on ‘penalising the polluters’.

The four factors, namely: SWM and 3Es (economy, equity and environment); SDGs (sustainable development goals); SWM value chain; and zero waste are all measuring the

same concept. It is understandable that all four factors scored very close – between 4.0 and 4.1. The three factors: SWM and 3Es; SDGs; and zero waste, were also prominent issues in the qualitative part of the study. What was significant in the qualitative inputs was that the high scores are not attributable to implementation of the strategy, but about awareness of the plan and being conscious about the underpinning thinking. Most respondents linked the three factors to the impact of SWM in the logic framework. Penalising of polluters is currently still an option that is beyond the horizon in terms of the respondents.

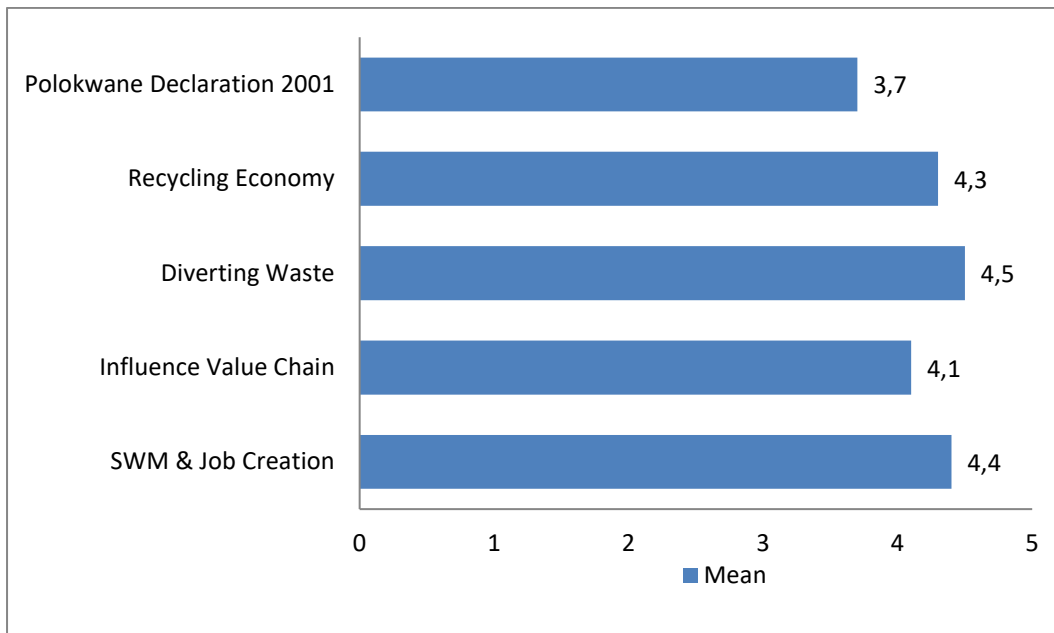
Penalising polluters depends on an effective M&E regime which would assist in collating data such that prosecutions would follow the transgression. The lack of M&E would stall the implementation of this strategy of penalising the polluters and also hamper SWM service delivery broadly.

There is general awareness of the 3Rs (reduce, re-use and recycle), sustainable development goals and zero waste strategy (UNEP 2013; Shanghai Manual – A Guide for Sustainable Urban Development in the 21st Century 2011: 18). Implementation of the prescripts may be a distance away, but general awareness is prevalent in administration. The awareness of the international and national prescripts does not extend to communities that can support government improve the solid waste management situation.

6.4.4 South African Advocated Prescripts and Strategies on Waste Management Handling

This section looked at the various prescripts, strategies and undertakings that inform the Solid Waste Management handling in South Africa.

Figure 21: Prescripts of Solid Waste Management in South Africa



Three (3) of the five factors analysed, namely: Diverting waste to recovery (3Rs - reduce, re-use and recycle); SWM as a job creator; and creation of a recycling economy had high rankings (between 4.3 and 4.5). The factor ‘Influencing the value chain from ‘cradle to grave’ (ranking 4.1) was lower compared to the other factors in the group with rankings above 4.1. The lowest of the factors was the Polokwane declaration which had a mean ranking of 3.7.

Two of the highest ranked factors, namely: recycling economy; and diverting waste, had to do with the implementation of waste hierarchy. The findings concur with the findings from the qualitative section of the study where respondents ranked the issues higher because of awareness of the concepts and not necessarily on the implementation of the concepts. Respondents attested that not much is happening on waste diversion and on recycling. Job creation was linked with the outcome of the logic framework of SWM. Job creation was associated with recycling where communities, co-operatives and entrepreneurs were supported and funded for participating in waste matters. In one instance, the municipality

added value to plastics by granulating plastic adding value from R4.00 per kg (if not granulated) to R11.00 per kg (when granulated).

The lowest and unusually low ranking is that of the Polokwane Declaration. The Polokwane Declaration is a nation-wide sector strategy adopted by all stakeholders as a blue print in 2001 with specific undertakings and timelines (milestones) leading towards 2022. All the timelines (milestones) from 2012 have been missed because the document is neither binding nor enforceable. The only notable and achieved objective pertained to municipalities which were able to develop Integrated Waste Management Plans (IWMP). Integrated Waste Management Plans are implemented because they are mandatory and enforceable in terms of the Integrated Pollution and Waste Management Policy (2000) and the National Waste Management Strategy (Simelani and Mohee 2012: 2).

6.4.5 Local (Municipal-wide) advocated Strategies on Waste Management

This section was looking at dynamics and issues that may be interpreted as locally focussed in the delivery of SWM services.

Figure 22: Current Local Thinking on Solid Waste Management

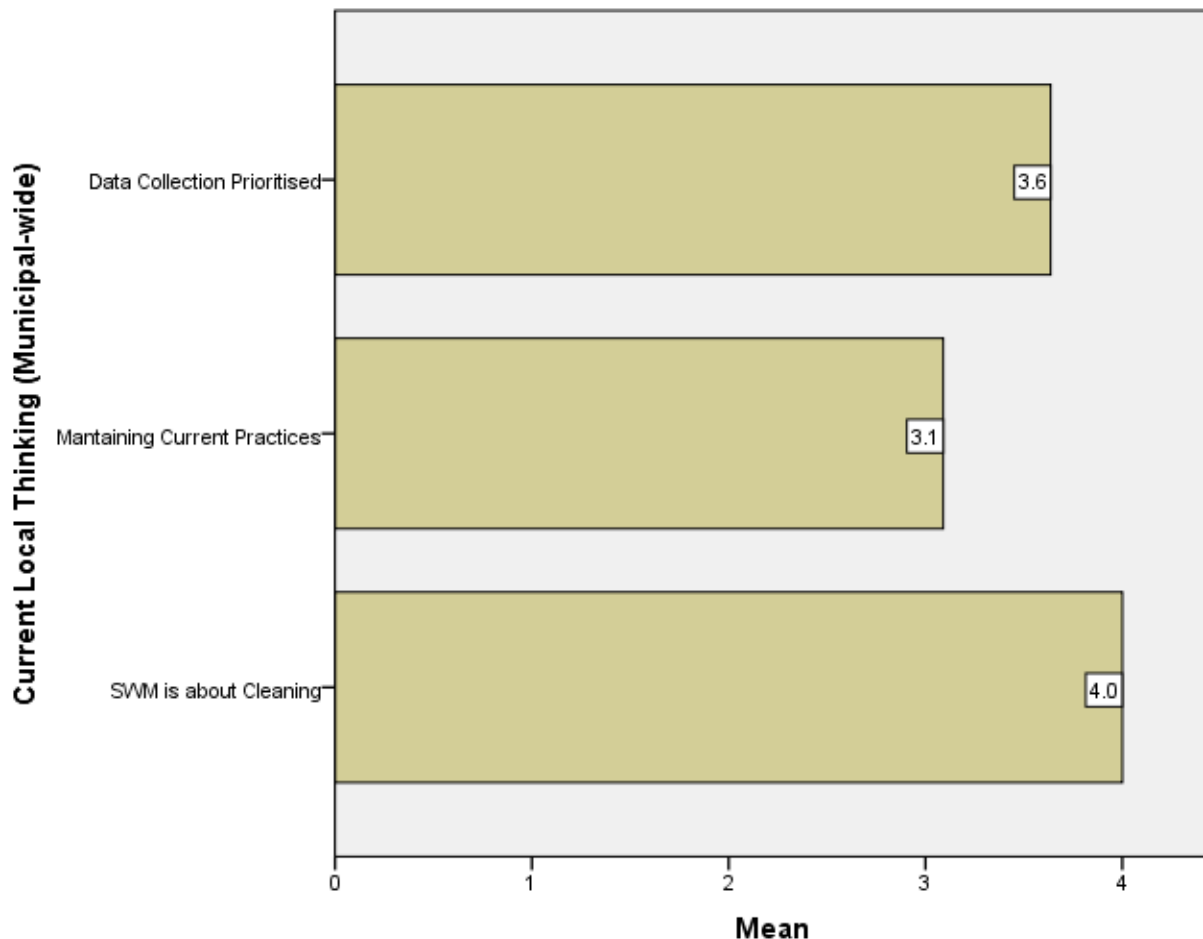


Figure 22 presents the means of the SWM issues and thinking at local level. The issue that was scored the highest is the understanding of SWM as a ‘cleaning function’, it had a mean score of 4.0. The second highest at 3.6, is the importance apportioned to data collection in the SWM process. The lowest at 3.1 was on whether SWM practices are more on preserving the currently used practices or not. Clearly respondents were non-comittal on this issue.

In the qualitative findings of the study, the solid waste function is understood to rest on three pillars, namely: consumer responsibility; 3Rs (reduce, re-use and recycle); and waste minimisation. The differences in what is captured quantitatively where waste is about cleaning (current and real-life situation), compared to the theoretical perspective which is captured qualitatively contributes to the low value in reliability of the instrument used (low Cronbach’s

alpha). A similar observation applies to 'prioritised data capturing'. In the findings of the qualitative section, respondents cited data capturing as an area that needs upgrading and optimising.

Data collection and the inculcation of current prescripts, both international and national, should be cascaded to municipalities and to lower level staff in the SWM departments. It is clear that the thinking and the practice as it is cascaded from national level is not translated or understood in the same manner. Cash, Adjor, Berkes, Garden, Lebel, Olsson and Pritchard (2006) in their report cited that the view or perspective within an organisation or across different levels in government differs as one cascade down the structure. The thinking at senior level differs significantly from the perspective at lower levels.

At strategic level the concept of solid waste management (SWM) M&E is based on outcomes and impact which has its basis in systems thinking. The same concept of solid waste management (SWM) at lower levels in municipalities, is more about input, activities and outputs. At delivery levels the dynamics change unexpectedly, to being unpredictable and irregular, which is typical of a chaos thinking perspective (Mason 2007: 15). The chaos thinking perspective is typified as: day-to-day dealings; unpredictability; immediate solutions; constant monitoring (supervision); and close or immediate negative feedback and positive feedback. The immediate changes and immediate decisions are typical chaos theory perspectives and which characterises the entire systems operations (Trading Strategy Guides 2017). These immediate changes and immediate decisions are called fractals in chaos theory terminology.

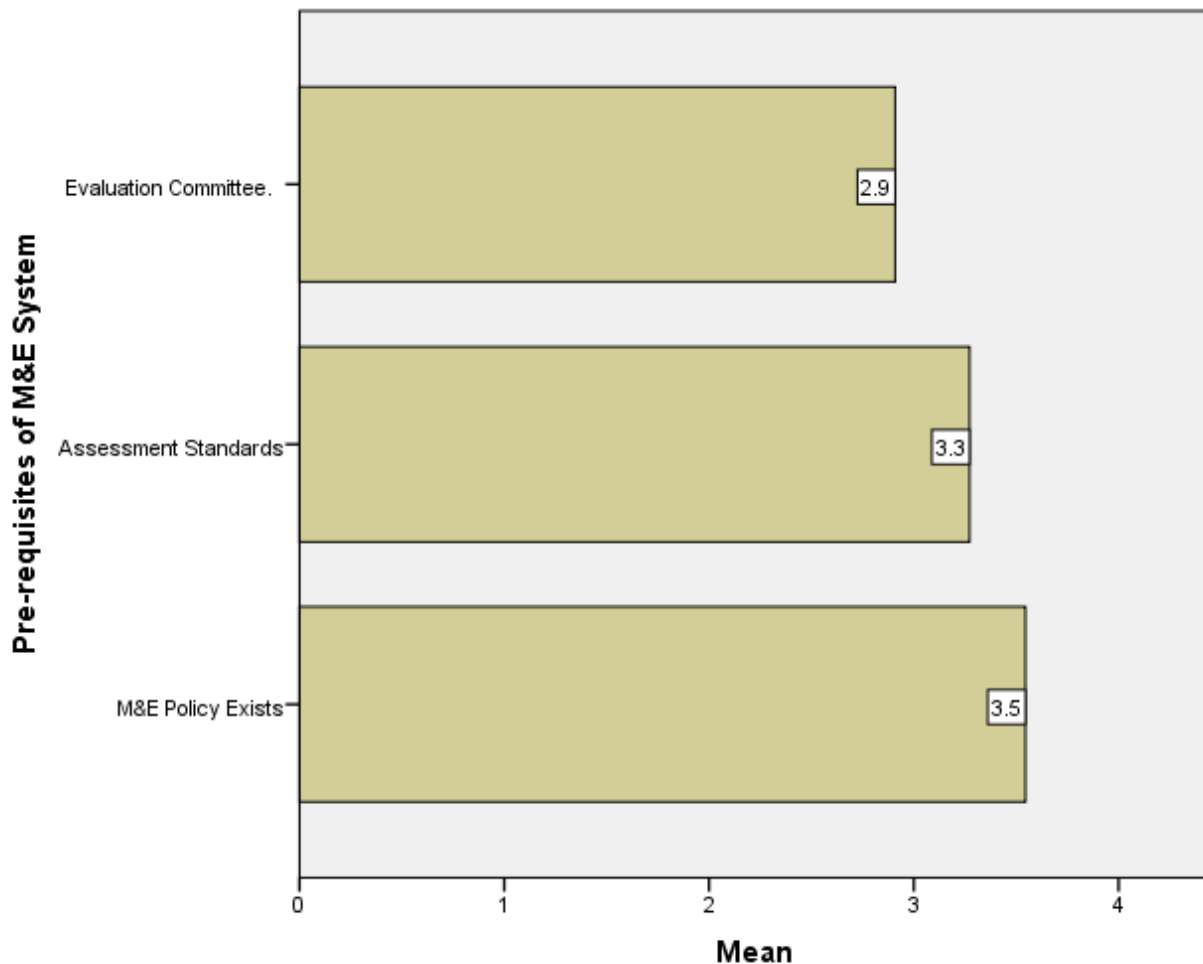
This demonstrates that at higher levels within the municipalities, the view of SWM is more from a systems thinking perspective, whereas at lower levels the perspective is from a chaos theory view point where small changes result in major outputs and outcomes. An example of a small change is the Durban case on a stinking landfill site. The 'spark or small change' is the lack of M&E by an employee of the Department of Environmental Affairs in monitoring service providers offering landfill services. The lack of M&E could lead to a stinking landfill site; causing a foul smell in the vicinity; which may cause health issues and possibly deaths; this may lead to unrest and protest action by the community; law enforcement agencies in calming the situation may create a worse situation; this situation can escalate from being a local issue to being a provincial and even a national issue. Originating from a small change

('spark') an amplified situation, whether positively or negatively, may become a resultant outcome.

6.4.6 Pre-requisites of a Monitoring and Evaluation (M&E) System

Figure 23 below highlights the factors that are essential for a M&E system to be operational within an institution.

Figure 23: Pre-requisites of an M&E System



The Cronbach's Alpha (reliability) of the instrument measuring the 'pre-requisites of an M&E system' was 0.32, which is below the 0.7 threshold of acceptable reliability. All the ranked items were low which suggested that respondents were not sure about the necessary pre-requisites of an M&E system. The monitoring and evaluation (M&E) policy was the highest factor (3.5). The second highest factor at 3.3 was the standards and assessments necessary to institute a monitoring and evaluation. The lowest of the factors (ranking of 2.9), which was slightly below neutral, was the 'existence of an Evaluation Committee' as part of the M&E system.

All three issues are important in instituting an effective M&E system, but the respondents did not identify any of the three issues as crucial aspects of the M&E system.

There are many issues that were identified from the qualitative part of the study which respondents felt are crucial in having an effective M&E system. The identified issues are:

- Adoption and support of the M&E at higher levels of the institution;
- Having a risk register and audit report;
- Customisable system;
- M&E being part of the integrated development plan (IDP);
- A system that provides information on spatial waste hotspots;
- Coordination of M&E across all levels in the institution; and
- M&E being part of the individual's scorecards.

Govender (2011: 259) proposed a Municipal Wide Monitoring and Evaluation Systems Model (MWMESM) which encapsulates most of the issues identified by respondents. In this model the involvement of the administrative and the political leadership, the enactment and enforcement of policies and plans, the coordination of M&E initiatives throughout the logic framework, organisational and individual scorecards customisable, and reports used to track the progress through negative feedback mechanisms. The inputs from respondents is in line with the current literature on M&E optimisation.

6.4.7 Drivers of the M&E System

The factors below serves as drivers to an effective M&E system in local government.

Figure 24: Drivers of an M&E System

The inputs on 'drivers of M&E' are closely linked to the previous responses which solicited pre-requisites of M&E in the previous question. The reliability is low (0.12), consistent with that of the previous question. From Figure 24, it is evident that Learning by Doing with 4.4 and indicators with 3.9 are the drivers of M&E implementation in the institutions. The culture (3.5) and compliance (2.4) have no significant contribution in assisting the institution drive M&E

'Learning by doing' has to do with a negative feedback mechanism and organisational learning. This is a key component in M&E and service delivery broadly because tracking progress is crucial in service delivery. In tracking progress 'indicators' are the main source of information needed to be fed back to the system. Logically, the two aspects, namely: learning by doing; and indicators; are mutually reinforcing.

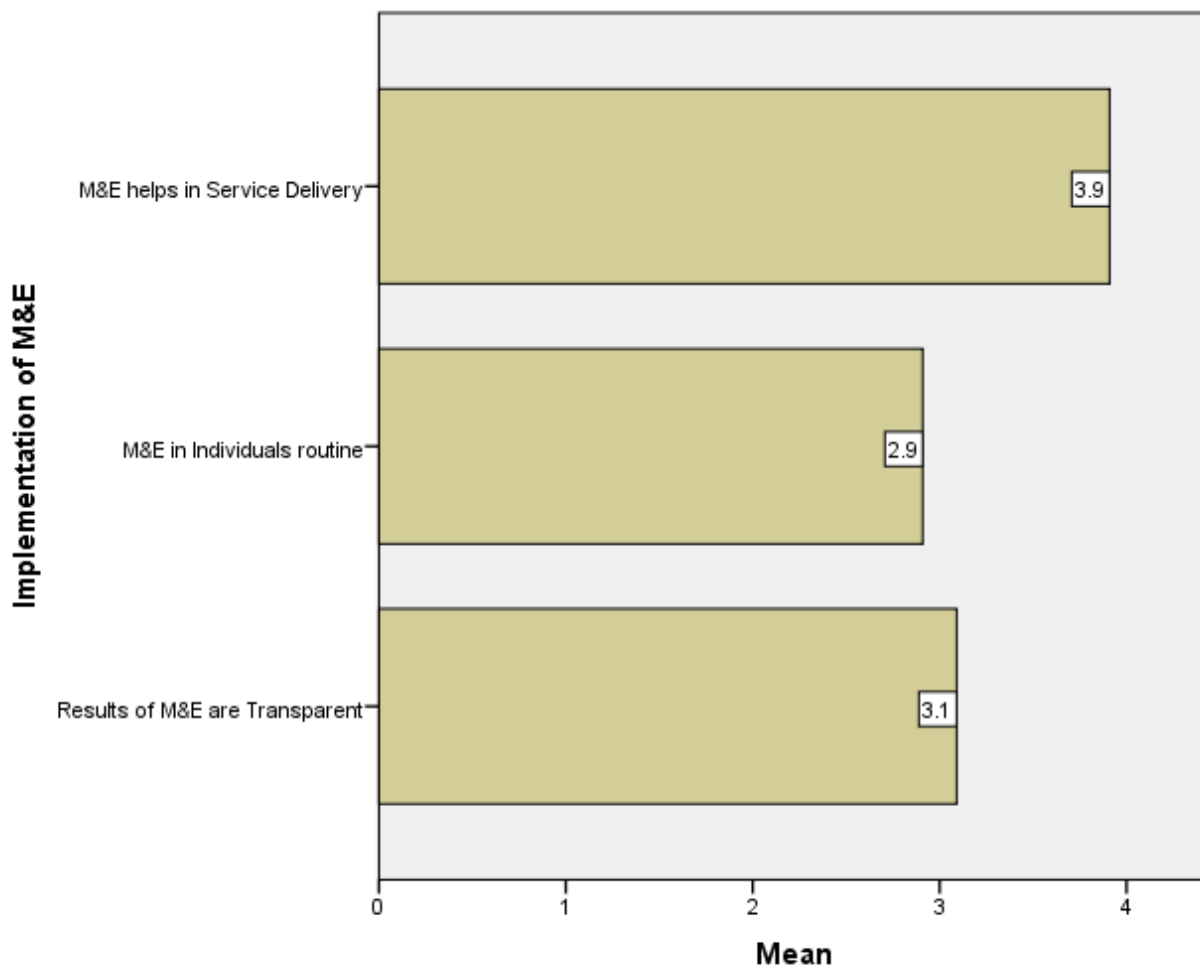
The responses of participants qualitatively, points to compliance and the underlying culture as the drivers of many aspects in municipalities, especially M&E. This radically different view compared to the 'neutral' stance (values are 2.4 and 3.5) could be the major contributor to attaining a low reliability value for the instrument. Other reinforcing factors are the same as mentioned in the previous question like: support from leadership, M&E being part of the broader plans, coordination of the M&E functions across divisions and M&E being on the priority list of municipalities.

The AGSA reports (2012, 2013, 2014, 2015, 2017), have consistently cited municipalities as having a compliance culture and lacking in creativity and innovation. Even though, the AGSA has not identified the root cause, it might squarely be placed in using systems thinking (logic framework) particularly in a day-to-day environment where chaos logic is needed in understanding and interpreting the situation (Mason 2007: 15). This is an environment where negative feedback and positive feedback loops are crucial in making immediate decisions sometimes not even worrying about outputs, outcomes and impact.

6.4.8 Implementation of an M&E System

Figure 25 shows the responses on the factors that contribute to M&E implementation in the institutions.

Figure 25: Implementation of the M&E System



The respondents ranked very low all the items concerning the implementation of M&E. The low ranking could be based on limited understanding on the modalities of M&E implementation.

The respondents ranked the 'M&E helping in service delivery' the highest (3.9 score), was significantly higher than the other two factors. The second ranked score at 3.1 was 'Transparency of Results' attained during implementation. The lowest of the factors, at 2.9, is 'M&E being part and parcel of individuals daily routine'. At 2.9, this signified that respondents are non-committal about M&E as an important part of the daily operations of SWM.

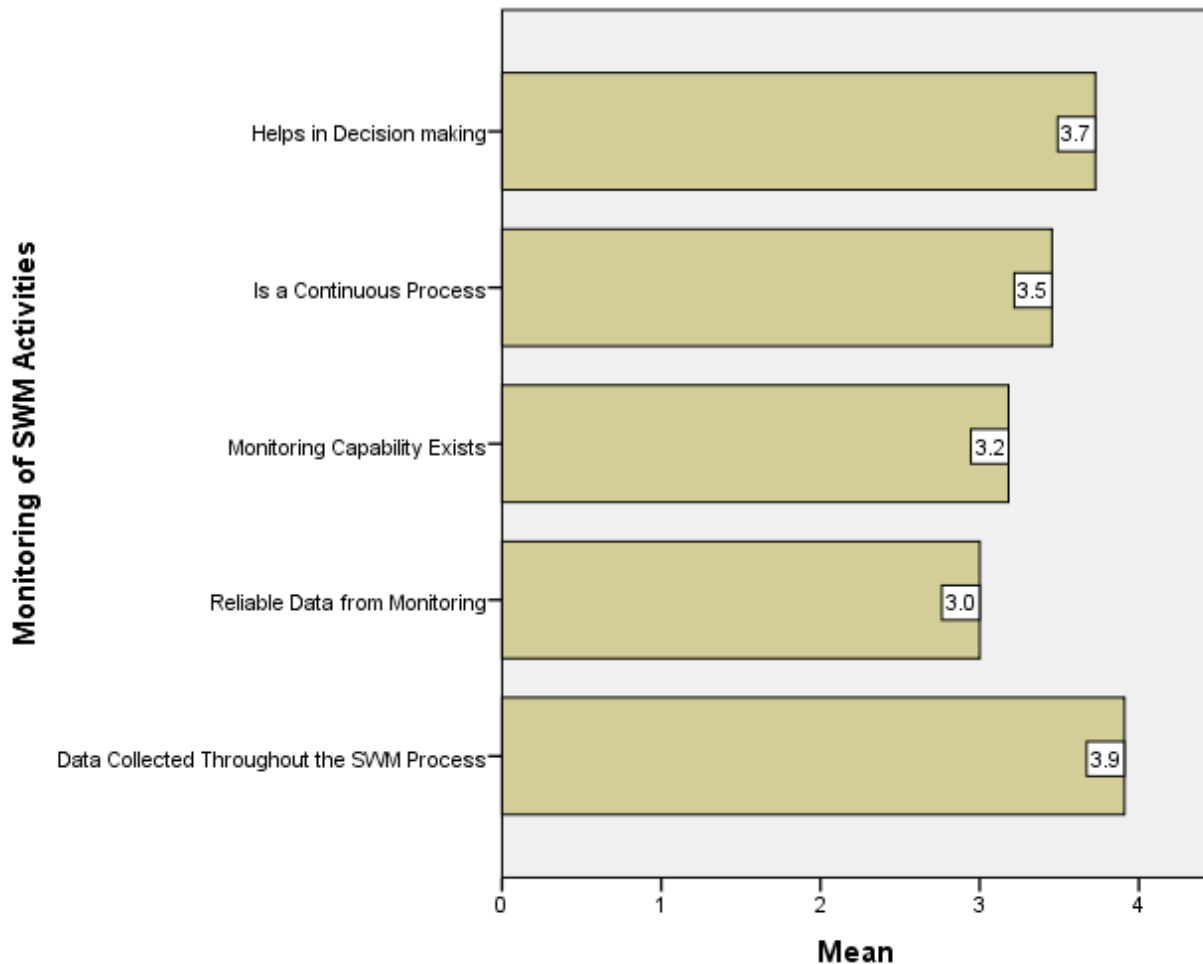
M&E was corroborated as an enabler in service delivery consistently in the qualitative part of the study both as a current enabler and also as a future enabler. One highlighted aspect about M&E was about the generation and provision of data throughout the SWM delivery process.

The UNEP (2013: 8), UNDP (2011: 11) and Suryudi (2007: 1690) show a direct proportional relationship between the M&E and service delivery. The relationship between M&E and service delivery is also typified in the logic framework tool (SPAM model) where both the service delivery and M&E are mapped throughout the model from input to impact. Finally, in this study the direct proportional relationship between M&E and service delivery is confirmed both qualitatively and quantitatively.

6.4.9 Monitoring of Solid Waste Management Activities

Figure 26, below, provides an analysis of activities involved in the monitoring process throughout the SWM value chain.

Figure 26: Monitoring of Solid Waste Management Activities



Respondents ranked the ‘monitoring data is collected throughout the process’ and ‘decision making based on collected data or results’ highly (3.9 and 3.7, respectively). The figures for the two highly ranked were still low compared to those found in the earlier questions. The balance of the three remaining factors, namely: monitoring as a continuous process throughout the value chain; existence of monitoring capability; and the collection of reliable and quality data (3.5, 3.3 and 3.0, respectively), were still ranked low. This showed that respondents did not believe that there is monitoring happening throughout the SWM process, neither is reliable data collected in the process and no capacity was available to monitor efficiently.

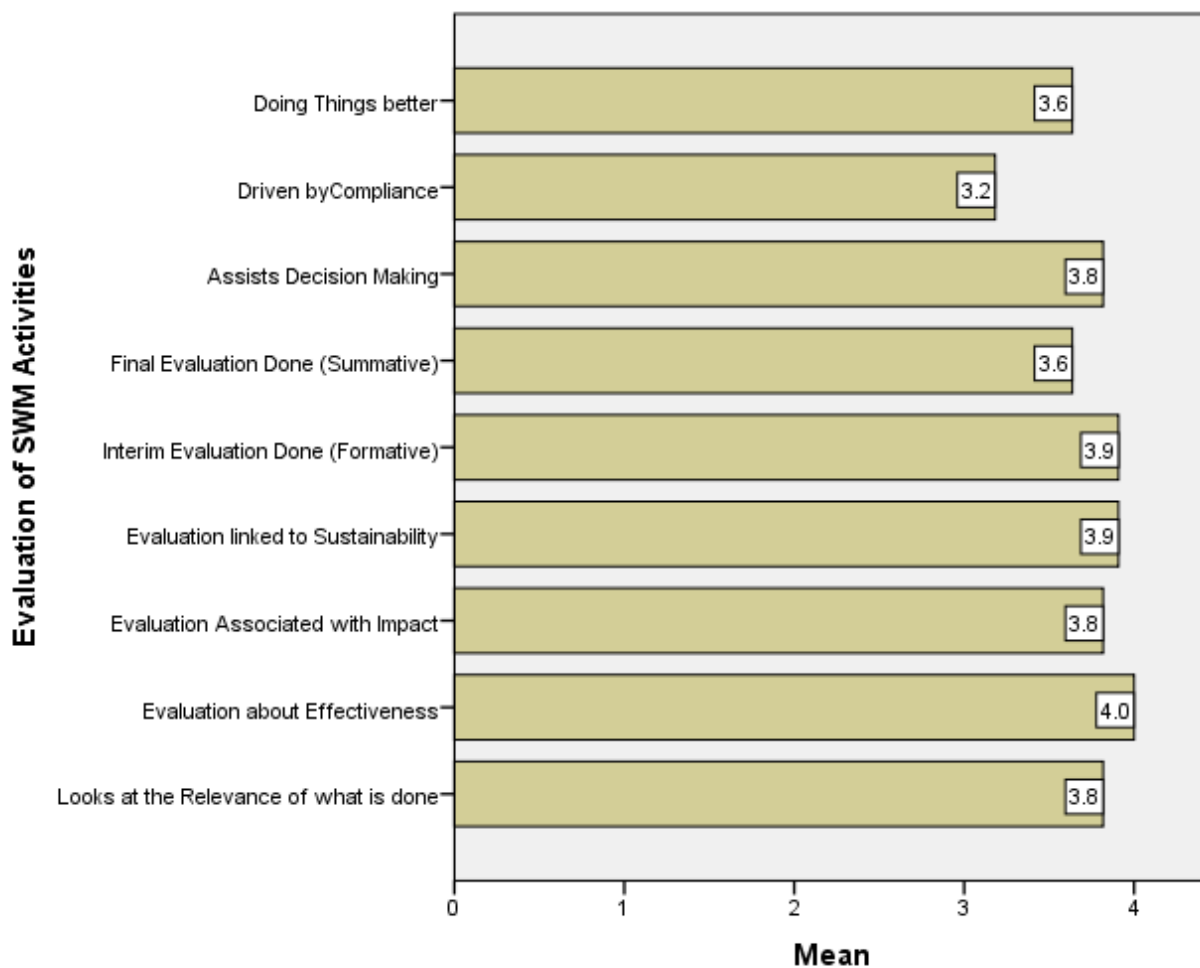
The quantitative results also show that data is collected throughout the SWM activities, and it is used to make immediate and day-to-day decisions on operations. The respondents, however, do not believe the reliability and the quality of the data collected, neither is the capability and capacity of the collectors of data believed. The respondents confirm the existence of rigorous monitoring during the actual day-to-day collection of waste across the service offerings, namely: refuse collection rounds (RCRs); street cleaning and litter picking; illegal dumping clearing; commercial and bulk clearing; landfill dumping; and garden sites. The generic term used is supervision, which is both an administrative term but also the actual act of monitoring as processes unfold. Data is captured and collected during or immediately after collection. It is at the higher levels (at strategic levels) where the quality of the data is questioned.

The qualitative section complements and triangulates the quantitative results sufficiently. The findings in the study are confirmed by literature in that the national data on waste management is an extrapolation from Gauteng and Cape Town figures because the quality and regularity of data cannot be confirmed (Godfrey 2015; South Africa, DEA National Waste Information Baseline Report 2012a: 9, 15).

6.4.10 Evaluation of Solid Waste Management Activities

Figure 27 depicts the factors that contribute to Evaluation of SWM in the institutions.

Figure 27: Evaluation of Solid Waste Management Activities



The rankings of the items within the construct of ‘evaluation of SWM activities’ were generally lower than other constructs dealt with in earlier sections (rankings between 3.2 and 4.0). This indicated that respondents did not attach any importance to the evaluation of SWM activities during service delivery.

A factor that stood out based on its extremely low value compared to the rest is the factor which enquires if evaluation is done for compliance purposes. The response of 3.2 suggested that evaluation is not done for compliance purposes. This may lead to a conclusion that compliance is not a major driver to service delivery in municipalities.

The results of the quantitative part of the study could be written in a story line as follows: ‘Evaluation in SWM is done to improve the effectiveness (doing things right), sustainability,

the impact, and assists in decision making by operators and managers. Evaluation is done during (formative / interim) and after (summative) the implementation process of SWM. Finally, evaluation is not done for compliance purposes, but is relevant to the SWM function rendered by the municipality'. Unfortunately, the qualitative section of the study does not seem to concur with the story line that emerges from the quantitative analysis.

The results of the qualitative data also highlighted some aspects that are gathered in the quantitative section. The formative and summative evaluations link up with negative feedback and positive feedback loops. The effectiveness, sustainability and impact of the solid waste delivery process are part of the positive feedback loops wherein new learning, new concepts of waste, buy-in of stakeholders, and attitude of stakeholders are canvassed and advanced. Compliance is still the driving force towards implementation of most municipal programmes, SWM inclusive as well.

Macdonald, Rust, Thrift and Swanson (2010: 10) and UNEP/SETAC (2009: 1) confirm the relevance and importance of evaluation in optimising the effectiveness, sustainability and the general learning within the implementation of projects or programmes. If the negative feedback and positive feedback loops are effective, the system can be elevated every time a full cycle is reviewed.

6.5 QUALITATIVE DATA ANALYSIS

Twenty (20) respondents were invited to participate in the study. The interviewed respondents were middle to senior management who are within the solid waste management field. The interview schedule had 16 semi-structured questions which guided the flow of the discussion.

6.5.1 Response rate

Sixteen (16) respondents participated in the study, representing an 80 per cent (80%) response rate. Twelve (12) of the respondents took part in the initial quantitative section of the study and were invited to take part in the semi-structured interviews. The response rate of 80 per cent (80%) was acceptable and fairly represented senior and middle managers in the SWM departments within the four municipalities studied.

6.5.2 Factors Influencing Provision of Solid Waste Services

The key themes from the interviews were grouped and mapped along the components of SPAM model (section 3.10; figure 14), namely; inputs, activities, outputs, outcomes and impact. The negative and positive feedback loops were incorporated for completeness of the analysis. Monitoring and evaluation (M&E) formed part of the entire system.

6.5.2.1 Inputs.

The themes that formed part of the inputs are: essential resources, planning and design, monitoring and evaluation, service delivery and general issues. These themes are discussed below.

6.5.2.1.1 Essential Resources

The areas identified under essential resources were: resource constraints, labour relations issues, systemic issues, population growth, migration and spatial issues.

Resources Constraints

The resource constraints that were identified by respondents, among others, were: finances or budget constraints, skills, expertise, capacity and equipments.

- **Budget Constraints and the Budgetary Process**

The budget constraint or lack of funding was cited as limiting in terms of SWM service delivery. A majority of respondents stated the budget as a limiting factor in SWM service delivery. A senior manager stated as follows:

On crucial issues like the budget, it is not there. I have to play an independent role...when a project manager says I have implemented such and such a project with the said amount. I must go and check and account, even though I don't sign or have the budget...the budgetary process also adds to our problems.

Funding in the SWM departments is usually based on historical information and not anticipating the population growth and migration that is happening in cities like Johannesburg (Simelani and Mohee 2012: 2). The budget, among other constraints, was highlighted as a common thread that runs through all other key service delivery hinderances (Municipal Managers Forum 2017: 28). This was also confirmed by the findings in the quantitative section of the analysis, in section 6.5.1 of this study. Budgetary concerns scored the highest among the factors that hinder the delivery of solid waste services (SWS) in municipalities. Budgetary constraints were also cited by Masindi (2010: 5) as one of the major contributors to the lack of service delivery in SW services area.

Monitoring and evaluation (M&E) cannot be effective when different members of staff are responsible for compiling the budget and other staff members are accountable for managing the budget. The lack of the necessary budget to run SWM operations makes service delivery and hence M&E difficult to undertake.

- **Skills, Expertise (Capability) and Capacity**

Capacity is a generic challenge in all four municipalities, the difference was on the severity of its impact on SWM (Municipal Managers Forum 2017: 44; South Africa, Gauteng Department of Agriculture and Rural Development – Waste Collection Standards 2010: 2;

Masindi 2010: 5). Service delivery is hampered due to the key positions being vacant over a long period of time. A senior manager explained:

One main factor is the capacity...as divisional head interns report directly to me; the warm bodies are not there. I'm more operational and my strategic thinking is vanishing. I handle the assets of the division and support all sections but I'm now more down on the ground than being at strategic level. I'm running a budget of R1.7bn but have no capacity. It is just me and the manager finance and nobody else. Then we have to take interns who are not operating at our level and use them for more things. These interns are babies-babies ...we take more projects to please the politicians.

Monitoring and evaluation and SW service delivery are adversely affected if there is lack of permanent, qualified and skilled staff to deliver services.

Solid waste supervisory and management experience are also a challenge (South Africa, Gauteng Department of Agriculture and Rural Development – Waste Collection Standards 2010: 2; Masindi 2010: 5). A statement that captured this feature from a respondent was:

Other problem ...is the low level of education of the people who are employed in the industry...The people who work with waste have a low self-esteem level and to manage those people you have to come to their level. Usually people employed as seniors to these persons don't understand that you have to come down to the level of the employees.

The observation by the respondents is consistent with the findings of the Auditor General of South Africa who also cited lack of skills and expertise (capability) as some of the major challenges in municipalities, which have a negative contributory effect to service delivery (Municipal Managers Forum 2017: 44; South African Cities Network (2014: 15); AGSA 2012, 2013, 2014, 2015, 2017; Govender 2011: 38, 86).

- **Equipment / Machinery**

Equipment plays an important role in the delivery of SWS. The importance of equipment in the solid waste value chain runs through the whole chain from separation, collection, stacking, transportation, transferring, re-routing to various streams and disposal (landfill). All

four municipalities use the generic trucking collection, transferring waste to either a transfer station or directly to a landfill site.

A senior manager stated as follows:

SWM is about equipment and people...the trucks and the loading and off-loading mechanisms have to be in good working order to determine the route times.

The equipment that is used namely; loading trucks, compactors, graders and crushers are very old and is limiting the efficiency and effectiveness that could be attainable if the latest models were purchased. The old equipment continuously needs servicing because of intermittent breakdowns. Budgetary constraints impose the option of maintenance of the old equipment with no option of procuring better and more efficient equipment.

Solid waste management is a resource intensive activity within the municipality. A senior manager stated that for a truck that offloads bins the mechanism for holding and tipping the bin has to take 6 seconds. If the mechanism takes 10 seconds, the whole route is affected and the truck would not finish the route in the anticipated time. This highlights the importance of the machinery in the SWM field.

Other municipalities like the Johannesburg Metropolitan Municipality are using high-tech to enhance M&E in SWM. The Johannesburg Metropolitan Municipality uses drone aircraft to monitor and even evaluate the service delivery standards after the waste collecting team has passed through a certain designated area. The drone would be dispatched along the route and in identified hotspots will take pictures and videos of the areas that have been serviced. This deployment of sophisticated equipment distinguishes the different levels of advancement between the metropolitan municipalities and the local municipalities. Metropolitan municipalities are better skilled and are using the latest technologies than local municipalities who are challenged in many ways.

Labour Relations Issues

Several respondents cited labour related issues as major contributors to non-delivery of SWS. A senior manager who has been in the SWS field for more than two decades further emphasised the critical and negative role that the rise of unionism has contributed to the general human resource management and service delivery specifically. He stated that:

The biggest problem you now find is that there are now unions...and there is always tension between management and the unions...partly because management is afraid of unions but when you sit with the unions you find them to be receptive.

The SWM field in municipalities is equally affected by the disruptions and unrest which results in no service delivery when labour relations issues are at stake. This situation, in SWM terrain, is exacerbated by the large number of lower level staff who are unionised (South African Cities Network 2014: 15; South Africa, DEA 2010: 281). In all four municipalities the SWS departments are labour intensive with high numbers of lower level employees.

6.5.2.1.2 Planning and Design

Planning and design dealt with issues that form the basis in institutional formulation and a set of guidelines that inform the institutional operations.

Key Systemic Issues

Systemic issues are those that form part of the institution, they include, among others: conforming to the legislative framework; information flow and communication; monitoring and evaluation; and processes. Systemic issues are based on both Systems Thinking ('behaviour of the systems is determined by the interaction of components' (Amagoh 2008: 2)) and Chaos Theory ('small changes in inputs resulting in dramatic increases in outputs, outcomes and impact' (Haran 2011; Urry 2006: 6)) concepts.

- **Legislative Environment and Prescripts**

Local government (municipalities) operate in a regulated environment with legislation such as the South African Municipal Finance Management Act (2003), South African Local Government: Municipal Systems Act (2000), South African Local Government: Municipal Structures Act (1998), Constitution of South Africa (1996) and many others being at the forefront of organisational structuring and delivery. Some of this legislation, like the South African Municipal Finance Management Act (2003) is seen as restrictive and sacrificing efficiency (speed) of delivery. This issue was further emphasised by a senior manager stating that:

The Municipal Finance Management Act (2003) stalls things especially Public Private Partnership (PPP) type projects and may span several financial years. The processes are too long considering that you are expected to take it to Treasury and the conditionalities are very discouraging of the project. Council's approval takes time, also the changing of councils as well.

The National Treasury's Municipal Service Delivery and Public Private Partnership Guidelines (2007; 6) gives the detailed processes that have to be followed by municipalities if they have to engage in a PPP arrangement. This is an elaborate process that could take several years to implement (South African Cities Network 2014: 15; National Treasury – Municipal Service Delivery and Public Private Partnership Guidelines 2007: 6). This is but one of the legislative prescripts that municipalities have to consider when implementing service delivery initiatives. It is generally accepted by municipal practitioners that the municipal environment is highly regulated which in most instances stifles M&E and service delivery.

- **Information flow and Communication**

There is a lag in cascading of information from National government and in the higher echelons of the municipality towards the operators at lower level. This sometimes results in information and emphasis which is slightly different from the original message intended from National government. A respondent noted that:

South Africa in the past 20 years has not concentrated on service delivery, especially not on the outcomes...we need to intensify communication in SWM...for instance communicating more about separation at source.

National government has put more emphasis on M&E throughout government, setting a government-wide M&E (GWM&E) system with the ability of collecting and collating data across all spheres of government (Public Service Commission 2008: 2). The same emphasis, unfortunately, is not sustained and cascaded such that it reaches the lower level of government. Monitoring and evaluation is lacking in all four municipalities in the study. The lack of a strong M&E system in municipal service delivery has an impact in SWM delivery. This can also be seen in the lack of information on SWM data which should be used in planning for future SWM service delivery.

- **Population Growth**

Planning and apportioning resources is a challenge in SWS because estimations are based on the number of households whereas in low income areas it is difficult to keep track of the numbers. A manager stated his frustration as follows:

We plan for 10 000 households only to find that by the end of the year we have 15 000 households.

The respondent explained that in affluent communities it is easy to know the exact number of households along a certain stretch of street, whereas in a low-income area it is difficult because you will have many other tenants within the same household. This makes it difficult to estimate the resources, time and capacity that are needed to service the area. He further stated that:

A study conducted showed that for the same square metre area, the low-income area produces more waste than the high-income areas. Reasons being that the low income buy more frequently and discard everyday whereas the high income buy in bulk and therefore have less waste. This means for RCR (Refuse Collection Rounds) the bins are full by the second day.

This unpredictability makes it difficult to anticipate and apportion resources to service some of the areas. Another issue that is associated with low income and affluent communities is the access to the different localities. Predominantly, access by trucks to service the low income is difficult. This is as the result of spatial planning which did not provide for services like solid waste services.

6.5.2.1.3 Monitoring and Evaluation of Inputs

Understanding of M&E

M&E is easily understood at conceptual level (higher or strategic level) but becomes difficult to implement at operational and functional level. A senior manager noted the following about M&E in municipalities:

M&E is still new, was promulgated in 2011 and we were taken aback and still grappling to get a good M&E system...now we have a component / division that is dealing with M&E. The city (City of Johannesburg) noticed that we don't have R&D, we don't have M&E and now have divisions dealing with those to help monitor.

At lower levels of management the concept that is constantly used is supervision instead of M&E. The exact point where M&E and supervision interacts is not clear to respondents.

Sudnickas (2016: 196) proposed that an organisation could be differentiated into four activity areas, each with its own indicators to determine performance. The four areas are: individual employee's performance level, workgroup or teams' performance level, program performance level, and organisations' level. Monitoring and evaluation (M&E) system operates at higher levels in the organisation which are at 'programme performance level' and at 'organisations' performance level'. At these higher levels both monitoring and evaluation are dominant during operations. Supervision is associated with the 'individual employees performance level' which is at the lowest level. It is understandable for respondents to interpret supervision as monitoring because they closely resemble the same process.

- **Monitoring and Evaluation of Inputs in the Provision of SWM Data**

Monitoring and evaluation is important in provision of data and information so that decisions of management are informed by the reality as delivery unfolds. A senior manager emphasised the importance of M&E noting that '**M&E is about provision of data**'. A senior manager in the City of Johannesburg explained the importance and influence of M&E in their service delivery model in terms of three interactive and interlinked structures which are: City of Johannesburg (CoJ) unit, the Board of the waste management entity (Pikitup) and the operations section in the entity (Pikitup). He puts it as follows:

There is a three-way M&E model – opsko (operations committee - Pikitup), Board (Pikitup) and the CoJ unit. The unit (CoJs) monitors the services of Pikitup, like cleanliness levels, standards, compliance, waste management activities e.g. wage bill, weigh bridges...are they functioning or not, are they complying with the record of decisions (ROD), and other environmental factors necessary to comply with e.g. garden sites, etc... the data and report generated gives an M&E overview of the processes.

M&E, which is reflected in the SPAM model in this study, is a crucial component in linking the theory of change (TOC) which is about the 'wicked problem' (chaos theory) and the apportioning of the necessary resources (SPAM / logic framework) for effective implementation to take place (Montague 2014; Govender 2011: 108)

Support from Top Management for an Effective M&E System

The support of M&E must emanate from the top. A senior manager proposed the following:

It (M&E) must become part and parcel of the city's priority...M&E must form part of the priorities from IDP all the way through...if it is not there, that means the City has not got a bird's eye-view of what is happening.

He went further, stating that:

Coordination is currently not there...but if it is properly coordinated ...it will be more like an engineered system that regulates to achieve targeted efficiency. This (system) culminates into a report that is a feeder to the annual report. This would create a new perspective and thinking about waste.

Currently, in the municipal setting M&E is understood and appreciated at the top level of the institutions. Executive and senior managers have their individual scorecards linked to the institutional scorecard or performance management system which is a requirement in terms of the South African Local Government: Municipal Systems Act (2000: s38). The challenge for municipalities is cascading the performance management system, monitoring and reviewing the performance of employees in line with the performance management system (South Africa, Local Government: Municipal Systems Act 2000: s40).

MIS as an Effective M&E System

Critical factors that need to be in place to have an efficient system would include, among others, a functional waste information management system (WIMS), increased prosecution rates and exploring alternative treatment technologies (ATT).

- **Waste Information Management System**

This is a system for data collection which would make for easy access to information, knowledge management and intelligence on solid waste management. This system is commissioned and operational nationally, but the data collection and processing is still not effective. Most municipalities are not actively supplying data to the WIMS.

- **Prosecution Rates Management**

Specialised courts that deal with environmental transgressions need to be re-visited. A senior manager stated:

There needs to be a dedicated environmental court that is needed to look at environmentally related cases. The City used to have these courts but with the changing of institutions (transformation) the courts took a back seat. The old courts were in Wynberg, and Randburg.

The environmental courts which prosecuted offenders of waste management have been re-prioritised and many other matters superceding waste cases. Resultantly, offenders in the waste management space have gone unprosecuted because the specialised SWM procecuratorial team has left the sector. Legal SWM experts are also difficult to find because of the SWM and environmental management courts being non-existent.

- **Alternative Treatment Technologies**

Metropolitan municipalities are ahead in the implementation of some of the SWM technologies as compared to local municipalities. A respondent from a metropolitan municipality noted as follows:

We are exploring ATT (Alternative treatment technologies) ...under the ATT we have WtE (waste-to-energy), landfill gas (methane), biogas...the city is busy with all three of them. All over the world especially in the developed world, these countries are disposing very little residuals after producing energy because of scarcity of landfill sites and airspace.

The latest and benchmark technologies are explored in metropolitan municipalities. Pikitup which is a municipal-owned SWM entity, is commissioning projects using the current technologies. Clear targets of waste minimisation and waste optimisation measures are initiated throughout the waste value chain in the metropolitan municipalities. Waste-to-energy (WtE) technologies, biogas technologies and landfill gas utilisation are some of the technologies that are pursued in metropolitan municipalities.

The Waste Information Management System (WIMS) and the waste management courts are closely related because a database of waste offenders and offences would be located in the WIMS. Respondents in the study felt that offenders within the waste sector seem to be transgressing the law with impunity knowing well that very little will happen to them. An

optimally functional WIMS coupled with a strong judicial system would alleviate the deliberate flouting of the law by waste offenders.

However, what is still missing in the thinking of municipalities is the latest concept of waste: where waste is seen as a natural resource instead of been seen as a nuisance (Chandak 2011: 14). The thinking in the developed countries has moved to the extent that revenue generated from waste is quantified in terms of its contribution to the GDP of the country. This makes waste an important input to production processes in many sectors of the economy, instead of being seen as a nuisance.

6.5.2.1.4 SWM Service Delivery

Improved Service Delivery of SWM and an Effective M&E System

The inclusion of timeous information gathering and timeous information dissemination to decision makers is crucial in a well functioning M&E system. This would assist in resource allocation and tactical changes that may need immediate intervention. A respondent also went further saying:

Resources...allocations, transport, hourly staff (which are inputs) ...because people only complain when there is a problem and they are not aware of the good things that happen behind the scenes. Information provision...especially when traffic impacts on service provision.

Communication is at the heart of service delivery improvement. The process commences with data collection which is done during the monitoring process of service delivery. Respondents cited monitoring as an important aspect of data collection in M&E. This data is needed by senior managers for speedy decision making during or immediately after operations have taken place. The increased flow of information enhances service delivery.

In the M&E framework or SPAM model (logic framework) monitoring happens throughout the framework, but service delivery happens during the inputs, activities and outputs which are the implementation part of the framework (Govender 2011: 108). The enhancement of service delivery, therefore, is an interlink between monitoring and implementation (inputs, activities and outputs).

6.5.2.1.5 General Issues

New Concept of Waste Management

Waste is still conceptualised as negative which makes the stakeholders, the community in particular, choose to move the responsibility to the municipality. This is typical when the municipality plans to develop a waste management site or a landfill site. The common reaction of the communities is to oppose the move vehemently. There is no concept of associating the waste generated to a resource or product to be sold. A respondent summarised the reaction quite clearly, saying:

Some examples of waste management problems is in landfilling. We use the guidelines of GDARD (Gauteng Department of Agriculture and Rural Development) on waste disposal...and the people do not want landfill sites to be next to where they stay. This is called NIMBY (not in my back yard).

In areas where the community is involved in waste management the concept of waste and the appreciation of waste changes dramatically. The community gets involved voluntarily to clean their surroundings. Waste management is seen as a business and job creator that alleviates poverty in the communities (Holstock 2014).

Research and Development as an Input

Research and development (R&D) has not been prioritised as one of the key inputs in waste management considering that WM is a rapidly evolving field. Metropolitan municipalities have taken up the challenge and put strategies in setting up divisions or sections to deal with research and development. A manager noted the following:

The city noticed that we don't have Research and Development, we don't have M&E and now we have divisions dealing with those to help monitor.

In all four municipalities there are no research and development (R&D) divisions within them. This shortcoming makes it difficult for municipalities to pre-empt or anticipate future trends in SWM service delivery.

6.5.2.2 Activities as per SPAM

In the SPAM model, M&E logic framework, used in this study the activities are the actual component of the model where SWM implementation takes place.

A manager who has offered his services across Southern African countries in solid waste management and is also a landfill management expert, intimated that :

The current way of handling solid waste (value chain) is the same across all Southern African countries and the primary focus is on waste disposal in landfill sites.

Another senior manager's view on the current thinking and implementation explains it as follows:

There are set targets some of which are nonsensical like zero waste...we have not been doing a lot in sorting at source. We are now starting...kerb side recycling (separating on the street – wet waste and bottles). We are planning to send separate bags; this should have started 1 July 2016...there are also those doing recycling at the landfill - contrary to the site permits. Site permits don't allow for people to work together with the machines...it is dangerous. But this is still a practice in countries like Mexico because there are no jobs.

The national perspective of SWM is based on the waste hierarchy (See section 2.2.2.2). The priority is placed on reducing waste production and cascading the prioritisation down the waste value chain hierarchy (UNEP 2013: 3; South Africa, Gauteng Department of Agriculture Conservation and Environment - Integrated Waste Management Policy 2006).

6.5.2.2.1 Diversion of the Waste Stream or 3Rs (reduce, re-use and recycle)

The 3Rs strategy is a national strategy that is known and accepted by municipality practitioners. Metropolitan municipalities are ahead of the local municipalities in terms of implementation of initiatives that support the 3Rs strategy. Biogas and energy harvesting initiatives are being implemented in metropolitan municipalities but similar initiatives are not initiated in local municipalities. Metropolitan municipalities like the City of Johannesburg have clear targets on waste minimisation. A senior manager, explained:

The deliverables in the policy mentions the diversion rate of waste away from the landfill site. This rate has to be intensified through waste minimisation, separation at source, technologies that the city is looking into...the solid waste is divided into three; namely rubbles (city is looking at procuring crusher plants to deal with this), food waste (city is looking at a plant to produce biogas and bio-fuel) and residual waste after removing the two – also a plant to deal with this waste. The last is to produce electricity. The reason for such a drive is that the land space is minimal.

Metropolitan municipalities like the City of Johannesburg and Ekurhuleni Metropolitan are engaged in biogas and bio-fuel generation which are down stream in the SWM value chain. Although the resources like financial, capacity and capability (expertise) are major challenges in the municipal sector entirely, however, this study shows that the situation is more pronounced in local municipalities than in metropolitan municipalities (Municipal Managers Forum 2017: 44; Smale 2016; South Africa, GDARD – Waste Collection Standards 2010: 2; Masindi 2010: 5).

6.5.2.2.2 Monitoring and Evaluation (M&E) of Activities as per SPAM

Monitoring and Evaluation (M&E) is still a challenge to all municipalities, both local municipalities and metropolitan municipalities. Metropolitan municipalities are initiating measures to cascade M&E and some are setting up divisions which are tasked with institutionalising M&E. The commonly used measuring or assessment terminology is supervision instead of monitoring and evaluation. Supervision is more on the individual performance management system level, whereas M&E is a high level management system that oversees the entire institutional and operational systems.

Govender (2011: 246) in his study stated that municipalities were still in the mode of doing M&E for compliance purposes instead of using the system to assist in service delivery. Govender (2011: 247) proposed that if municipal officials are incentivised their attitude might change and may start using M&E as a tool to achieving targetted outcomes and the needed impact to the public.

Institutionalising the SWM M&E System in Municipalities

A variety of actions and activities are needed to institutionalise a SWM M&E system. A senior manager in a metropolitan municipality summarised the model as follows:

We need to build capacity, work on the systems and issues of unions. For me to know that people are (present) at work...we can use biometrics on trucks but unions may reject them. The integrity must increase like depot managers who do not report if employees do not come to work.

Respondents believed that the SWM system can be institutionalised by applying a variety of measures which will include: culture change; attitude of employees; upgrading the systems; communication (especially with labour); and upgrading equipment (trucks).

In a department where the majority of employees are unionised, as in municipal SWM departments, constant communication with the union representatives assists greatly to avert stoppages. These stoppages hinder service delivery which may ultimately result in unrest and protests by community members. The stoppages would later be ascribed, by community members and other stakeholders like the Auditor General of South Africa, as poor or no service delivery (Auditor General of South Africa 2012, 2013, 2015, 2017).

A Systematic Approach to Institutionalising M&E in SWM Service Delivery

A systematic approach which cascades the M&E towards the lower levels of an institution is ideal. This approach will entail blending in M&E immediately during the strategy development stage and the identification of risks also in the early stages.

Respondents believed that M&E and risk identification are dealt with in different forums which weaken the strategy of an institution. One respondent felt that the M&E is not felt tangibly. She intimated that:

M&E because we're not hands on and we're doing it with remote control, makes it difficult to ascertain if it is indeed a living thing.

Institutionalising the M&E would entail several decisive steps such as: developing M&E policy; appointing M&E champions; capacitating staff on M&E deployment; developing

tangible indicators; agreeing on monitoring and evaluation timelines; and improving the oversight role (Govender 2011: 252). Instituting the M&E system development during the early stages will assist in infusing M&E into the fabric of the institutional framework.

6.5.2.2.3 Service Delivery as an Activity

The service delivery related issues that respondents cited were at a strategic level with some bordering at an operational level. The themes that were identified are presented below.

The Current Generic Solid Waste Operations

The current SWM regime, which is common to all municipalities, has six (6) distinct areas that are done on a daily basis. These are: refuse collection rounds (RCRs with trucks); street cleaning and litter picking; illegal dumping clearing; commercial and bulk clearing; landfill dumping; and garden sites. Part of RCR and landfilling involves recycling by individuals and cooperatives. Biogas harvesting and electricity generation from waste is still on a small scale (Smale 2016).

Consumer Responsibility

This concept emphasises that the consumer must pay for the activities that were done on their behalf. In the case of solid waste management the levies are added to the monthly billing statements for communities. It is not always a successful strategy in cases where communities cannot afford monthly fees. The Municipal Managers Forum (2017: 37) depicted graphically a gradual decrease in household income relative to the debt situation. In 2015, the household debt has reached about 80 per cent (80%) of disposable income.

The Municipal Managers Forum (2017: 38) cited that the increase in household debt has had an adverse effect on billing and many municipalities are experiencing negative cash positions. Consumer responsibility remains a very difficult area to manage as a municipality.

Reduce, Re-use and Recycle (3Rs)

In the three components of the 3Rs strategy the municipality only plays a facilitation role which cannot determine the pace of delivery. A senior manager in a metropolitan municipality mentioned that:

The numbers that are taken for recycling are about 10-18 per cent (from the total waste annually). Many companies take the recyclables along the value chain like Mpact, Mamashia, and many others. This makes it difficult to ascertain the exact statistics collated.

The data that is found in abundance in municipalities is on recycling. The volumes of reduce and re-use are difficult to quantify because they happen outside the direct control of municipalities. It is the private sector that is expected to actively reduce production material that would end up as waste. The re-use component of the 3Rs is also private sector but households should also be involved.

Waste Minimisation

There is very little happening on the waste minimisation dimension, except for planning and discussion around it. It is still seen as a longer term project. A manager in a metropolitan municipality, stated that:

Waste minimisation (separation at source) is still new in South Africa...our plan is to educate kids at schools, invest in the young ones.... technology is about separating the processes. To commission a plant, it takes about 3 years – which is three financial years.

In the waste minimisation strategy recycling is the area where serious activity is taking place (South Africa, DEA – Separation at Source 2014: 2). Community members collect recyclables in the bins when these are put outside for collection. These community members collect plastics, papers, metallic objects, cardboard and glasses. These recyclables are then sold to medium-sized recycling companies who process the products. There is very little activity on the 'separation at source'. This area should be prioritised by municipalities because this would alleviate the burden of separating later. The other important aspect about the separated waste is that it has high value and is easy to handle (South Africa, DEA – Separation at Source 2014: 2).

The M&E of the activities and statistical data of the recyclables are difficult to collate because these products move through private companies who may not prioritise the data collection.

The SWM processes that could be improved to enhance Service Delivery

Respondents felt that almost all the activities and processes involved in the solid waste value chain could be improved when more focus and research are directed at them.

The value chain of SWM entails: waste collection (houses, commercial and bulk); street cleaning and litter picking; illegal dumping cleaning; sorting; recycling; biogas harvesting; garden sites; landfill dumping; data collection (Gauteng Waste Information System); and M&E. The value chain can be optimised at every stage by research and looking at best practices in other countries. The challenge is that municipalities have no capacity and capability of doing research on their own, instead they are forever engaged in service delivery and using the same methods. It is only in the metropolitan municipalities where they have financial and human resources wherein they explore different ways of delivering SWM services.

The challenge of optimising service delivery still hinges on resource constraints, namely: finance; and capacity development (South Africa, GDARD – Waste Collection Standards 2010: 2; Masindi 2010: 5). Metropolitan municipalities are less constrained when compared with local municipalities, hence their fast-tracked progress as compared to local municipalities. Monitoring and evaluation is still a challenge for all municipalities throughout the SWM value chain.

Critical factors that are essential for effective SW Service Delivery

Several respondents cited communication as one crucial component that is missing in M&E and in service delivery broadly. Clearer statements included:

South Africa in the past 20 years has been concentrating on service delivery but not on the outcome...intensifying communication is working on the minds of the people...in SWM for instance separation at source should be communicated more.

A manager stressing the importance of communication, explained as follows:

The city needs to intensify on the impact by telling people about say, separation at source...example, Rea Vaya buses (inner city rapid transport system) were introduced to limit cars and emitted gases. Telling the masses optimises on the impact.

Communication is cited as the most critical component that is needed to deliver SWS effectively. The internal and external communications are cited as lacking. The internal communication challenge was within the SWM departments where regional managers operate as competitors for resources forgetting that if one region is faltering the whole municipality is blamed. In SWM the collection is daily, so the loss of a day cannot be recouped because each day has its own route. It is this internal communication and working together that needs to be inculcated into the team.

External communication with the public is very limited. If the community is involved in SWM it makes service delivery very efficient. The process of separating the waste at source could easily work if the public understands the reasoning behind this important drive. Equally, the municipality needs to distribute separate bags that would be used to store the different waste streams. Unfortunately, nothing is happening in all municipalities. The different coloured bags or bins are only distributed to some few commercial centres and organisations which still proves to be ineffective.

South African Cities Network (2014: 15) mentions, among others, communication as one major thrust that is needed to actualise SWM and the involvement of communities in municipalities. Communication in the form of public participation is crucial in galvanising communities to be involved in SWM matters. The South African Local Government: Municipal Systems Act (2000: s2 (b)) defines a municipality as being composed of three parties; namely, the administration, councillors and community. Public participation and public consultation is an imperative in the running of municipalities.

6.5.2.3 Outputs as per SPAM

Zero waste and the performance management system were the two outputs that emerged in the study. A detailed account of these outputs is detailed below.

6.5.2.3.1 Zero Waste

There is a gradual focus, especially in metropolitan municipalities, in reducing waste such that less flows towards the landfill site. Respondents are aware of the scarcity and challenges of sourcing new landfill sites.

Smale (2016) intimated that projects like separation at source, recycling centres and waste buy-back centres have been supported in municipalities in Gauteng to reduce the waste that proceeds towards the landfill site. In 2015, provisional figures for recycled waste stood at 23 per cent (23%) and that of the landfilled stood at 47.3 per cent (47.3%). In 2015, it was estimated that Tshwane and Johannesburg landfill airspace would be exhausted in 10 years (Smale 2016). This makes the Tshwane and Johannesburg situation critical and needing urgent action.

6.5.2.3.2 Performance Management System

Periodical Assessment

The SWS delivery by municipalities is periodically assessed and ranked by the Gauteng Department of Agriculture and Rural Development. The evaluation is done to assess the quality of service delivered by the municipality within the province.

In the case of the City of Johannesburg the municipality does the assessment of Pikitup in terms of the service level agreement. The service level agreement between the municipality and the municipal entity is entered into every financial year.

6.5.2.3.3 Monitoring and Evaluation of Outputs (As per SPAM)

Continuous M&E

Senior managers are still grappling with cascading M&E down to their respective subordinates to help in service delivery implementation. At lower levels the concept that is

used and understood is supervision. A senior manager explained his perspective of monitoring of the service delivery, saying:

The process works like clockwork if all is well and the supervisors can monitor at appropriate intervals...checks where the truck starts and he just checks where it leaves which is at the same spot of starting...an example is that the supervisor would know that on Monday this truck does 24 tonnes...if for instances it collected 16 tonnes, obviously that would signify a problem of some sort. These figures are then collated into month and annual tonnage.

There is a perception in managers and senior managers that supervision is monitoring. These concepts are closely related but different because monitoring assesses the entire systems performance in its delivery towards outputs, outcomes and impact. Supervision, on the other hand, is purely on individual performance assessment which is part of the Performance Management System (PMS).

The performance management system in a municipality is a statutory requirement in terms of the South African Local Government: Municipal Systems Act (2000: s38 (a)). Administration is expected to cascade the performance management system throughout the institution to assisting inculcate a culture of performance monitoring.

6.5.2.4 Outcomes as per SPAM

Community involvement and the employment creation aspect were the two issues that emerged as part of the outcomes in the study. The employment creation aspect was for both entrepreneurs and for the general public. The two identified areas, community participation and employment creation, are dealt with in the subsequent sections.

6.5.2.4.1 Enhanced Community Participation

Municipalities have made it a common practice for communities to become involved in planning and in participating in solid waste related matters. The inclusion of local community members assists in anticipating and dealing with challenges before they become problematic.

Johannesburg Metropolitan Municipality is in partnership with some community-based organisations which offer SWM services within their locality. In these partnerships the metropolitan pays for the services rendered by the community organisation and monitors the services rendered in terms of the service level agreement.

6.5.2.4.2 Increased Employment and Entrepreneurship Creation

There were many opportunities created within the solid waste sector which resulted in individuals or groups receiving job opportunities. Individuals and groups (cooperatives) are supported by municipalities to expand their businesses within the sector. A senior manager, explained:

What we are doing with recycling is that we have a big site where we request recyclers to come and collect and using cooperatives, we also try to use value-add to plastic. It is R4,00 per kg but if you granulate it, it becomes R11,00 per kg. The municipality only becomes the enabler to the cooperatives.

The manager also intimated that ‘...these guys who work at the landfill sites sometimes make as much as R5000-R6000 per month’. The important contribution of the solid waste economy or value chain to families and economies of various countries has been gradually noted by scholars and commentators (Moses 2013; Chandak 2010: 18). Community members are now noting the impact of solid waste in employment creation and entrepreneur creation.

6.5.2.5.3 Monitoring and Evaluation of Outcomes as per SPAM

An Effective M&E System

An effective M&E system, from the respondents’ point of view, is a multi-faceted system with components which, among others; can generate risk registers, customisable, give spatial

information about hotspots areas, produces audit reports (internal and external), can also check its own effectiveness and can give traffic information.

A manager in the City of Johannesburg intimated about an ideal effective M&E system, saying:

(it should be) a unit...which generates risk registers, customised system, such (that) you can click and get spatial information about waste spots and problem areas...waste flow, the biggest generators in the city. The city generates 1.6 million tonnes per year and the south alone contributes 700-900 million tonnes. The north is contributing about 500 million instead.

Currently, the M&E is not assisting in planning, anticipating and projecting future challenges. Respondents feel that an effective M&E should be helping in providing information for planning purposes, resource allocation, mitigating risks, and providing spatial or global positioning of waste spots that need to be monitored closely. The location of landfill sites and the traffic in Johannesburg is not factored into the transportation of waste to the landfill site. The trucks have to pass through peak traffic on their way to the landfill sites which is located on the other side of the city. This information or intelligence should be gathered from the M&E system if it is to be optimally functional (Govender 2011: 74; South Africa, The Presidency 2007).

Institutionalising an M&E System

Institutionalising an M&E system means adopting it at the highest level from corporate governance, taking it to administration from a strategic level to the lowest levels of service delivery. Some respondents believe that for M&E to be in the fabric of the institution, it should be on the scorecards of individuals.

M&E in municipalities, especially the local municipalities, still resides at a strategic level and has not been cascaded to be part of the municipal daily operations. The municipalities integrated development plan (IDP) is written in a logic framework format but still M&E is not appreciated. USAID (2012: 1) and Roduner, Schappi, Agridea, Egli and Zurich (2008: 8) explain the logic framework as a tool or an integrated framework for M&E. Seeing that the IDP (municipal strategic planning document) is written in a logic framework format, M&E should have been a matter of course in municipalities. It would not be surprising to find that

municipalities have challenges with the institutional and individual performance management system because these two emanate directly from M&E (logic framework).

Literature concurs with the sentiments of the respondents that institutionalising M&E should entail among others: developing tangible measurements (indicators); and improving management and Councillor oversight (Govender 2011: 252). The step that would supersede oversight would be the development of individual and institutional scorecards.

A Conceptual M&E System that Supports SWM Service Delivery

Key features of an M&E system that supports service delivery, among others, should have the following:

- Waste Information Management System (WIMS);
- Baseline data and tracking mechanism;
- Tracking of diverted waste, disposed, recycled, etc.;
- Register most of the activities within the SWS value chain (highest generators of waste, etc.);
- Register enforcements and conviction rates of defaulters (National Environment Management Act, Waste Act, Integrated Waste Management Policy, By-laws of waste, etc.);
- Institutionalised and cascaded such that it touches all facets of service delivery in an institution;
- Individual score cards (especially for senior managers);
- Assist in the planning cycle; and
- Specialists that support it (managers, lawyers, and others).

Respondents perceive a SWM M&E system which is: timeous; integrated with the provincial and national waste information systems; tracking the past information and blending future projections; generates up-to-date information for management decisions; supported with relevant skills set; serves as a referral database; part of the planning cycle; and is cascade across all areas in the institution.

The South African Gauteng Department of Agriculture Conservation and Environment - Integrated Waste Management Policy (2006), UNEP (2013: 3) and the South African National

Environment Management: Waste Act (2008) all stress the importance of monitoring and evaluation of SWM as an important component in dealing with service delivery of solid waste. The above cited documents build on the waste management strategy that was adopted in the Rio de Janeiro Earth Summit (June 13, 1992). An efficient and effective M&E helps in achieving excellent service delivery.

6.5.2.5.4 Service Delivery as an Outcome

Monitoring and Evaluation leading to enhance Service Delivery in SWM

Statements from respondents which captured the essence of M&E and how it contributes to service delivery, were:

- **It will identify the loopholes.**
- **It will show the city its deficiencies.**
- **Will enable the city to budget better.**
- **It will help the city to utilise its resources better. The importance of M&E is that it exists within the ambits of the different systems. The good part would be that the city might reinforce one loophole and find that the ultimate output is enhanced because the system is interlinked.**
- **Municipalities are politically controlled entities while within them there are Academics, specialists and technocrats. If politicians get their way, then the whole ethos of service delivery may be lost.**
- **It would be helpful if the M&E would monitor the tone and the voice (promises) of the political office bearers such that they don't put the system under pressure. Some times while we're busy with the feasibility to buy buses that use biodegradable as fuel the politicians announce that the buses will use only biodegradable only to find that the reality is that those buses use only a small amount of biodegradable and not the figures as alluded to by the politicians.**

The respondents understood clearly the link between M&E and service delivery. Literature also shows that a well functioning M&E system would assist in improving the efficiency, effectiveness, impact and sustainability of the project, programme or institution (South Africa, The Presidency 2007; Lahey n.d.).

Transformation in Local Government

- **Amalgamation**

Knowledge and expertise was lost during the amalgamation of municipalities in the formation of local government in the year 2000. Experience and models that had been built over the years in solid waste management was adversely affected. One major short-coming was the lack of knowledge management during the transformation process. A senior manager with decades in the solid management realm commented saying:

The research that I have given you is 'the effect of transformation in service delivery'...What can be deduced is that transformation took away the efficiency not only in Solid Waste but across all service delivery areas. When we did transformation because there was no knowledge management we lost that core knowledge.

He went further saying:

Waste Management you find in most areas has deteriorated over time mainly because of transformational issues.

The local government reconfiguration process for the year 2000 amalgamated many former transitional Authorities to form single local municipalities. The City of Johannesburg Metropolitan (CoJ) amalgamated 11 Local Authorities (City Power Johannesburg 2012: 4). The different Local Authorities had different skills and expertise that had been accumulated over the years. In the amalgamation of the Local authorities, the process was not sensitive to the knowledge and expertise that had been accumulated by the different Local Authorities over the years. As a result, the experience and expertise were lost during this quest to have a unified institution.

- **Long Range Planning and Coordinated Planning**

As part of transformation the capacity for long range planning and coordinated planning were lost as well. A respondent mentioned that:

Previously when we do planning the Provinces were asked, through ordinances, to do the Provinces Master Planning...this included bulk

infrastructure...so you would have planning done for power stations, waste purification plants, waste disposal sites, main arterial routes.

The senior manager stated that prior to the amalgamation of Local Authorities in the year 2000, it was part of the Provincial competence to plan for longer range projects and regional-wide master plans that would not have been catered for by Local Authorities. In the current system, it is not clear where these responsibilities reside. District municipalities and Local municipalities seem to be short-termism in their focus and the regional-wide plans are not identifiable.

6.5.2.6 Impact as per SPAM

Two of the cited impacts are in employment creation to community members and community involvement in SWM matters. In metropolitan municipalities the thinking has moved beyond the immediate benefits into national and global initiatives such as Sustainable Development Goals (SDGs).

6.5.2.6.3 Monitoring and Evaluation of Impact

The importance of M&E in the SWM

Monitoring and evaluation is seen as being part of the entire value chain. The exact detail of operationalising M&E was seen as more institutional (at strategic level) but with no clearer process of operationalising or cascading it. A senior manager explained his assessment of the current regime, saying:

The city has to be proactive instead of being reactive on matters of M&E... analyse the risk and cost the risk...we forget about costing the risk.

M&E is not felt at operational and at functional levels, but it is perceived to be residing at strategic level. The impact of M&E should be felt at operational and at functional level because these are the levels where actual SWM service delivery is taking place. In an improved model, M&E should be pervading throughout the system and also being implemented alongside risk management.

The generic service delivery model of municipalities and business plan (IDP) is based on a logic framework (South Africa, Local Government: Municipal Systems Act 2000: s25). A refined logic framework (SPAM) which is used in this study emphasises M&E as an essential component of the logic framework. The absence of a rigorous M&E regime within the SWM service delivery model slows down the SWM delivery. Another negative impact, resultant from the consequence of the absence of M&E, is the absence of the data collection capability. Data is important in assessing and refining the SWM system for future planning.

6.5.3 Summary of the SWM SPAM Model in Gauteng Municipalities

Table 11, below, summarises in a tabular form all the themes that were captured in the qualitative part of the study. These themes are tabulated using the SPAM framework which is used as the conceptual framework of the study. In each of the five dimensions of the SPAM model, namely: input, activities, outputs, outcomes and impact, the M&E and service delivery associated with each of these dimensions are tabulated correspondingly.

Table 11: Solid Waste Management Systemic Performance Analysis Model for Gauteng Municipalities

SUMMARY OF SPAM MODEL OF SOLID WASTE MANAGEMENT IN GAUTENG MUNICIPALITIES				
INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES	IMPACTS
<u>Necessary Resources</u> •Financial	<ul style="list-style-type: none"> Waste Hierarchy and Waste Diversion (3Rs) 	<ul style="list-style-type: none"> Zero waste Performance management system 	<ul style="list-style-type: none"> Community Participation Employment and 	SDGs

<ul style="list-style-type: none"> •Equipment •Capacity •Skills (capability) •Labour Relations issues (Culture change & attitudinal change) <p><u>Planning & Design</u></p> <ul style="list-style-type: none"> •Legislative Environment & Prescripts (SONA, NWMS, IDP, etc) •Information Flow & Communication •Population Growth •Migration 	<ul style="list-style-type: none"> • RCR (Collection - Households & Bulk) • Street Cleaning & Litter Picking • Separation • Recycling • Landfilling and Landfill Management • Biogas, Bio-fuel & Energy Harvesting 	<ul style="list-style-type: none"> - Periodic review and assessment 	<p>Entrepreneur Creation</p>	
<p><u>M&E (Inputs)</u></p> <ul style="list-style-type: none"> •Data Provision •Information Provision •Provides Support and Coordination •Provision of Critical Support Areas <ul style="list-style-type: none"> - Waste Information Management System (WIMS) - Prosecution Rates - Alternative Treatment Technologies (ATT) 	<p><u>M&E (Activities)</u></p> <ul style="list-style-type: none"> •Supervision instead of monitoring. •M&E a compliance issue at Institutional level. •Early Risk Identification Modalities •Develop M&E Policy •Appoint M&E Champions •Tangible Indicators & Timelines 	<p><u>M&E (Outputs)</u></p> <ul style="list-style-type: none"> • Continuous monitoring 	<p><u>M&E(Outcomes)</u></p> <ul style="list-style-type: none"> •Effective M&E Systems with the following Components: <ul style="list-style-type: none"> - Risk Registry - Spatial Information Hotspots - Audit Reports (Internal & External) - Traffic Information - Baseline data & Tracking Mechanisms - Data on worst generators of waste •M&E adopted at Governance level 	<p><u>M&E (Impacts)</u></p> <ul style="list-style-type: none"> • M&E is felt across all levels in an Institution (Strategic, operational and at functional). • Information flows across all levels (Input, Activities, Outputs, Outcomes and Impact)

6.6 CONCLUSION

This chapter provided an analysis and the interpretation of the qualitative (interviews) and the quantitative (survey) data collected from the respondents who took part in the study. The triangulated data showed areas which otherwise could not have emerged prominently as themes and variables if only method was used. The findings of the study suggest that the factors that influence (negatively) the delivery of SWM services could be mitigated and used as a guide to monitor progress on service delivery. Also, notable is the challenge of the monitoring and evaluation system within the municipalities in general.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

The purpose of the study was to ascertain the monitoring and evaluation (M&E) of solid waste management services as a means to enhance service delivery in selected Gauteng municipalities. This chapter presents key findings for the research objectives and proposes a conceptual framework for solid waste management service delivery.

7.2 KEY FINDINGS TO RESEARCH OBJECTIVES

7.2.1 Objective 1: The challenges and the factors that influence the provision of solid waste management services

The resources constraints (budget, equipment, capacity, capability), systemic issues (legislative prescripts, population growth, migration and communication), M&E related matters and service delivery related issues were the main contributors in influencing the delivery of solid waste services in municipalities.

7.2.1.1 Resource Constraints

The necessary resources affect the efficiency in delivery solid waste services. The different components identified in the study are listed below.

7.2.1.1.1 Budget

The budget allocations to SWM divisions or departments in municipalities lags behind the needs that are identified annually. The budgets are determined from historical data which is 'old' compared to the prevailing status in the localities. The restrictive budget contributes significantly in constraining solid waste service delivery.

7.2.1.1.2 Equipment

The solid waste management departments or divisions depend on capital for equipment such as trucks with loading and off-loading mechanisms, compactors, graders, and many more labour saving handling devices. Currently, solid waste management departments or divisions have challenges which include: operating with outdated equipment; lack of essential equipment; and a lack of maintenance of the aging equipment. These factors contribute negatively in the SWM service delivery.

7.2.1.1.3 Capacity

Service delivery in SWM is hampered by a shortage of staff in key positions. Vacant positions are not filled across several divisions in the municipalities and specifically in the solid waste services. This has had a negative effect to service delivery in the SWM functional area.

7.2.1.1.4 Capability or Skills

The solid waste management functional area is developing rapidly, globally, due to the earlier development of the Millennium Development Goals (MDGs) and subsequently the Sustainable Development Goals (SDGs). It has become imperative to either upgrade the skills and expertise or employ individuals with the requisite waste management skills. In municipalities, neither of the two options have seen drastic movement. Resultantly, the requisite SWM skills and expertise are a major shortcoming in the delivery of solid waste in municipalities.

7.2.1.1.5 Labour Relations

The solid waste services function in municipalities has a majority of employees who are at the lower levels and most of them belong to labour unions. This situation results in constant disagreements between the middle and senior management staff and the lower unionised staff members. These internal disagreements have resulted, in many instances, in strike actions by unionised staff affecting solid waste service delivery to the communities and to other stakeholders.

7.2.1.2 Planning and Design (Systemic Issues)

The planning and design challenges are systemic issues that come as a result of the underpinning legislation in the sector and some societal issues that affect the sector broadly.

7.2.1.2.1 Legislative Prescripts

The SWM functional area in municipalities is affected by several statutory and non-statutory prescripts which determine how service has to be delivered. Globally, this commences from the SDGs and cascades to several national laws, policies and regulations. In national solid waste discourse, the National Waste Management Strategy (NWMS), the Integrated Development Plans (IDP) and Integrated Waste Management Plans (IWMP) are important prescripts in solid waste service delivery. These three guiding documents determine how SWM is managed in municipalities and also set the framework of service delivery in SWM.

7.2.1.2.2 Information Flow and Communication

Information flow and communication, internally and externally, is a crucial component in the delivery of solid waste services. Municipalities are under-staffed and lacking requisite skills in delivering solid waste services. The empowerment and involvement of communities in solid waste delivery would assist in achieving what is currently not feasible. Information flow and communication is at the heart of using the communities as active participants in solid waste delivery.

7.2.1.2.3 Increasing Population in Gauteng

The population growth affects the delivery of solid waste services adversely. Gauteng province, contributing about 35 per cent (35%) of the Gross Domestic Product (GDP) of South Africa and with a population of about 13.2 million (Statistics South Africa 2015), is experiencing pressure in providing solid waste services. The rate of increase of the necessary resources is lagging behind the rate of increase in the population. The respondents cited population growth as one of the contributory factors negatively affecting solid waste service delivery.

7.2.1.2.4 Migration

Migration was cited as one of the contributory factors which affects the delivery of solid waste management. The projections and resource allocations in municipalities is based on historical data. Respondents noted that migration by community members towards the cities and big towns affects Gauteng province and the Gauteng municipalities more than in other provinces. The net result makes the projections of resources needed for SWM to be difficult due to the actual figures outpacing the projected figures.

Recommendations

The 'necessary resources' and the 'systemic issues' need to be dealt with concurrently so as to have a significant positive impact in solid waste service delivery. The historical projections of resource allocation need to be revisited so that real-time monitoring of data is used when preparing budgets. The real-time data can only be possible if M&E is implemented throughout the SWM value chain. The real-time monitoring data is possible only if the M&E system is fully operational across the strategic, operational and functional level in a municipality. This makes M&E an imperative in SWM service delivery in municipalities.

The costing of solid waste services should be revamped such that each service delivery point can be charged according to the service rendered. In instances where the household needs more than the requisite number of bins, that would be indicative of a larger number of people residing in that household. Possibly, letting and sub-letting of the apartments would be the reason for increased waste coming from that dwelling. This should be constantly monitored such that the costings are adjusted appropriately. If more bins are apportioned to one dwelling that means that more municipal resources are used in servicing that dwelling.

Monitoring and evaluation for informal settlements is also possible by quantifying the volume size of the Skippy bin (big communal bins) and the number of times the truck collects the Skippy bins. The quantification derived from the calculation from the Skippy bin would give a fair indication of the population, consumption patterns and other variables that would assist in projections for future planning. It is M&E that would be the crucial cog in computing solid waste service delivery plans, data and implementation even in informal settlements.

The budget apportioned to SWM in municipalities is limited and retrospective. It attempts to solve problems after they have occurred: like cleaning later (streets, litter, bulk and dumping); minimal separation; and collecting waste when it has been generated.

A deliberate strategic decision has to be taken to gradually move the solid waste management budget away from the tail-end of the SWM process (landfill) towards the front-end of the process (waste avoidance & reduction). This will be in line with the current national prioritisation of the SWM hierarchy and which is in line with current thinking and practice in the SWM domain internationally where the focus is on areas before generation of waste and on areas before collection of waste (cradle to cradle). If done aggressively, this could be achieved within ten years or two terms of an integrated development plan (IDP) of a municipality. The recommended practice will gradually shift the thinking and the current practice of dealing in solid waste in South Africa.

7.2.2 Objective 2: The processes that are involved in the implementation of solid waste management services

The findings on the processes that are used in SWM are influenced by international and national perspectives and also by local (municipal) dynamics. The two perspectives of SWM processes are detailed in the subsequent sections.

7.2.2.1 International and National Perspective

All the processes involved in SWM service delivery are underpinned by legislation and regulatory prescripts. These prescripts are national legislative framework (National Domestic Waste Collection Standards and the National Waste Management Strategy) and the international prescripts (Sustainable Development Goals; 3Rs {reduce, re-use & recycle}; and zerowaste). These regulated prescripts leave little room for management to be creative and innovative in solid waste management service delivery.

7.2.2.1.1 Sustainable Development Goals

The necessity of making the processes that are undertaken in solid waste service delivery modalities overarching is the constant theme about the social impact associated with waste management; the economic dimensions of job and entrepreneur creation; and the environmental impacts associated with solid waste to the human health, fauna, flora and the environment broadly.

The Sustainable Development Goals (economy, equity and environment) are important factors in service delivery in municipalities. Even though the international prescripts are taken into account in solid waste management service delivery, the actual implementation of these prescripts is still at the early stages.

7.2.2.1.2 Waste Hierarchy

The waste hierarchy (waste avoidance & reduction; re-use; recycle; recovery; and treatment & disposal) is the currently accepted model of waste management. Priority in the model is placed in 'waste avoidance and reduction' and this prioritisation is cascaded down the value chain in the model. In South African municipalities the impact is on the recycle component of the hierarchy.

Monitoring and evaluation data is predominantly available for the 'recycle' and in the 'treatment & disposal' components of the hierarchical model. Strengthening the SWM M&E in data collection, collation and interpretation, throughout the SWM value chain would assist in strengthening the other components of the hierarchical model.

7.2.2.1.3 Waste Diversion / Zero Waste

The 'zero waste' concept, which is achievable predominantly through waste diversion, is moving at a slow pace compared to developed countries where the hierarchical model is monitored throughout the value chain. In Gauteng province about 48 per cent (48%) of

general waste reaches the landfill sites and about 23 per cent (23%) is recycled in the process.

7.2.2.1.4 National Waste Management Strategy

The National Waste Management Strategy, together with other related regulations and policies such as the Integrated Waste Management Plans (IWMP) and the municipal Integrated Development Plan (IDP), is influential in the manner, processes and thinking that underpins the solid waste delivery processes. All facets of SWM service delivery are informed by one or more of the documents which regulate SWM.

The SWM regulated environment has had an adverse effect of stifling creativity and innovation within the sector. The unintended consequence of regulation has had an effect of prioritising compliance over and above other creative ways of delivering services. What came out uppermost in compliance is on meeting the domestic waste collection standards as dictated by the prescripts.

7.2.2.2 Municipal / Operational Perspective

Currently, all Gauteng municipalities use similar processes of dealing with solid waste management as detailed in the National Waste Management Strategy.

7.2.2.2.1 Generic Solid Waste Management Model in Municipalities

The generic value proposition for delivery, entails: refuse collection rounds (RCRs with compactor trucks); street cleaning and litter picking; illegal dumping clearing; commercial and bulk clearing; landfill dumping; and garden sites.

Metropolitan municipalities are performing better as compared to the local municipalities because they are better resourced than the locals. The technologies and capacity the

metropolitans possess makes them efficient and effective in SWM service delivery. The Johannesburg Metropolitan Municipality uses drone aircraft as M&E tools for speedy data collection and analysis. This is real-time M&E.

7.2.2.2.2 Energy Harvesting

Metropolitan municipalities are harvesting bio-gas (methane and ethane) from the landfill sites and using it as bio-fuel in transportation and in electricity. Local municipalities are aware of the practise but have not yet started utilising the landfill gas.

Recommendations

- **Streamlining Delivery Mechanism**

The processes that are involved in SWS are generic for all municipalities and over a period of time. The first phase of revamping the delivery model would include two distinct processes that would reinforce each other. These processes are: public involvement in SWM; and separation of waste at source. Public involvement in the form of educating and involving the public in SWM broadly would expedite SWS delivery. Consequently, the public would understand and support the initiative of separating the waste at source. This phase has the potential of drastically reducing the quantity of waste that ends up on the waste landfill sites.

The second phase should be to prioritise technologies that are used in energy harvesting from waste sources. The currently used methods are biogas harvesting and electricity generation from combustion or synthetic gas. Other products that could be produced from synthetic gas includes: fuel, fertilisers, alcohols, waxes, ammonia, synthetic natural gas, and alkenes. This second phase could result in more job creation by strengthening other industries where waste serves as input to these industries.

- **'Day-Zero' Solutions**

Johannesburg and Pretoria, who are two of the three Metropolitan Municipalities in Gauteng, are 10 years away from a major crisis which can be called a 'Day-Zero' in terms of landfilling. The landfill sites used by the two Metropolitan Municipalities are projected to be filled and no

longer usable in 10 years. This will present a catastrophe of imaginable proportions considering that Gauteng contributes about 34.5 per cent (34.5%) of the economy of South Africa and contributes about 45 per cent (45%) of the waste. The solutions to this impending challenge should be, among others:

- Provincial department should design a policy that focusses the municipalities on waste separation;
- Prioritising and moving the SWM budget upstream in the SW value chain;
- Actively support and participate in strengthening the recycling sector; and
- Investigate WtE solutions that would usurp most of the SW that moves towards the landfill sites.

- Inculcating Creativity and Innovation in SWM Service Delivery

The dictates and the prescripts of the SWM regulated environments does not encourage creativity and innovation. This is due to Systems Thinking whose negative feedback mechanisms encourages 'control' (managing more rigidly). If the negative feedback mechanism is coupled with forward information (Chaos mechanism), then innovation and creativity are enabled. In this enabled system, senior managers need only 'manage less' to enable self-organisation. Operating in a Chaos enabled environment should be done as follows:

- Information to-and-fro (feedback loops) have to be encouraged and used continuously. A system has to be designed to retrieve information promptly for decision making;
- Stimuli, such as educating or public participation, has to be fed into the system such that a sustainable perpetual action is attained. This sustainable action will build on itself and produce large results. The resultant responses would be fed back into the system in the feedback loops (as learning), analysed and sent forward through the loops as decisions (innovation or creativity);
- Senior management should not rigidly manage ('control') but should find a mid-point of letting teams self-organise and create innovations and patterns that work for them; and
- Innovation and creativity should be fed forward into the system such that it becomes part of the standard operating procedures (SOPs).

7.2.3 Objective 3: The effectiveness of the SWM M&E system

The solid waste management monitoring and evaluation (M&E) system is not effective in the SWM service delivery function. Five key performance areas (KPIs) are detailed below which are used in this study to measure effectiveness of an M&E system, and the SWM service delivery is lacking in all five KPIs.

The five KPIs are: community participation; employment and entrepreneur creation; inherent components of system (provision of: risk registry, spatial information, audit reports, traffic information, baseline data & tracking mechanisms and data on worst generators of waste); transformation of the municipality; and long-range and coordinated planning.

7.2.3.1 Community Participation

Community participation and involvement in SWM is still at very low levels which then means that municipalities must spend resources in aspects that could be done by communities if they were active participants. In terms of the Local Government: Municipal Systems Act (2000: s2 (b)), the community is part of the municipal make-up. The administration and the council complete the three components of a municipality. Therefore, community participation is an imperative and not only a strategic or an operational matter.

7.2.3.2 Employment and Entrepreneur Creation

There is identifiable progress in employment creation and entrepreneurial creation within the SWM area. In some instances, the municipality plays an active role to encourage and support initiatives, while in other areas individuals take the initiative without the municipality's support.

Employment is predominantly in the recycling area where individuals do kerb-side collection of recyclables like bottles, plastics, metals and cardboards. The kerb-side collection did not come about as an initiative of the municipality, but as an opportunity identified by individual

collectors so as to sell the collected waste to private sector buyers. There is minimal collection of waste at the landfill sites but this is discouraged because of the hazardous conditions and compactors operating within the vicinity.

In the Johannesburg and Ekurhuleni metropolitan municipalities they have engaged co-operatives and small businesses in rendering some SWM function within the locality of the businesses. This has created entrepreneur creation in SWM within some localities.

7.2.3.3 Decision Aiding Components of the System

Provision of information that would assist in an effective M&E system is detailed below.

Table 12: Issues Provided by an Effective M&E System

ISSUE	PROVISION BY M&E SYSTEM
Risk registry	Not readily available
Spatial information	Not available
Audit reports	Not readily available
Traffic information	Not available
Baseline data & tracking mechanism	Baseline data is available, but the tracking mechanism is not available.
Data on worst generators of waste	Not available

7.2.3.4 Municipal Transformation

The amalgamation and the transformation of municipalities that took place during the advent of the municipal sector in the year 2000, affected most municipalities adversely. Institutional knowledge, personnel skills, SWM systems and methodologies were lost during the transitional period. Most municipalities are still recovering from the massive overhaul of the municipal sector.

7.2.3.5 Long-range and Coordinated Planning

7.2.3.5.1 Long-range Planning

There is no long-range planning in municipalities. The planning that is involved in SWM is limited to a 5-year plan which is dictated by the municipal 5-year IDP. Most of the planning that is in SWM is long-term strategically but short-term in delivery. The lack of long-term planning impacts on the short-term planning over a longer period because the challenges experienced at functional level may have emanated on issues that should have been identified and plans put in place to deal with them in good time. In addition, service delivery priority's change with regular changes of management structure. This results in a lack of consistency and a lack of sustained institutional memory.

7.2.3.5.2 Coordinated Planning

Coordinated planning is lacking in municipalities, especially in new residential developments. Municipalities offer four basic services, namely; water, electricity, sanitation and waste. The different municipal divisions offering the four major basic services operate as if they are companies independent of each other. In new residential developments focus is given to water, electricity and sanitation provision. Usually, SWM is the least prioritised when packaging new residential developments such that the issue of access of waste collection trucks and waste disposal areas are relegated to being an after-thought.

7.2.3.6 Monitoring

The two important aspects of monitoring that emerged from the study are the association of monitoring with data collection and the use of data for management decision making. The understanding of monitoring is, to most respondents, synonymous with the day-to-day supervision which limits the effectiveness of the monitoring system.

7.2.3.7 Evaluation

While the general view about evaluation in the study paints a picture of a system that is still in its early stages of development, the results on the aspects of evaluation seem to suggest a well-functioning system on components of the system like: knowing the effectiveness of the system; interim evaluations, final evaluations; focussing on impact; and sustainability.

The study confirms that at a functional and tactical level supervision is perceived as M&E, hence the higher responses on issues pertaining to M&E and its effectiveness. The high ranking of 'effectiveness of M&E' is attributable to the supervision aspects of solid waste management which are at activity level and at individual performance management level, but not at higher management and systemic levels.

In summary, the effectiveness of SWMS cannot be determined accurately at strategic and at operational level because it is a functional and tactical matter, but could be ascertained at functional level where monitoring and then evaluation happen at very close intervals.

Recommendations

To increase the effectiveness of the SWM M&E system a well-functioning data collection procedure coupled with an efficient data analysis mechanism which converts data to useful information and a speedy distribution of the information to decision makers would increase the effectiveness. Increasing the M&E capability has the benefit of speeding up of the service delivery in the entire system. Therefore, increasing the effectiveness of the M&E (positive and negative feedback mechanisms) of the SWM system will result in an increase in service delivery.

7.2.4 Proposed Conceptual Framework of the Solid Waste Management System

Figure 28 below, shows the conceptual framework that emanates from the study. This conceptual framework is a summary of the findings of the study of SWM in Gauteng municipalities using chaos theory framework as a basis.

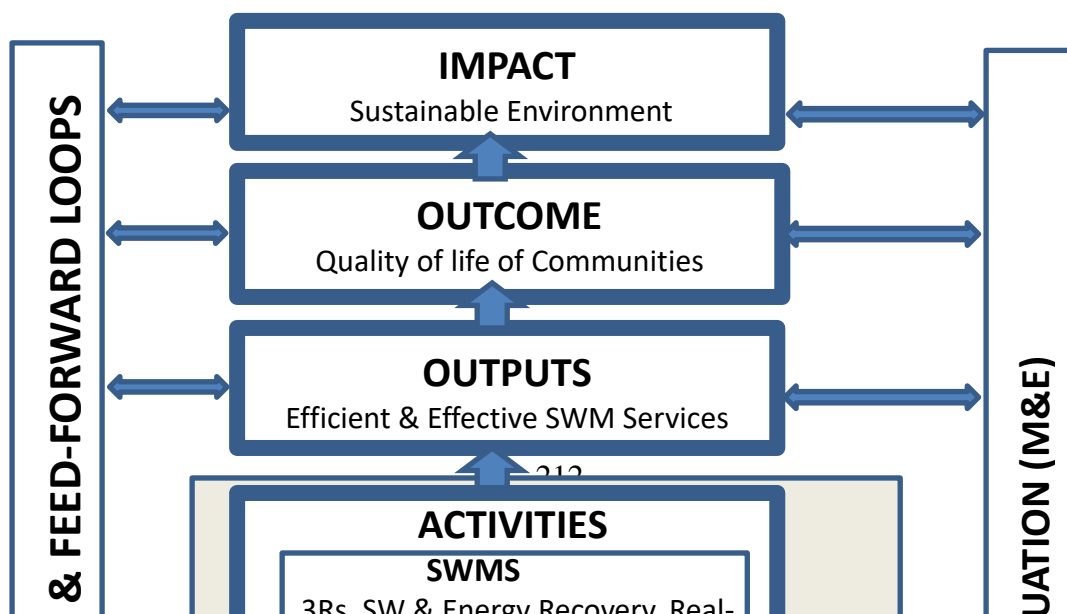
The dimensions of the SPAM framework are: inputs, processes, outputs, outcomes, impacts, negative feedback and positive feedback loops to the model. In systems thinking the negative

feedback loop is important because it assists in controlling the system so that stability or equilibrium is maintained. This serves as a 'braking mechanism'. This mechanism is internal because management can institute measures to control the system.

The positive feedback (chaos theory frame / 'wicked problem'), on the other hand, deals with external factors that assists the system to 'accelerate' and continue to sustain itself. This perpetuation propellant or instigation (butterfly effect) could be initiated from a negative incident like a stinking landfill site (the Durban case) or a positive message to the community which galvanises the community to assist propagate the message further. In the SWM study public education or public participation creates a 'spark' that could initiate the perpetual positive support needed from the community.

The SPAM model or M&E, however, is just a component within the conceptual framework of the study. It should be noted that the SPAM model is simply an M&E tool used within the study. The conceptual framework of the study links the problem situation, the TOC, the M&E (SPAM) and implementation (service delivery).

Figure 28: Systemic Performance Analysis Model for SWM from a Chaos Theory Perspective (Gauteng Municipalities)



Source: SPAM Adapted from Govender (2011: 108)

In using the principles of chaos theory – small changes or initiatives resulting in extensive changes, the identified areas are: public involvement in SWM; initial investment by a municipality; and a focus on energy harvesting. Currently, municipal administration positions itself as the only key stakeholder in SWM implementation in spite of the fact that the South African Local Government: Municipal Systems Act (2000: s2 (b)) defines the community as part of the municipality. If the municipal thinking changes to seeing the community as key partners in implementation this would increase the man-power capacity to millions immediately, hence increasing delivery dramatically. This can only happen when persistent investment in public education and public participation is done consistently with a clear message of making SWM a joint and collaborative venture. The message should be packaging 'waste' as a 'resource' and not as a nuisance to the community. Job creation and the reduction of unemployment would also be associated with the SWS sector.

An M&E model (SPAM) that has a clear focus on: data collection, data collation, data interpretation; institutionalised and cascaded across the institution; and reflected in the scorecard of the institution and in individual scorecards of employees. This M&E or logic framework becomes the tool that is used to apportion and manage the resources that would be needed for implementation.

The Chaos systemic model for SWM derived from SPAM incorporates: M&E from inputs towards impact; negative feedback (braking - **internal**) and positive feedback (accelerator - **external**) mechanisms. Deviations are a normal feature in the system and not seen as outliers or aberrations.

Feedback Loops (Positive and Negative)

It is in the **positive feedback loop** where sustainable changes can be introduced to move the processes (service delivery) forward. In this case, improved stakeholder participation on waste matters coupled with long range planning will take SWM delivery to higher levels. The improved communication should be supported by **inputs** like; resources (funding, capacity and equipment); managed labour relations issues (unions); and systemic issues (legislation, regulations and policies).

The **outputs** will be verified by Gauteng Department of Agriculture and Rural Development so that the results are fed back to the system using the negative feedback loop. The tools that will be used in the **negative feedback loop** are: monitoring (efficiency); evaluation (effectiveness); and coordinating the planning across municipal disciplines.

Feed-forward Loop

A new concept is identifiable from the SPAM model, and is named **Feed-forward loops**, where double arrows are shown radiating to-and-from the inputs, activities, outputs, outcomes and impact. The inward arrow points to the negative feedback which flows from the impact towards the inputs (downward flow). This is for both negative and positive (feedback) **information** relayed along the system but moving downwards. This should not be confused with resources, risks and assumptions that move up along the SPAM (logic framework) model.

The same double-sided arrow conveys information outwards and upwards from inputs towards impact. The information conveyed upwards pertains to innovation, patterns and creativity after management had analysed information that had been received from the negative feedback loops (learning). The double entry (learning) and exit of information upwards (innovation, patterns and creativity) is the basis for Chaos Theory in management implementation. This should be applicable in natural systems (Weather and Stock markets) and in Human Systems (Organisations and Social sciences).

Finally, the implementation will have three distinct areas, namely: persistent communication to all stakeholders on progress and challenges; clear municipal, provincial or national goals; and consistent monitoring and feedback of the information gathered resulting in an increased speed of implementation. The implementation speed is about using the concept of a 'self-perpetuating loop' or 'accelerator' (chaos theory) to reinforce and build on the achievement already attained. Coupled with the implementation is the identification of a suitable SWM delivery model of using a municipal-owned entity, outsourcing the SWM function or managing the process internally.

7.2 DIRECTION FOR FUTURE RESEARCH

The study highlighted several research opportunities that could be followed up which affect Local Government and the SWM services. These opportunities are detailed below.

Firstly, research could be undertaken to explore the effects of transformation in service delivery in the SWM terrain, and in local government broadly. The South African transformation in 1994 brought with it changes across the breadth of society and government and the impact of this transformation provides opportunities for further research.

Secondly, the SWM service delivery model in local government could be researched further using the efficiency and the effectiveness model or other optimisation models in service delivery.

Thirdly, the use of chaos theory in other municipal trading areas (sanitation, electricity and water) of service delivery in local government. Current practice is the use of systems theory while this study focussed on chaos theory.

Fourthly, the municipality's and public's perception and perspectives of service delivery should be investigated. Perspectives of other important stakeholders like the AGSA could be incorporated in the study.

Finally, a confirmatory study on the use of Chaos Theory in SWM M&E in municipalities could be investigated. This would be grounded on the findings of this study.

7.3 CONCLUSION

The final chapter in the study outlines the findings of the study in line with the research questions in the study; gave appropriate recommendations which are in line with the research objectives; and identified potential areas of future research. A service delivery-based model in solid waste management is presented which will assist in the development and refinement of service delivery in local government in Gauteng, and in the broad local government sector in South Africa. The results of the study should influence and give direction to future planners and role players in the solid waste management sector.

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ANNEXURE A: Permission Letter to Conduct Research from the Department of Cooperative Government and Traditional Affairs



cooperative governance

Department:
Cooperative Governance
REPUBLIC OF SOUTH AFRICA

TO ALL MUNICIPAL AND CITY MANAGERS IN GAUTENG PROVINCE

Dear Sir / Madam

**Re: Doctorate in Public Administration: Mr. Dumisani Milton Nkomo
Student No. 21450943**

Monitoring and Evaluation of Solid Waste Management Services to Enhance Service Delivery in Municipalities: A Case Study of Gauteng Province in South Africa.


This letter serves to confirm that Mr. D.M. Nkomo, who is a registered student at the Durban University of Technology, is currently conducting research in the field of Local Government with a focus on M&E of solid waste management service delivery in the Gauteng Municipalities.

It is hereby confirmed that Mr. D.M. Nkomo has been granted permission to conduct the research related to the above field and to access information related to his research. Mr. D.M. Nkomo has also been granted permission to submit questionnaires to Municipal officials and to interview identified officials that are relevant to the research.

The research is relevant to the National and Provincial Governments initiatives to ensure the municipalities operate according to their constitutional mandate and to strategically align their service delivery with the National and Provincial priorities. The study would be useful to municipalities in dealing with M&E and on service delivery of Solid Waste and related issues.

Please be guided accordingly.

Yours sincerely


Bongiwe Mculu
Senior Manager: Community Work Programme
Date:

ANNEXURE B: Permission Letter to Conduct Research from the South African Local Government Association (SALGA – GAUTENG).



Enquiries: Lucky Leseane
Reference: 2/17/3
Gauteng
3rd Floor Braampark
Forum 2, 33 Hoofd Street
Braamfontein, 2017
Tel: 011 276-1150
Fax: 011 403-3636
E-mail: Lleseane@salga.org.za

www.salga.org.za

20 November 2014

TO ALL MUNICIPAL AND CITY MANAGERS IN GAUTENG PROVINCE

MONITORING AND EVALUATION (M&E) OF SOLID WASTE MANAGEMENT SERVICES TO ENHANCE SERVICE DELIVERY IN MUNICIPALITIES: A CASE STUDY OF GAUTENG PROVINCE IN SOUTH AFRICA.

SALGA Gauteng Province would like to introduce Mr. D.M. Nkomo, who is a registered student at the Durban University of Technology (Student No. 21450943). He is currently studying for his doctorate in Public Administration. The field of his research is in Local Government with specific reference on Monitoring and Evaluation (M&E) of solid waste service delivery within the Gauteng Municipalities.

His research will entail conducting interviews, sending questionnaires and in some instances asking for supporting documents relevant to the research. All the information that will be exchanged or gathered will be treated with strict confidentiality to both individual and the institution broadly.

The research is relevant to the National, Provincial and Local Government initiatives. The findings of the research will assist the municipalities to look at alternative ways of discharging their constitutional mandate and to strategically align service delivery with the National and Provincial priorities. Furthermore, the study would be useful to municipalities in dealing with M&E and on service delivery of Solid Waste and related issues.

SALGA will facilitate that the findings of the research will be presented to municipalities so that insights are taken up by all municipalities within Gauteng Province.

We support this endeavor and trust that you will give him the necessary support to conduct the research.

Yours sincerely

Lucky Leseane
Provincial Executive Officer
SALGA Gauteng Province

Eastern Cape
First Floor, 3 Berea Terrace
Berea
East London: 5214
Tel: 043 727-1150
Fax: 043 727-1156

Free State
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Bloemfontein: 9300
Tel: 051 47-1960
Fax: 051 430-8250

Gauteng
3rd Floor Braampark
Forum 2, 33 Hoofd Street
Braamfontein: 2017
Tel: 011 276-1150
Fax: 011 403-3636

Limpopo
49 Standard Bank Building 2nd Floor
Corner Landros Mare and Thabo Mbeki Street
Polokwane: 0699
Tel: 015 291-1400
Fax: 015 291-1402

Mpumalanga
Salga House
11 Van Rensburg Street
Nelspruit, 1200
Tel: 013 752-1200
Fax: 013 752-5595

North West
Jade Square, Suite 400
Corner OR Tambo & Margaretha Prinsloo Street
Klerksdorp: 2570
Tel: 018 462-5290
Fax: 018 462-4662

Northern Cape
Crescent House
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Tel: 053 833-2505
Fax: 053 833-3828

Western Cape
7th Floor
11 Adderley Street
Cape Town: 8000
Tel: 021 469-8800
Fax: 021 461-1936

ANNEXURE C: INTERVIEW GUIDE

Interview Guide (Qualitative)

KEY COMPONENTS	PROCESS
<ol style="list-style-type: none"> 1. Thanking Respondent 2. Introduction by researcher 3. Purpose 4. Confidentiality 5. Duration of the interview 6. How the interview will be conducted 7. Opportunity for questions from the respondent 8. Signature of consent. 	<p>The researcher will thank the respondent for the opportunity granted for the interview, introducing himself and stating the purpose of the interview.</p> <p>The confidentiality, the duration of the interview and how the interview will be conducted will be explained to the respondent.</p> <p>The respondent will be given an opportunity to ask any question or questions for clarity.</p> <p>Finally, the researcher will ask the respondent to attach a signature demonstrating the willingness to be part of the study.</p> <hr/> <p style="text-align: center;"> Interviewee Researcher Date </p>
<p>QUESTIONS</p> <ul style="list-style-type: none"> • 16 open-ended questions. • Factual questions are asked before opinion or reflection questions. • Probing or clarity seeking questions follow after opinion or reflection questions. 	<p style="text-align: center;">Factors influencing provision of SWS</p> <ol style="list-style-type: none"> 1 What factors hinder the provision of SWS in your institution? 2 Which factors, under the control of management, assists in provision of SWS? 3 How can M&E influence the provision SWM? 4 What critical factors of M&E need to be incorporated to help improve service delivery of SWM? 5 Would a systematic approach assist in institutionalising M&E in SWM service delivery? <p style="text-align: center;">Implementation Process</p> <ol style="list-style-type: none"> 6 What is the current regime of delivering SWM? 7 Which of the processes identified could be improved? 8 Where would M&E fit in the improved model or system?

	<p>9 Which critical factors need to be in place to deliver effectively?</p> <p>Effectiveness of M&E</p> <p>10 What are the crucial things necessary in having an effective M&E system?</p> <p>11 Which is the right way of instituting a M&E system?</p> <p>12 How can the right systems and support structures of M&E be put in place?</p> <p>13 How will M&E system enhance service delivery in SWM?</p> <p>Model of M&E woven into SWM</p> <p>14 How do you conceptualise a SWM M&E system that supports service delivery in your institution?</p> <p>15 How can that system or model be institutionalised?</p> <p>16 What critical factors would need to be in place to have the system feasible?</p>
<p>CLOSING KEY COMPONENTS</p> <ul style="list-style-type: none"> • Additional comments • Next steps • Thanking respondent 	<p>Researcher will ask for additional comments, explain how data will be used and incorporated into the study.</p> <p>The researcher will thank the respondent for participating in the study.</p>

The interview guide is adapted from Boyce and Neale (2006)

ANNEXURE D: QUESTIONNAIRE

SECTION A: INSTITUTIONAL OR BIOGRAPHICAL INFORMATION

1. Name of municipality or entity: _____
2. Department: _____
3. Your current position: _____
4. Number of years in your current position (please tick relevant box):
 - 1 year
 - 1 to 3 years
 - 4 and 5
 - 6 years and less than 10 years
 - 11 years and more.
5. Your highest educational level attained (please tick relevant box or boxes):
 - Grade 12,
 - National Diploma;
 - Degree;
 - Post graduate degree;
 - Other – please specify _____
6. Age group (please tick relevant box or boxes):
 - 18-25;
 - 26-35;
 - 35-45
 - 46 and above.
7. Gender (please tick relevant box or boxes):
 - Male
 - Female

SECTION B: FACTORS INFLUENCING THE DELIVERY OF SOLID WASTE SERVICES (SWS)

Abbreviations

SWS – Solid Waste Services

SW - Solid Waste

SWM - Solid Waste Management

Ranking 1 – 5 (1 denoting strongly disagree and 5 denoting strongly agree)

Code		StronglyDisagree Strongly Agree				
		1	2	3	4	5
	TO WHAT EXTENT DO THE FOLLOWING ISSUES INFLUENCE SOLID WASTE MANAGEMENT (SWM) DELIVERY IN YOUR INSTITUTION?					
	FACTORS INFLUENCING DELIVERY (INPUTS)					
F 1	Budget allocation					
F 2	Technology					
F 3	Equipment					
F 4	Up-to-date research in the SWM field.					
F 5	Capacity (resources and culture in the municipality)					
F 6	Capability (knowledge and behavior of staff)					
F 7	Urbanisation					
F 8	Unemployment					
F 9	Population growth					
F 10	Negative feedback or Learning from within the unit					
	CHALLENGES INFLUENCING DELIVERY (THEORY OF CHANGE)					
CI 1	Implementing the National Strategy on Waste Management					
CI 2	Implementing Laws and Regulations.					
CI 3	Leadership (Politically and Management).					
CI 4	Communication from National to Municipal SWM unit.					

SECTION C: IMPLEMENTATION PROCESS

Code		Strongly Disagree to Strongly Agree				
		1	2	3	4	5
	TO WHAT EXTENT DO THE FOLLOWING ISSUES INFLUENCE SOLID WASTE MANAGEMENT (SWM) DELIVERY IN YOUR INSTITUTION?					
	International Discourse (Activities)					
IP 1	Sustainable Development (Sustainable Development Goals)					
IP 2	Zero production of waste (such that there is no dumping of waste later – inverting the waste hierarchy)					
IP 3	Penalising the polluters.					
IP 4	Influencing the waste value chain (prior to generation, at generation, at handling and at the next generation cycle - [Lifecycle model or cradle-to-cradle])					
IP 5	Linking SWM with the Economy, Environment & Social factors.					
	South African Discourse (Activities)					
SA 1	Zero waste generation by 2022 (Polokwane Declaration 2001).					
SA 2	Creation of a recycling economy.					
SA 3	SA waste management strategy – diverting waste to re-use, recycle and recovery.					
SA 4	Influencing waste stream (prior to generation, at generation, at handling and at dumping (Cradle-to-grave)					
SA 5	SWM and job creation for communities					
	District and Local Municipalities (Activities)					
DL 1	SWM is basically a cleaning function.					
DL 2	SWM is about maintenance of the current practices.					
DL 3	Data collection is a priority.					

SECTION D: MONITORING AND EVALUATION

GENERAL INFORMATION

Definition of Monitoring and Evaluation (M&E)

M&E could be understood as the measuring or assessment of how we do things and how we were able to achieve what we had planned to do within a reasonable time, finances and people.

Monitoring

A continuous planned process of data collection, collating, analysing and interpreting it for assessment and reporting purposes.

Evaluation

A planned periodic assessment of data during implementation and after implementation to ascertain if the project or programme met the goals identified during inception.

Code		StronglyDisagree Strongly Agree				
		1	2	3	4	5
	MONITORING AND EVALUATION (M&E)					
	PRE-REQUISITES OF AN M&E SYSTEM (INPUTS)					
PR 1	There is a policy on M&E in the municipality					
PR 2	Clear standards of assessment on M&E.					
PR 3	There is an Independent Evaluation Committee.					
	DRIVERS FOR M&E SYSTEM					
DS 1	The reasons for M&E are driven by learning and doing things better the next time we do it again.					
DS 2	M&E is about compliance than service delivery.					
DS 3	The culture in the SWS department is conducive for an effective M&E.					
DS 4	The indicators that show how we are progressing are clearly understood.					
	IMPLEMENTATION OF AN M&E SYSTEM (OUTPUT / OUTCOME)					
IS 1	The results and findings of the evaluation are made known to all (Transparency).					
IS 2	M&E is a daily exercise for individual employees.					
IS 3	M&E helps in service delivery / implementation.					

Code		StronglyStrongly				
		Disagree		Agree		
		1	2	3	4	5
	MONITORING (IMPLEMENTATION)					
M 1	Data is collected throughout the SWM process (from collection to disposal).					
M 2	Reliable (or quality) data is collected throughout the SWM process.					
M 3	Monitoring capability exists within the SWM unit (collect, collate, analyse and interpret data).					
M 4	Monitoring is a continuous process which supplies data to SWM decision makers.					
M 5	Reports from the monitoring function are used by decision makers.					
	EVALUATION (IMPLEMENTATION)					
E 1	Focus of evaluation is on relevance.					
E 2	The priority of evaluation is on effectiveness.					
E 3	Impact is important in evaluation					
E 4	Evaluation is linked to sustainability of the programme.					
E 5	Interim evaluations are done at set times (formative evaluation)					
E 6	Final evaluations of SWM are done at the end of the financial year (summative evaluations).					
E 7	Evaluation helps in decision making					
E 8	Evaluation is for compliance purposes as opposed to results orientation					
E 9	Evaluation is about doing things right					

THANK YOU! PLEASE SEND COMPLETED AND SIGNED DOCUMENT TO:

FAX: 086 600 1788

OR

EMAIL: CUTEDGE@WORLDONLINE.CO.ZA

ANNEXURE E: Ethical Certificate

Please initial alongside if the project is to be registered as secret	
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Please ensure that you have completed, in every respect, all of the following prior to submission of your Research Proposal. Students are advised to use the electronic version of the PG 4 form which is available from the DUT website or from the Faculty Officer.

Please complete **ALL SECTIONS**, using Arial 10-point font, single line spacing in MS Word. Where sections are not applicable please adapt the form accordingly.

1. Proof-read your hard copy, ensure correct referencing, edit rigorously and then submit to your Supervisor(s).
2. Number all pages and show correct author source references both in the text proper and in the References at the end using the Harvard referencing method (IEEE for Engineering students).
3. Complete the Ethics Section, the Work Plan and the Budget correctly in every respect and again engage in a thorough spell check prior to submission to your Supervisor/Co-Supervisor(s).
4. Please note carefully the closing dates, as outlined in the Academic Calendar, contained in the Rule Book for Students, the registration dates as well the expected duration for the completion of the project.
5. It is imperative that you adhere to your specified guidelines for completion of your research and institutional/faculty deadlines as published on the DUT website.

Declarations

Student Declaration

I, the undersigned, certify that:

- I am familiar with the rules regulating higher qualifications at Durban University of Technology, and understand the seriousness with which DUT will deal with violations of ethical practice in my research.
- Where I have used the work of others this has been correctly referenced in the proposal and again referenced in the bibliography. Any research of a similar nature that has been used in the development of my research project is also referenced.
- This project has not been submitted to any other educational institution for the purpose of a qualification.

- All subsidy-earning outputs (artefacts and publications) from postgraduate studies will be in accordance with the Intellectual Property Policy of the Durban University of Technology.
- Where patents are developed under the supervision of the Durban University of Technology involving institutional expenditure, such patents will be regarded as joint property entitling the Durban University of Technology to its share, subject to the Durban University of Technology's policy on the Management and Commercialisation of Intellectual Property.
- I understand that I am expected to publish an article based on my research results.
- I understand that plagiarism is wrong, and incurs severe penalties.

I HEREBY DECLARE THAT THE ABOVE FACTS ARE CORRECT.

Signed: _____ Date: 21 January 2018

Supervisor Declaration

- (a) I approve the student's provisional title of research project.
- (b) I acknowledge that the topic is researchable and the student has the potential to complete the dissertation in the suggested time frame allowed.
- (c) I am satisfied with and approve the research proposal;
- (d) *I approve of the Co-Supervisor(s) proposed by the HoD and student.
- (e) I have checked that the student has complied with all the instructions outlined in the Postgraduate Student Guidelines and those appended to the Research Proposal, and confirm that the Research Proposal is ready for submission to the FRC.
- (f) I accept responsibility to advise and guide the student.
- (g) I accept the appointment of Supervisor.

**delete and sign alongside if not applicable*

Signed: _____ Date: _____

Head of Department Declaration

I, _____ (Full name of Head of Department) have read the research proposal and I hereby submit it to the FRC for approval.

Signed: _____ **Date:** _____
(HoD)

The abovementioned proposal (including the ethical considerations) has been considered and approved by the Faculty Research Committee.

Signed: _____ **Date:** _____
(Chairperson: Faculty Research Committee)

Date of Approval by FRC	
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Routing	Student		Supervisor		HoD		FRC		HDC	
<i>pp 1-2/3 only</i>										

N.B. The attached checklist (Checklist and Evaluation of Research Proposal) must be completed and signed by the departmental reviewer(s) and HoD before the proposal is approved by the FRC.

Checklist and Evaluation of Research Proposal						
Reviewer / Review Panel Chair				Title		
Tel (W)		Tel (H)	Cell	Fax		e-Mail
				Yes	No	Unclear
				Yes	No	Unclear
1.	Research Topic					
1.1	Is the research problem/question clearly stated?					
1.2	Is the problem/question researchable?					
1.3	Is the topic relevant?					
1.4	Is the scope appropriate for the qualification?					
1.5	Is the research appropriately delimited?					
1.6	Are the research aims clear?					
1.7	Are the assumptions stated (if any)?					
1.8	Is the terminology adequately defined?					
2.	Literature					
2.1	Is the literature relevant to the problem?					
2.2	Has an adequate conceptual framework been developed?					
2.3	Is the literature current, apart from seminal works in the field?					
2.4	Has the relationship between the research topic and previous research been outlined?					
2.5	Are textual referencing and bibliographic citation correct and consistent?					
3.	Methodology					
3.1	Does the research design address the research problems/questions?					
3.2	Are the data collection/production methods appropriate?					
3.3	Are the data analysis methods appropriate?					
3.4	Have ethical considerations been addressed? ¹					
4.	General					
4.1	Is the proposal generally free of language/typographical errors?					
4.2	Is the proposal free of plagiarism? ²					
4.3	Is the research manageable in terms of timeframe?					
4.4	Is the budget allocated realistic?					
5.	Funding					
5.1	Is the proposal financially viable?					

¹ Indicate whether ethical clearance through a research ethics committee is required.

² In the case of plagiarism, the proposal should be returned to the candidate with a warning. The candidate will need to re-submit (see Policy on Plagiarism).

Recommendations	
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Signed (Reviewer): _____ **Date:** _____

Signed (HoD): _____ **Date:** _____

LETTER TO PARTICIPANTS



18 February 2015

Faculty of Management Sciences
Department of Public Management & Economics

Dear Participant

SURVEY ON MONITORING AND EVALUATION OF WASTE MANAGEMENT SERVICES IN GAUTENG.

1. The purpose of this survey is to solicit information from municipal officials and municipal managers who focus on monitoring and evaluation of the waste management service within a municipality. The primary aim of the survey is to investigate how monitoring and evaluation contribute to service delivery of this service, within the Gauteng Province.
2. The information and ratings you provide will help in identifying the factors that contribute to the challenges of waste management service delivery. The estimated time to complete the questionnaire is about 25 minutes. Please make sure not to leave any question unanswered.
3. Your participation in this research is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequences. Confidentiality and anonymity of your inputs and records will be maintained by the Durban University of Technology.
4. If you have any questions, queries or concerns, you may call me or my supervisor at the numbers listed below.
5. Thank you for your participation.

D.M

**NKOMO
STUDENT**

Contact Details

Cell No.: 082 567 9515

Email Address: cutedge@worldonline.co.za

Fax No.: 086 600 1788

Supervisor / Promoter

Dr. I. Govender

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Co-Supervisor / Co-Promoter

Contact Details

Cell No.:

Email Address: