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**DEVELOPING AN ENVIRONMENTAL MANAGEMENT
ACCOUNTING FRAMEWORK FOR THE WASTE MANAGEMENT
SUSTAINABILITY OF MUNICIPALITIES IN GAUTENG**

By

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degree of **Master of Commerce (MCom) Accounting**

**School of Accounting, Economics, and Finance
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2022

DECLARATION

I, Thomas Nyahuna, declare that:

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DEDICATION

I dedicate this study to my late uncle, Daniel Jon. I know you would have been very proud. I know you are smiling from above.

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First and foremost, I thank the Almighty God for providing me the opportunity and strength to get on and complete this Master's research journey.

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ABSTRACT

Municipalities through local government play a significant role of solid waste management, among other roles. This is important to avoid emergence of negative waste-related environmental impacts. However, this is true for municipalities in Gauteng. Improper municipal solid waste management is leading to negative environmental and social impacts on communities such as rising pollution, emissions, blocked drains and related diseases. From an accounting standpoint, the traditional management accounting system is incapable of handling the environmental concerns hence environmental management accounting (EMA) was developed to overcome these limitations. Therefore, EMA is a new research area particularly in the local government. The primary aim of this study is to develop an EMA framework for the waste management sustainability of the municipalities in Gauteng. This is done by initially understanding how EMA can be used to improve waste management in the municipalities. More specifically, the study through secondary objectives aims: (1) to identify the nature of information used to report waste management issues, (2) to explore the current EMA practices used to improve waste management and (3) to examine the benefits of adopting the EMA practices. The study utilised a qualitative approach based on a constructivist grounded theory research design. Data was collected through documentary analysis. Using a purposive sampling, annual reports of five municipalities spanning 2015 to 2021 were used to achieve theoretical saturation. The overall findings show that EMA practices such as waste management system, environmental audits and employee environmental training are presently used to improve waste management. In addition, the results indicate that non-monetary environmental information is mostly used to report waste management issues in municipalities in Gauteng. This shows inefficiency in collecting of monetary information. Applying EMA practices in the municipalities has led to environmental benefits such as reduction in contribution to climate change, improvement in environmental performance and compliance with national legislation. Based on the findings, the study recommends that a national or provincial waste information database be developed, including definition and classification of different kinds of waste to overcome the limitation of absence of monetary waste management data in municipalities.

Keywords: Environmental management accounting, waste management, municipalities, Gauteng, environmental performance, grounded theory, framework

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LIST OF ACRONYMS AND ABBREVIATIONS

CIMA	Chartered Institute of Management Accountants
DEA	Department of Environmental Affairs
EA	Environmental Accounting
EMA	Environmental Management Accounting
EMAP	Environmental Management Accounting Practices
EMP	Environmental Management Practices
GHG	Greenhouse Gas
IFAC	International Federation of Accountants
MEMA	Monetary Environmental Management Accounting
MSWM	Municipal Solid Waste Management
PEMA	Physical Environmental Management Accounting
SALGA	South African Local Government Association
SWM	Solid Waste Management
TMAS	Traditional Management Accounting System
UN	United Nations

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CHAPTER 1: INTRODUCTION

1.0. Introduction and background

Environmental accounting is without a single definition. In many contexts, environmental accounting is taken to mean “the identification and reporting of environment-specific costs, such as liability costs or waste disposal costs” (Burrit, Christ & Varsei, 2016). Environmental accounting is a tool used to widen the scope of the accounting frameworks applied to evaluate economic performance, so as to factor in components that are ignored in the traditional management accounting system (Gunarathne & Lee, 2015). The traditional management accounting system is incapacitated to address environmental management. This gap develops because the numerous costs of environmental impacts are not properly captured within the traditional management accounting system.

One of environmental accounting’s subset namely Environmental Management Accounting (EMA) emerged to specifically address and capture environmental benefits and costs within the corporate sector. These costs are regularly hidden in the overhead accounts within traditional management accounting system. As a result, EMA was developed in direct response to limitations of traditional management accounting system (Lee & Schaltegger, 2018). Birkin (1996) indicates that “EMA is a straightforward development of management accountancy”. This prompted Gunarathne and Lee (2015) to view EMA as a conduit between management accounting and environmental management. For this study, EMA relates to the “identification, collection, analysis and use of a broad scope of information for internal decision-making” (Schaltegger & Burrit, 2000). A major distinguishing feature of EMA is that environmental costs such as effects of outside environmental degradation need to be internalized by the company unit that generates them (Kelsall, 2020; De Beer & Friend, 2006). In this context, EMA promotes setting of municipal charges to residents that sufficiently mirror the total ecological costs of solid waste management better than the traditional management accounting system (Qian, Burritt & Monroe, 2018).

Conversely, the traditional management accounting system has been inadequate and limited in providing and reporting information for environmental performance (Schaltegger, 2018; Christ & Burrit, 2013). Under traditional management accounting system, environmental costs are dumped in overhead accounts and therefore shared by all product lines, as a result, contributing to inaccurate estimation of product/services prices and lower profitability (De Beer & Friend, 2006). In addition, this promotes cross-subsidization of costs that is financing one less profitable product or service with the profits created by a different product/service due to inappropriate apportionment of environmental costs from overhead accounts back to processes, services, products and product lines. That is to say, traditional management accounting system lacks the ability to fully reveal the costs and benefits of managing the environment (Lee & Schaltegger, 2018; United Nations (UN), 2001). Put differently, traditional management accounting system inadequately tracks and hides environmental costs. Consequently, with the hiding of this information by traditional management accounting system, corporate decision makers are left with little or no information on the environmental costs and thus no motivation to manage and minimise them (International Federation of Accountants (IFAC), 2005; Wagner & Blom, 2011).

Given the above inadequacy of traditional management accounting system, insufficient environmental information obtained from traditional management accounting system can inhibit effective decision making such as investment on environmental management capital expenditure as information on environmental benefits and costs need to be first evaluated (Burrit et al., 2016). Based on the aforementioned weaknesses of traditional management accounting system, local government officials are inclined to factor in only operational costs in waste management when making waste management decisions (Ball & Craig, 2010). This suggests that environmental costs are omitted in waste management decisions. In this manner, Burrit, Hahn and Schaltegger (2002) argue that organizations are unaware of the impact on income statement and balance sheet of their ecological-related actions. In this way, many opportunities for reducing costs and improving business practices are being lost (De Beer & Friend, 2006) because municipalities might fail to recognize cost minimisation and additional enhancement

opportunities; apply wrong service pricing and solid waste management decisions (Qian et al., 2018).

Solid waste management means “the collection, transportation, processing, disposal, and monitoring of waste materials” (Rasmenia & Madyira, 2019). In this regard, municipal solid waste management consists of every action that intends to lessen social and environmental impacts of solid waste management (Bartolacci, Paolini & Quaranta, 2018). In many countries such as India, China, Nigeria and Portugal, waste management is the key task of local government (Wang et al., 2020). However, in developing nations like South Africa, Ghana, Indonesia and Bangladesh, it is one of the most poorly carried out services (Bartolacci et al., 2018; Maleka, Nyirenda & Fakoya, 2017).

Increasing waste generation due to accelerating economic growth and rising population remains a major global challenge in developing countries such as India, Malaysia and China (Bowen et al., 2020). This dictates for local authorities to establish efficient and sustainable Municipal solid waste management systems focused on minimising environmental effects of waste management. More so, as most local authorities around the world face the severe challenges of managing solid waste management (Bowen et al., 2020). Researchers in the field agree that municipal solid waste management is a growing environmental and financial burden in most developing countries (Bartolacci et al., 2018; Bowen et al., 2020; Rasmenia & Madyira, 2019) such as South Africa (Mbulawa, 2019; Malope, 2020; Gumbi, 2015). Municipal solid waste management poses enormous challenges for environmental protection and sustainable development in South Africa. For this reason, Maleka et al. (2017) insist that the subject of solid waste management demand significant attention in South Africa. Hence, some four years later, Adeleke et al. (2021) conclude that to attain sustainability through economic improvements there is a need to modernize solid waste management through improved data collection in South African municipalities. In addition, the study opines that this might help to reduce the growing municipal solid waste management challenges in South Africa.

South Africa faces a growing challenge in municipal solid waste management, with serious public health challenges and environmental implications (Rasmenia & Madyira, 2019; Gumbi, 2015). But, locally, the municipal solid waste management problem is especially critical in Gauteng province due to its highest population growth, progressing economic development and rapid urbanization (Malope, 2020; Adeleke et al., 2021; Gumbi, 2015; South African Local Government Association (SALGA), 2015). Gauteng generates 45% of South Africa's total municipal waste (Malope, 2020; Maleka et al., 2017). Unfortunately, the increase in waste generation has not been followed by equivalent handling capacity. Consequently, Malope (2020), Ayeleru, Okonta and Ntuli (2018), Rasmenia and Madyira (2019) and Adeleke et al. (2021) argue that municipal solid waste management is not managed properly in Gauteng, thus, producing associated diseases, pollution, loss of biodiversity and obstruction of drains contributing to flooding. Mbulawa (2019) argue that this contributes to a downswing in productivity and economic development.

Approximately, 3% of South Africa's greenhouse gas emissions (GHG) originate from the improper waste management with Gauteng contributing the highest share of 46% (Rasmenia & Madyira, 2019; STATSSA, 2018). Tsheleza et al. (2019) supported this view by estimating that if this unchanged will result in an increase in communicable diseases by over 20% by 2030. From the above mentioned discussion, it can be argued that Gauteng municipalities are failing to effectively address and reduce solid waste management problems. Thus, it is clear that a different and sustainable hands-on approach to resolve the solid waste management problem is needed in municipalities in Gauteng.

Importantly, a sustainable solution is vital for the reason that these emissions disturb earth's climate leading to climate change. Furthermore, Rasmenia and Mayira (2019) maintain that air pollutants originating from waste sites, for instance hydrogen sulphide emissions, can destroy the respiratory system leading to lung disease, asthma and diabetes. If not mitigated, these ecological concerns jeopardize the class and nature of life for present and yet to come generations. Similarly, Malope (2020) establishes that the after-effects of poor municipal waste management are disastrous in Gauteng in

terms of the impact on climate change and ecosystem. Ayeleru et al. (2018) report that Gauteng is at the centre of a critical waste crisis, with the South Africa Department of Environmental Affairs 2018 report noting that only 10% of waste is recycled. Given this, solid waste management has become a major environmental and social problem in Gauteng (Malope, 2020; Gumbi, 2015). This means municipal solid waste management is ineptly organized in many features and lacks right procedures for effective collection, transport, recycling, and disposal in Gauteng (Dlamini, Simatele & Kubanza, 2019). For these reasons, Adeleke et al. (2021) accentuate that proper environmentally and economically sustainable solid waste management is immediately required in the municipalities in South Africa in general and Gauteng to particularly overcome the growing related problems.

Recent empirical studies attributed, among other factors, the lack of effective municipal solid waste management in Gauteng to inefficient cost management (Mbulawa, 2019). Other scholars have attributed the lack of effective solid waste management to unsustainable budgets and poor billing (SALGA, 2015). These factors are in some way linked to a lack of communication between management accountants and environmental management department. In this way, environmental costs are either under or overestimated as the environmental management department is not involved in identifying and estimating the costs (Tsui, 2014). Consequently, this affects waste management performance of municipalities. However, Adeleke et al. (2021) also further put forward the absence of dependable and correct waste-related information in City of Johannesburg as a key factor impeding municipal solid waste management efficiency. To this end, Gauteng municipalities lack systems to improve environmental and economic viability from solid waste management (Mbulawa, 2019).

In a bid to reduce the poor waste management performance in municipalities, the Polokwane Declaration of 2001 on Waste Management was established. Kubanza and Simatele (2019) report that the Polokwane Declaration “set targets of 50% waste to landfills by 2012 and zero by 2022.” However, these targets have not been met and have been revised to a target of 50% of waste to landfill by 2025 (Adeleke et al., 2021). Also, Dlamini et al. (2019) presented “Waste-to-energy” (WTE) technologies as a way

to resolving the current problems of waste management in Johannesburg. Nevertheless, despite these efforts in improving the South Africa's and specifically Gauteng waste management systems, it is still being persistently confronted with some problems and limitations.

However, management accounting can perform a significant role in responding to the waste crises in Gauteng municipalities by incorporating environmental impacts into the adjusted traditional management accounting system encompassing environmental phenomena. In this sense, EMA emerges as an attractive possible pathway to address and mitigate the increasing problems of waste management in Gauteng municipalities. This is because an absence of an EMA framework generates impediments and "creates difficulties in effectively collecting, identifying and evaluating environment-related data" (Setthasakko, 2010). Availability of environment-related data may enrich solid waste management through providing quality waste-related environmental information for decision making (Qian et al., 2018). Hence, this study argues that EMA practices enhance municipal solid waste management.

This study examines how EMA can improve municipal solid waste management in order to reduce environmental problems such as pollution, resource depletion and public health problems in Gauteng. This can be achieved by ensuring, through the proposed EMA framework, that environment-related waste data is collected and evaluated in light of waste management decisions. The collection of this monetary and non-monetary environment-waste related information will assist to ensure that decision making on waste management related issues is takes into account this information. In short, it is assumed in this study that EMA, by improving waste management data collection, will in a way address the municipal solid waste management problem in Gauteng. This study aims to reduce the environmental footprints by developing an EMA framework for municipalities in Gauteng. The proposed multi-objective EMA framework is anticipated to improve municipal solid waste management and proper cost estimation. This is expected to emerge from incorporating monetary and non-monetary waste related information in waste management decisions. Thus, the EMA framework is

proposed to integrate both monetary and non-monetary waste related environmental data in a single decision making trail.

1.1. Problem statement

The municipalities in Gauteng face dire solid waste management challenges. Since 2002, municipalities in Gauteng have been recycling about 10% of the waste (South Africa Department of Environmental Affairs, 2018). As a result, this has contributed significantly to the country's greenhouse gas emissions. STATSSA (2018) report that Gauteng contributes around 46% of the 3% emissions from an inappropriate waste management in South Africa. On the other hand, the municipalities in Gauteng are failing to meet provincial waste reduction targets due to the enormous waste management challenges (Adeleke et al., 2021).

Due to rapid urbanization the poor waste management emerged around 2002 in Gauteng (Malope, 2020). This is highly contributing to climate change through increasing carbon emissions and directly affecting the ecosystem and species. This culminates in a permanent threat to the health of the people and the environment. Also, this has led to increases in spreading of different communicable diseases (Rasmenia & Madyira, 2019). Additionally, Adeleke et al. (2021) identify that the improper waste management in Gauteng is causing solid waste-related environmental hazards such as blocking of drains and flooding. Hence, this inspired Kubanza and Simatele (2019) to accept that poor waste management in Gauteng is severely affecting communities in terms of increases in public health challenges, poor service delivery and inaccurate waste management levies. Mbulawa (2019) estimates that this is leading to reduced productivity and provincial economic growth. Equally, Tsheleza et al. (2019) opines that the continued improper waste management in Gauteng will increase contraction of communicable diseases by 20% by 2030 if unresolved. SALGA (2015), and Madubula and Makinta (2015) identify that the inaccurate levying of waste management on residents is causing a revenue leakage on the municipalities. Hence, funding of solid waste management in the Gauteng municipalities is limited (SALGA, 2015). Furthermore, Malope (2020) argues that this is a major source of environmental degradation, poor service delivery and community protests in Johannesburg. Therefore,

the specific problem that prompts this study is the increasing negative waste management-related environmental impacts in Gauteng province.

In findings solutions to the waste management challenges in Gauteng municipalities, it was critical to establish the key causes of these waste-related challenges. First, an absence of reliable waste-related data is cited among the major causes of the improper waste management in Gauteng (Mbulawa, 2019; Tsheleza et al., 2019; Malope, 2020; Adeleke et al., 2021). This means that municipality management cannot make adequate and informed waste management decisions. Secondly, SALGA (2015) and Mbulawa (2019) disclosed that poor financial performance by the municipalities in Gauteng is also leading to poor municipal solid waste management.

Various initiatives such as the Polokwane Declaration of 2001 that set targets to zero waste to landfills and “Waste-to-Energy” technologies have been presented as avenues to improve the management of solid waste. However, despite the progress in the waste management systems in Gauteng municipalities over the years, they are still constantly faced with more challenges and shortcomings. This is mostly witnessed in Gauteng as it is lagging in terms of recycling as supported by revising of the Polokwane Declaration on Waste Management’s target to a target of 50% of waste to landfill by 2025 (Kubanza & Simatele 2019; Adeleke et al., 2021).

Despite the unprecedented levels of waste management-related negative environmental and social impacts, Gauteng municipalities remain without documented information regarding EMA systems to improve municipal waste management services. That is, a treatment of accounting solutions; especially the EMA approach to address solid waste management has been neglected in the local government worldwide (Qian et al., 2018). This suggests that Gauteng municipalities lack data-driven or evidence-based waste management decision making. Literature shows that traditional management accounting system fails to capture and adequately account for environmental issues in organizations (Gunarathne & Lee, 2015; IFAC, 2005). Possibly, most of the solid waste management problems may be avoided if the Gauteng municipalities have EMA systems in place to integrate ecological information into waste

management decision making. In particular, a decision-making framework for the local government in Gauteng that integrates EMA aspects to address solid waste management remains missing. Hence, there is a need for developing an EMA framework for the waste management sustainability of municipalities in Gauteng.

Clearly, there is an absence of local studies on EMA in local authorities in South Africa notwithstanding that the country is on the forefront of adopting EMA. This can be ascribed to the reality that EMA is a fairly new field of accounting (Kelsall, 2020; Schaltegger, 2018). As such, it is important to understand how different levels of environmental management accounting (EMA) can be used for improving Gauteng municipalities' waste management services. This also addresses the lack of empirical knowledge from scientific research to understand about how EMA can improve municipal waste management (Qian et al., 2018). This was important in developing an EMA framework for the waste management sustainability of the municipalities in Gauteng.

1.2. Research aim and objectives

1.2.1. Aim of the study

The study intends to develop an EMA framework for the waste management sustainability of municipalities in Gauteng by first identifying how EMA can be used to improve solid waste management.

1.2.2. Research objectives

1. To identify the EMA practices used to improve waste management among Gauteng municipalities.
2. To identify the nature of information used to report waste management issues within Gauteng municipalities.
3. To ascertain the environmental benefits of applying EMA practices on waste management in the municipalities of Gauteng.
4. To develop an EMA framework to improve municipal solid waste management of municipalities in Gauteng.

1.3. Research questions

1. What are the EMA practices used by municipalities in Gauteng to improve waste management?
2. What is the nature of environmental information used to report waste management issues in the municipalities of Gauteng?
3. What are the environmental benefits of applying EMA practices on waste management in the municipalities of Gauteng; and
4. What EMA framework can be developed to improve municipal solid waste management of municipalities in Gauteng?

1.4. Research design

The study comprised of literature review and empirical study. The literature review enabled a thorough review of municipal solid waste management within EMA. The literature analysis placed a solid foundation that directed empirical study and provided an awareness and understanding into the research problem.

The research problem involves the following challenges that assist in identifying the suitable research methodology:

1. The need to understand the EMA practices by the municipalities in Gauteng in as far as the type of the EMA practices, nature of information to report the practices and benefits of adopting the practices are concerned. This is not a problem where application of EMA practices can be simply identified. It needs qualitative analysis to identify if these EMA practices are essentially applied, how are they being reported and the nature of benefits accruing from using the EMA practices. The research required a method that would capture words and messages during documentary analysis. This can only be done through a qualitative approach.
2. EMA research in the local government has been scarce. As a result, it is inadvisable to develop sufficient methods for a quantitative study (Qian et al., 2018).

Accordingly, based on the two challenges, it is evident that the study has to be an exploratory study. This is because of trying to acquire a deeper understanding of the adoption, application and benefits of EMA practices on waste management in the municipalities of Gauteng. Consequently, a qualitative methodology is chosen to be used.

1.4.1. Data analysis

Data analysis was performed using grounded theory because of the need to develop an EMA framework for the sustainability of waste management of municipalities in Gauteng emerging from the data. Annual reports and environmental reports of five municipalities in Gauteng spanning from 2015 to 2021 were analysed using grounded theory processes. Data analysis is undertaken concurrently with data collection (Charmaz, 2014). All data from documents are transcribed and analysed following the Straussian grounded theory approach, through which the researcher carried out (Strauss & Corbin, 1998):

- (i) Open coding; to identify, name, and categorise codes.
- (ii) Axial coding; analysing and combining open coding results to conclude on connections between the data.
- (iii) Selective coding; choosing one category to be the core category and relating all subcategories to that category. This was done by categorisation of themes. For the period of this process, instances are matched with each other within each of the classifications of data to highlight similarities and differences. As a result of this constant comparison, theoretical properties of the categories emerged (Strauss & Corbin, 1998). At this stage, relationships between the categories are established so as to develop an explanatory framework for the patterns of EMA and waste management variables of participating municipalities.

1.5. Chapter outline

Chapter 1: Introduction familiarise the reader with background of the study, problem statement, research questions, aims and objectives, research methodology, research contributions to knowledge, and thesis structure.

Chapter 2: Literature review survey literature on municipal solid waste management and EMA. Also the link between sustainability and municipal solid waste management is reviewed. In addition, the chapter studies the link between management accountant and environmental manager. The theoretical framework of the study is also discussed in chapter 2.

Chapter 3: Research methodology outlines the research method and design, data collection approach and data analysis.

Chapter 4: Results and analysis discuss and present results and findings on the objectives of the study. Afterwards, the researcher provides a modern input to literature by proposing an EMA framework for the waste management sustainability of municipalities in Gauteng.

Chapter 5: Summary, conclusions, and recommendations provide the study's summary, conclusion and recommendations for future studies.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The chapter begins by discussing the theoretical framework underpinning the study. This chapter provides a more in-depth account of municipal waste management globally, continentally and in South Africa. In addition, challenges emanating from poor waste management and barriers to enhanced waste management are discussed. The importance of waste management in accomplishing sustainability is conversed. Thereafter, EMA is discussed. This includes type of information provided by EMA. Also, the role of management accounting in EMA is discussed. The role of EMA in waste management is acquainted with.

2.2. Theoretical framework

EMA in organizations has no commonly applied theoretical framework (Qian et al., 2010). Institutional theory and stakeholder theory are employed as the theoretical models in this study to explain the EMA practices currently applied by the municipalities and nature of EMA information used (Kang & Lee, 2016). There have been a few studies concerning EMA at the municipalities. As a result, EMA-related practices and nature of EMA information used remain less investigated. The literature review discloses that bulk of EMA research has focused on achieving an understanding of EMA processes within the manufacturing sector. The local government sector has not been a centre of attraction for EMA studies.

Two theoretical frameworks emanating from the requisite literature are conversed next so as to clarify EMA practices and environmental information use within the municipalities in Gauteng. The perspectives come from the following theories:

1. Institutional Theory
2. Stakeholder Theory

Stakeholder theory views an organization's stakeholders summed up as a single person. Stakeholder theory describes the reason managers select a certain strategy

such as revealing voluntary environmental information. On the other hand, institutional theory explores bigger issues such as to enlighten why an organization admits an in-depth strategy in practice. A discussion on the theories follows:

2.2.1 Institutional theory

Institutional theory reflects the organization as an element embedded within its social structure it functions in. The notion is to achieve legitimacy. Institutional theory stresses in what way loyalty may contribute to “increased stability, legitimacy, and access to resources” (Ball & Craig, 2010). Scholars accept that uniformity originates in organizations grounded on instabilities in their institutional settings. Phan et al. (2017) contend that this perhaps contributes in an improved or an inferior way to the application of new organizational systems such as accounting.

Burritt, Hahn and Schaltegger (2002) suggest that despite absence of EMA research, institutional theory may be valuable for explaining drives for implementing EMA. In a similar fashion, institutional theory undertakes that the application of a particular accounting system such as EMA depends on the ambition of the organization to encounter external pressure (Sari et al., 2020). Jamil et al. (2015) discovered that institutional pressure is fundamental to implementation of EMA by companies in Malaysia.

Ball's (2005) observation on institutional effects on EMA in municipalities asserts that community bodies play a significant role in supporting EMA developments in municipalities. The author argued that social institutions contribute an important role in promoting EMA developments in local government. Also, Ball (2005) identified that when the community is compelled by an idea of environmental conservation as shown in Canadian municipalities, the ecological plan and accounting improvements are forced into an adoption to encounter such modifications in communities.

Scholars such as Ball (2005), Adams and Boyce (2019), Le et al. (2019), Arrifin (2016), Lattif et al. (2020) and Kelsall (2020) contended that homogeneity rises in companies based on modifications within settings of institutional circumstance. This can either lead

to better or worse contributions to the implementation of new company systems such as accounting. Studies by Le et al. (2019), Tulsi and Ji (2020), Molina-Azorin et al. (2009), and Qian et al. (2018)) affirm that institutional theory is central in availing critical data associated with EMA studies.

2.2.1.1 Institutional isomorphism

Institutional isomorphism is a model developed by DiMaggio and Powell in 1991. This is the similarity of organizations' systems and processes. Institutional theory can be adopted to realize the application of EMA in solid waste management. This can be done via three suggested mechanisms because there is an association between isomorphic factors and EMA (Falack et al., 2020; DiMaggio & Powell, 1991). Organizations reacting to institutional pressure may use EMA. Where there is no institutional pressure, EMA may not be used particularly when the benefits of EMA are not known (Qian et al., 2018). The local government does not consider it crucial to implement EMA in their operations. This is because the government makes it non-compulsory for municipalities to submit environmental information. Organizations that function in similar sectors lean towards being identical with time as numerous pressures applied upon them. Institutional isomorphism can be categorized as coercive isomorphism, normative isomorphism and mimetic isomorphism (DiMaggio & Powell, 1991):

Coercive pressure: This materialises because of pressure put on organizations by other organizations. Coercive pressure is fashioned by main stakeholders such as “government agencies, non-governmental organizations, customers and suppliers” (Latif et al., 2020). In EMA circles, coercive pressure can be viewed as being adopted by governments. As a result of coercive pressure, EMA use help companies to augment ecological performance and financial benefits (Qian et al., 2018). By the way, EMA implementation helps companies to progress their social standing (Bouma & Van der Veen, 2002). Following government policies and regulations, coercive pressure is critical for local government as they get funding from government.

Mimetic pressure: This ascends owing to organizations facing extraordinary situations. In that way, organizations replicate other organizations that appear to understanding or

formerly faced related challenges. Mimetic pressure arises once companies focus much on competition to uphold higher performance (Ferreira et al., 2010). That is, if their competitors are applying EMA, organizations should follow similar steps. Hence, EMA use permits organizations to respond to mimetic pressures and can lead to competitive advantage (Adams & Boyce, 2019). When EMA starts to be a standard practice within the local government in Gauteng, more municipalities elsewhere will be prompted to change the conventional accounting system to EMA due to mimetic pressure.

Normative pressure: This originates from professionalization, which transpires owing to proper education and training. This burden comes from training and accounting body membership (Falack et al., 2020). Normative pressure has been viewed to be the highly influential and forceful in contrast to both coercive and mimetic pressure (Ferreira et al., 2010; Jamil et al., 2015). Professionalization is an important driver for change in organizational practices (DiMaggio & Powell, 1991). In a municipality environment, little focus by professional agencies on the use of EMA means less motivation for a municipality to adopt EMA.

2.2.2 Stakeholder theory

The stakeholder theory was formulated in 1984 by Freeman. This concept argues that managers should make every effort to ponder on the concerns of major stakeholders within their organization grid. It is maintained that an organization does not function in a vacuum but instead in a linkage with numerous stakeholders. These stakeholders are all apprehensive about the way in which the organization performs its business undertakings. Freeman (1984) posits that an organization has to go further than profit maximization and think through developing relations with its major stakeholders. Vejzagić et al. (2018) warn that those organizations that do not integrate stakeholders' expectations in their plans are posed to poor performance in the long term. The researcher agrees that stakeholder theory is an important element in ensuring organizational success.

In relation to Freeman (1984), a stakeholder is defined as representing a single person or a collection of people who “can affect or be affected by the business' operations.”

Thienel (2014) affirm that organizations have to do stakeholder evaluation to establish major stakeholders and their interests in the organization. Stakeholder evaluation helps an organization to establish and achieve various requirements of all major stakeholders to evade future complaints and litigations. Le et al. (2019) contend that stakeholder evaluation is significant so as to be able to take into account exceptional circumstances such as the natural environment. This is important because the natural environment, which often times, has been ignored owing to failure to reveal it in the organization's financial statements. One can argue that the stakeholder theory can be instrumental in protecting the environment through ensuring implementation of some mitigation measures such as the use EMA in municipalities.

Stakeholders can be classified as either primary or secondary stakeholders (Le et al., 2019). Primary stakeholders are known as stakeholders with a direct connection and impact on the operational running of the organization. These consist of stakeholders such as customers and suppliers (Thienel, 2014). Secondary stakeholders encompass stakeholders that are indirectly connected to the organization but their activities impact on the business of the organization. These comprise of the government and regulatory agencies. In the context of municipalities, the primary stakeholders are more important because they are directly affected by any poor performance by the municipality and have the potential to demonstrate.

Due to pressure from stakeholder, organizations use EMA since as an approach to legitimise their actions. EMA practices seem to manage environmental impacts so as to stand the pressure of stakeholders. Consequently, stakeholder theory is also one of the most widely used theories by EMA scholars to clarify why organizations issue voluntary environmental information (Singh et al., 2015). Despite the criticism levelled against the stakeholder theory, it is still broadly applied (Teles et al., 2015).

2.3 Municipal solid waste management in local government

2.3.1 Municipal solid waste management: Global perspective

The waste management practices implemented around the globe have emerged from changing conditions such as the need to maintain public health in the best effective way. Also, reasons such as the requirement to uphold earth's resources for upcoming generations and the need to counter the growing waste generated in cities have been found to push for waste management practices. Despite the source of motivation for applying waste management practices, each specific collection of conditions contributes to the body of knowledge on waste management.

The body of knowledge on waste management practices has largely developed over the past two decades. This is because cities have used different methods to monitor the increasing masses of wastes and to keep a clean environment. In this way, cities have collected experience in terms of what works. A few cities have been chosen for analysis of their municipal waste management practices.

Adelaide, Australia

Adelaide generates about 765 000 tonnes of municipal solid waste yearly and maintains a 100% coverage in terms of waste collection (World Data Bank, 2018). The city has an advanced and well regulated waste management system. The city has established broad environmentally sensitive values for both industry and government. Industries in Adelaide are highly technology concentrated and in keeping with this, "the waste collection system is therefore highly modernised" (World Data Bank, 2018).

Even though Adelaide possesses huge landfill space unfilled, they remain motivated to make waste disposal as inappropriate as possible. This is done through material specific bans, amplified landfill taxes and encouragement of modernisation in recycling. The practices of Adelaide shows the significance of an extraordinary level of political will to adopt fundamental waste management policies. Adelaide's waste management system permits the effective application of existing technologies and integrates other features such as recycling and waste recovery processes. Public meetings as well

contribute towards achieving set targets of waste minimisation (World Data Bank, 2018).

San Francisco, United States of America

San Francisco collects approximately 509 000 tonnes of solid waste yearly with 100% waste collection coverage (World Data Bank, 2018). Increasing landfill, transport and material treating expenditures pushed San Francisco to search for modernisation so as to reduce growing costs. San Francisco is still without a landfill (Chatzouridis & Komilis, 2018). As a result, waste is taken to a disposal site located 95km from San Francisco. This overhead is taken into municipal rates to motivate recycling and composting. This lessens the necessity to dispose at the landfill (Chatzouridis & Komilis, 2018). In this manner, the waste management plan of “pay as you throw” prompts recycling and composting (World Data Bank, 2018). The plan achieves this by charging no extra costs on domestic clients for gathering recyclables and 75% rebate for business clients. On average, a resident of San Francisco produces 1.7kg of waste per day and 72% of this waste is recycled (Chatzouridis & Komilis, 2018).

The city was able to meet its target of waste minimisation and this is assisted by an enabling legislative framework that inspires the adoption of “green” products and prohibition of plastic bags (World Data Bank, 2018). Another major feature is public and community participation. The city conducts “community clean-up programmes” that include Public Works employees, trade and industry captains. The city also motivates for best practices by way of “street fairs.” Owing to such programmes, San Francisco disposes only 31% of its waste to landfills (Chatzouridis & Komilis, 2018). This leaves 69% converted from landfills for agricultural purposes. The practices of San Francisco also specify the importance of generating a supporting environmental by way of the enactment of regulations that introduce the preferred behavioural transformation.

Dhaka, Bangladesh

Dhaka is the capital and economic hub of Bangladesh. It is among the densely populated cities around the globe having a population density of 20 120 person per square kilometre. Its 2016 figures show a population of 8 million and 1 254 000 tonnes

of waste generated per year (Yadav, Karmakar & Dikshit, 2016). Similar to any capital city, Dhaka is having a problem of responding to increasing urban migration. Therefore that presents the need to develop sufficient infrastructure that can overcome the rising demand.

Waste collection is done on a door-to-door service provided generally by small businesses where waste is transported to pick-up points. The municipality then maintains these pick-up points. Citizens also actively participate by way of “ward-based waste management schemes” (Yadav, Karmakar & Dikshit, 2016). These schemes encourage community participation as citizens undergo training on waste management. The small businesses that collect wastes within the wards also undergo training to make sure that they are appropriately aligned to the municipalities’ collection strategy. The communities have waste pickers in excess of 130 000 who make sure that everything which can be detached from the waste is uncovered before disposal. Collected waste is either traded or used again through a multifaceted network of business partners. Given this, Dhaka is therefore well positioned to respond to the problems of a big population responsible for generating a huge volume waste daily. By utilising of small businesses, Dhaka is in a position to guarantee that 21% of waste is recycled, regardless of having 45% coverage ratio in waste collection (Yadav, Karmakar & Dikshit, 2016).

2.3.2. Municipal solid waste management: Continental perspective

While industrialised countries utilise highly advanced technology processes in managing waste, less industrialised countries utilise less advanced processes that are more labour intensive. Waste collection coverage in most cases is inadequate and frequently amplified by informal waste collection activities by waste pickers. The waste-pickers are typically jobless residents with no other choice but to work under circumstances that subject them to health risks. The following African countries are studied to understand their waste management situations.

Abuja, Nigeria

Abuja is the capital city of Nigeria. This city is a classic example of problems faced in solid waste management in Nigeria. Abuja yearly produces 2.1 million tonnes of waste (Gajere, Folorunsho, Obadaki, & Iruobe, 2019). The rapid population growth has not spared the Abuja city from generating unprecedented levels of waste. As the country pursues its agenda of industrialising Abuja city, the quantities of solid wastes produced is projected to increase to 2.7 million tonnes of wastes per year (Gajere et al., 2019). The constant haphazard building of houses in the city makes it complicated for the municipality to make available the preferred magnitude of service. Therefore, municipal solid waste management is one of the highest ecological problems facing Abuja since a large quantity of the waste produced is disposed of in unrestrained open spaces.

Abuja city utilises a method of communal bins found at different points along the roads. Houses-to-house collections are not popular. The city makes use of private service providers to transport bins from the public collection points to disposal places (World Data Bank, 2018). Others utilise non-governmental organizations to collect waste from the community to the pick-up points (Gajere et al., 2019). This is mostly seen in congested low-income parts of Abuja that are not adequately serviced by the local government.

One the earliest intervention of the Abuja city in solid waste management was to encourage composting. Accordingly, Abuja city designs composting plants with daily volumes of 190 to 400 tonnes. Composting is the most extensively used municipality solid waste management method in Abuja. Presently, 11% of waste is taken to composting (Gajere et al., 2019).

Harare, Zimbabwe

Solid waste management has been identified as the key problem facing urban towns in Zimbabwe. Increasing population growth in the course of past two decades, combined with hyperinflation and economic meltdown, among other reasons positioned the municipalities' resources under significant pressure. This led to inability to provide sufficient service to their residents. However, two forms of waste collection systems are

used in the city namely the Kerbside collection and communal (block) collection. The popular method used in residential areas is the Kerbside collection (Mafume, Zendera & Mutetwa, 2016). This is disturbing regarding that more waste is being uncollected in the city. Reduced waste collection regularity in Harare city is attributed to inadequate financial resources to efficiently manage waste.

Harare generates an average of 1.2 million tonnes of solid waste annually (Kharlamova et al. 2016). Waste collection by the municipalities had fallen from 70% of total waste. This mostly affects low-income residential places and informal settlements. As a result, illegal open dumping arose putting the communities at risk of environmental and health challenges. Also, this saw the emergence of fly borne diseases (Jerie, 2018). Harare city is also facing challenges of water pollution from uncontrolled dumping.

Harare city has been classified among the poorest in terms of solid waste management. The municipality cannot effectively render solid waste management services to its residents. Harare city still utilises mainly conventional closed municipal solid waste management method. This suggests that very little waste is taken to landfill. This method of managing solid waste does not help in resolving the waste management problem but instead generates other challenges (Mandeverere & Jerie, 2018).

2.3.3 Municipal solid waste management: South African perspective

South Africa is projected to produce 55.6 million tonnes of general waste per annum (Adeleke et al., 2021). In addition, 35.6% of the waste is recycled. Municipalities in South Africa face a difficult task of providing waste management services owing to increasing waste generation. Annually, about 3.81 million tonnes of waste remains uncollected therefore leaving huge quantities of wastes being dumped in open spaces (STATSSA, 2018).

The increase in solid wastes and absence of appropriate land to dispose of waste suggests that South Africa facing a crisis of space for waste disposal. This is worsened by the fact that only 10% of the wastes are recycled (DEA, 2019).

In South Africa, municipalities are responsible for making available a myriad of services to their societies. Municipalities are the most basic local government in South Africa (Rasmenia & Madyira, 2019). One of their services is proper solid waste management. As such, it remains a prime duty of the local government in South Africa to ensure adequate waste management and a sustainable society. Simatele, Dlamini and Kubanza (2017) refute that and believe that with the current status quo it is highly impossible to attain a sustainable society within South Africa. This was also echoed by Tsheleza et al. (2019) that in spite of vagueness embracing the economic forecasts of this country, overall solid waste production will nevertheless remain increasing based on population growth. This affects sustainability of a country. Therefore, municipalities need to be key elements of change on the way to sustainability so as to also enhance their own performance.

In spite of emergence of various plans with the purpose of improving solid waste management, landfill is still the major waste disposal technique in South Africa. South Africa is still lagging behind industrialised countries such as the United States of America and Australia. In the industrialised countries utilisation of landfills is taken as the last disposal technique in the waster order. Table 2.1 shows the waste generated in South Africa in each province.

2.3.3.1. Statistical figures of waste generated in South Africa

Table 2.1: Waste generated by each province

Province	Waste generated (million tonnes per year)
Western Cape	10.98
Eastern Cape	2.21
Northern Cape	1.64
Free state	1.64
KwaZulu Natal	4.84
North West	1.35
Gauteng	24.31
Mpumalanga	5.52
Limpopo	1.65
Total	54.14

Source: DEA (2019)

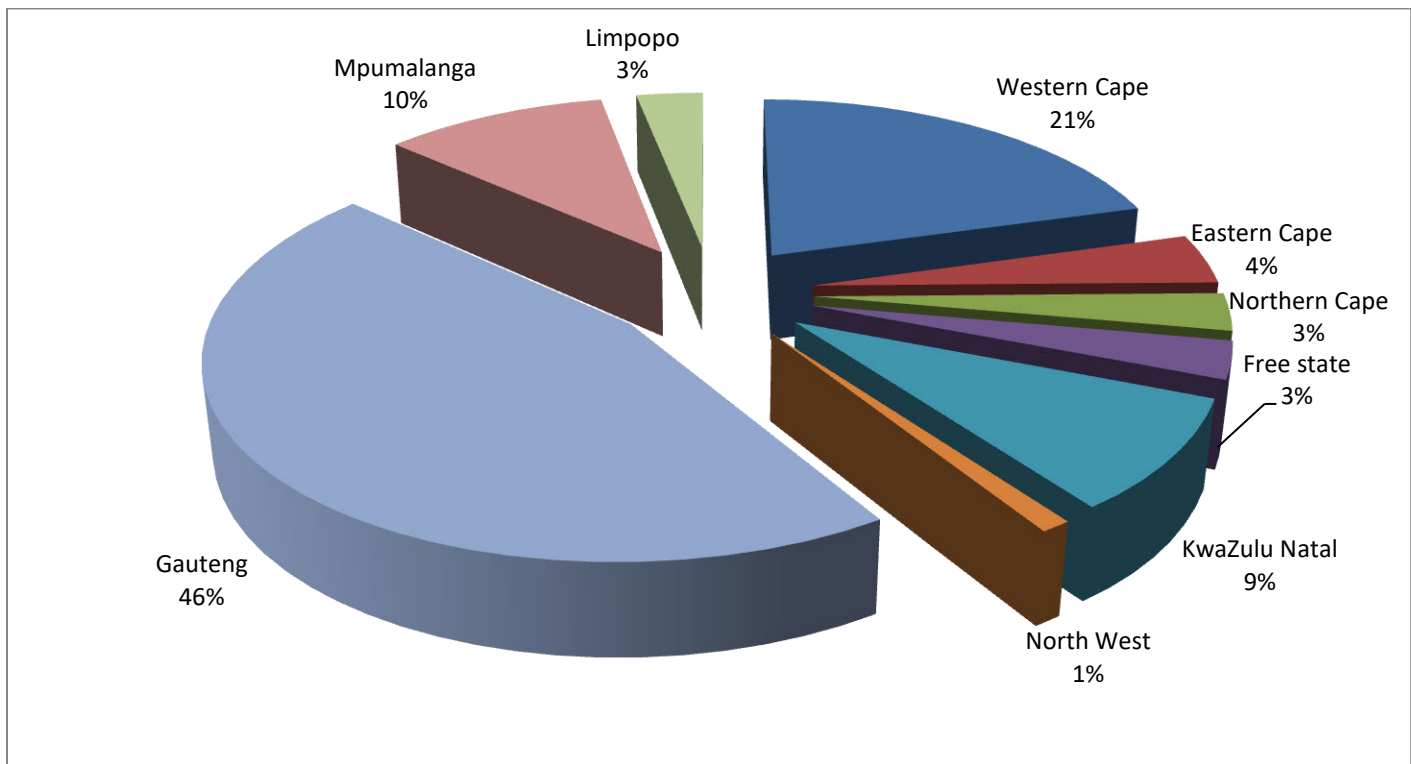


Figure 2.1: Waste generated per annum by each province as a percentage

Source: Author's computation from data obtained from DEA (2019).

Table 2.1 and Figure 2.1 show that Gauteng remains on top of other provinces on waste generated per annum. 46% of waste generated in South Africa originates from Gauteng. On average, 24.31 million tonnes of wastes are generated every year in Gauteng. Statistically, this depicts a province in a waste crisis. But, other provinces such as Western Cape generating 10.98 million tonnes as well as Mpumalanga producing 5.52 million waste per annum points to a great potential of engulfing into waste crisis zones in the near future if no proactive actions are taken.

2.3.3.2. Municipal solid waste management in Gauteng

Gauteng is South Africa's economic center generating about 47% of the provincial economy and 17% to national economy (STATSSA, 2019). Gauteng is the most heavily populated province in South Africa with an estimated population of 15.8 million (STATSSA, 2018). It, therefore, accounts for about a quarter of the country's population. It has been projected that 55% to 65% of solid wastes produced in Gauteng remains outside the formal waste management. Following the same model used in developing countries, waste management is normally landfilled, dumped and burnt in open spaces (Adeleke et al., 2021). In Gauteng, the disposal of municipal solid waste is a key ecological challenge taking into account the population and inadequate existing land for landfills. This creates problems to public health and the environment. However, the waste management practices comprise largely of waste collection, recycling and landfilling (Bowen et al., 2020).

SALGA (2020) claims that municipal solid waste in Gauteng is predicted to stretch to about 37 million tonnes by 2030. Contemporary statistics indicate that averagely Gauteng generates 24.1 million tonnes of solid waste each year. So, Gauteng is on a route where waste generation overtook population growth. Hence, Malope (2019) ponder that waste management still remains among the most abandoned areas of sustainability in Gauteng. The researcher opines that this calls and appeals to transform the waste management approach from its existing conventional practices to a more all-

inclusive and wide ranging approach. This helps to ensure that both the municipalities and the society are sustainably positioned. Also, transformation from existing conventional practices will assist to directly improve service delivery and therefore reduce service delivery protests aligned to poor municipal waste management. Given this, a sustainable waste management leading to better environment, economic and social dimension remain an urgent task. In Gauteng, solid waste is viewed as consisting of “household waste, street cleaning waste as well as waste from markets and commercial activities generating less than 50 kg” (STATSSA, 2019). Henceforth, in this study solid wastes refer only to these activities.

Xin et al. (2020) define waste management as “collection, transport, recovery and disposal of waste, including the supervision of such operations and after-care of disposal sites”. However, the cornerstone of waste management is waste minimization at the source to lessen their negative effect on ecological and social welfare (Adeleke et al., 2021). But, this has been a major and perennial problem for most municipalities in developing countries to address this challenge (Bharadwaj et al., 2020; Bowan et al., 2020; Dlamini et al., 2019). Therefore, the challenge demands proper attention to attain a sustainable environment. As a result, this subject has attracted an enormous scholarly attention.

Waste management is a key element of life and effective management of this has been considered crucial for sustainability/sustainable development. Despite this, municipal waste management is a significant social and environmental challenge in South Africa (Rasmenia & Madyira, 2019). Recent studies by Rasmenia and Madyira (2019) and Adeleke et al. (2021) affirm that Gauteng municipalities are experiencing critical crises of waste management. This is primarily due to enormous industrial progress, growing urban areas and rapid growth in Gauteng. Therefore, consumption levels are getting to unexpected levels. This means that the contemporary waste management systems are too weak and ineffective to handle the added strain. For instance, a case study by Malope (2019) and (Mbulawa, 2019) conducted in Gauteng metro cities discovered that solid wastes were mostly dumped or burnt in undesignated areas. Noticeably, Gauteng

still experiences challenges in finding appropriate and sustainable waste management systems at a faster pace of urbanisation (Adeleki et al., 2021).

In Gauteng, the presence of land for waste disposal is very limited (Mokebe, 2018; Adeleki et al., 2021). If this situation continues, there will be no place to dump the municipal solid waste. To solve this problem, new waste management methods, which should be both environmentally and economically sustainable, must be implemented. Open burning of solid waste has become a common eyesore where collection is limited. This has been worsened by poor funding. Developing countries including South Africa lack proper solid waste funding (Wang et al., 2020).

However, waste management studies in South Africa have focused much on disclosure (Mitchell & Hill, 2011; Raufflet, Cruz & Bres, 2014; Costantini, Mazzanti & Montini, 2013; Du Toit, 2016) but not any one of the previous scholars has focused on the impact of waste management on environmental performance.



Figure 2.2: Picture of improper municipal waste management in Gauteng

Source: Maeko (2019)

The picture in Figure 2.2 taken from a Mail and Guardian newspaper in 2019 titled “Jorburgers fail to manage waste” display the nature of solid wastes unmanaged in

Johannesburg. As paraded, the unmanaged solid wastes create an unattractive environment and unpleasant social appealing.

2.4. Solid waste challenges facing Gauteng

The improper management of solid waste by municipalities has led to a series of challenges in form of environmental, financial and social challenges upon societies. This indicates that proper management of solid wastes is critical and vital in modern day world in order to attain national and global sustainability. Qian et al. (2018) argue that waste management remains a key element of sustainability because of its direct links with environmental degradation, climate change and other social imbalances such as blocked drains and associated diseases. However, as validated by Gumbi (2015) and further discussed by Mokebe (2018) poor waste management impacts on all elements of environmental and human health. Similar challenges are also being experienced in Gauteng. The following challenges emanates from poor waste management:

2.4.1. Greenhouse gas emissions

The carriage of waste management to landfills leads to releasing of substantial GHG emissions which exerts huge effect on the climate and environment (Xin et al., 2020). In Gauteng, using of waste disposal as the landfill method generates methane gas, a GHG twenty one times heavier than carbon dioxide (Dlamini et al., 2019). Gauteng alone contributes the highest share of about 1.4% of South Africa's 3% GHG from solid wastes (STATSSA, 2018; Rasmenia & Madyira, 2019). Globally, waste management is responsible for about 5% of GHG emissions (Xin et al., 2020). Therefore, the minimisation of GHG emissions is a serious matter to be fixed.

Unscientific dumping contributes to adverse effects on all elements of the environment. One is that the improper management of solid waste in Gauteng is leading to high greenhouse gas emissions impacting on the climate. Climate change is documented to be chiefly caused by greenhouse gases such as methane and carbon dioxide. Poor waste management is a great source of climate change. Waste dumps give rise to negative impacts on the public health (Tsheleza et al., 2019). Open dumps discharge

methane from disintegration or decomposition of “biodegradable waste under anaerobic conditions” (Xin et al., 2020). Furthermore, the methane produces fires and explosions and is a key source of global warming (Xin et al., 2020).

Global warming then directly contributes to climate change. Climate change in Sub Saharan Africa is leading to droughts and heat waves (Dlamini et al., 2019). This endangers human life and employments. In addition, climate change creates an important threat to South Africa’s food security, health, water system and biodiversity. For example, research by Dlamini et al. (2019) exploring the status quo of solid waste management in City of Johannesburg confirm that Gauteng contributes the highest national impacts from greenhouse gas emissions from waste management. The authors further reveal that the main reason for the highest GHG emissions is that municipalities in Gauteng are overpowered by the solid waste generation from acute population growth. In other words, the municipalities are incapacitated. So, problems of GHG emissions originating from poor waste management are not only environmental but also developmental in nature.

A recent study by Malope (2020) in Gauteng demonstrated that improper waste management is leading to climate change which then is generating health challenges such as diarrhoeal and respiratory diseases. Given this, the present status quo of the Gauteng’s waste sector is severe. This is evident enough that municipalities are failing to be responsible for the needs of upcoming generations as enshrined in the constitution and the National Environmental Management Act (South Africa, 1998). To guarantee improved human health and reduced GHG emissions, there is need for efficient waste management system grounded on environmental and economic sustainability.

To achieve sustainability and also reduce public health challenges from poor waste management, lessening of waste materials is the most basic approach to minimise GHG emissions from the waste management. However, the GHG discharged from waste management can be adopted as an energy source (Xin et al., 2020). To reduce the effects of GHG emissions on climate change, South Africa introduced carbon tax on

1 July 2019. Also, municipalities have to pay for carbon tax stemming from carbon dioxide due to poor waste management. On the other hand, this means that residents have to pay more as municipal services will be priced inclusive of the carbon tax portion (Lee, Kima & Chonga, 2016). This provides adequate evidence that the effect on citizens of improper waste management is also of an economic nature. The carbon tax pushes citizens into cycles of poverty as most basic goods will be priced beyond affordable levels (Panya, et al., 2018). This suggests that by properly addressing waste management, this reduces social, environmental and financial challenges accruing from GHG emissions. Therefore, decreasing GHG emissions from waste management is also a strategic way of accomplishing the national goal of emission reduction in South Africa.

2.4.2. Associated diseases from poor municipal waste management

In Gauteng, the poor waste management has acute environmental consequences such as disease risks on households (Fakoya, 2014; Mokebe, 2018; O'Neill, 2016). For example, in a study carried out in Johannesburg, researchers report that citizens are exposed to open dumping and burning of solid wastes and developed health problems as a result of release of dangerous emissions such as dioxins, which are known to cause cancer and other health problems (Rasmenia & Madyira, 2019; Mokebe, 2018; Pholose, 2019; Malope, 2020). Some communities are resorting to waste disposal methods that are detrimental to peoples' well-being and the ecological existence. Methods such as open dumping and burning have become more common as communities believe have no alternative better option to address solid waste problems (Mbulawa, 2019). However, Taiwo, Venter and Oso (2016) assert that despite some considerable improvements in waste management in Gauteng, remarkable effects still remain visible. Put differently, the vast volumes of unmanaged solid wastes and ineptitude of the present-day waste management system has given rise to extraordinary impacts on human health.

Open burning of solid wastes release approximately 31 000 tonnes of noxious waste into the air around Gauteng each year (STATSSA, 2019). Rasmenia and Madyira (2019) contend that uncontrolled burning of waste at dump sites discharges very small

and smooth particles which are key sources of respiratory diseases, throat infections, nose infections and anaemia. Hence, Malope (2019) insists that challenges on human health emanating from improper municipal waste management in Gauteng remains a puzzle for authorities. This confirms that the impact of poor waste management on the social dimension of the society remains dire. Therefore, all three sustainability pillars namely environment, economic and social remains under constant threat in Gauteng owing to improper waste management.

2.4.3. Other social impacts

Pholose (2019) observes that open dumps have greater consequences for public and environmental well-being. In Gauteng, it is well documented that open dumps are well known by unpleasant odour, swarms of insects and dangerous objects like medical syringes and batteries. In the course of rain season, these are carried through drainage and on ground water, in that way polluting them. As a result, blocked drainage has been experienced after heavy downpours. In one article by Simatele et al. (2017) this has been cited as a major factor contributing to floods in some parts of Gauteng such as Alexandra and Diepsloot. The authors suggested that communities, in conjunction with municipalities, should be proactive in collecting solid wastes well before rain season to avoid the ugly consequences.

In the opinion of the researcher, the strategies pronounced in the Gauteng municipalities' environmental reports seem not to mirror substantial quantities of waste decline as intended by each waste management initiative. The waste management initiatives by the municipalities are intended to support the attainment of the planned goal to lessen waste to landfill. There appears to be no conceptual transparency on in what way solid waste management will be improved in terms of reducing solid waste-related negative environmental impacts. With the voluntary nature of present recycling undertakings and waste management initiatives the success of improving solid waste management will also greatly depend on the accurate collection of waste-related environmental information. Thus the researcher seeks respond to the environmental challenges facing the municipalities in Gauteng with regard to waste management, EMA systems to accurately collect waste-related data. This can also assist to reduce

some of the barriers to improved municipal waste management such communication gap between accountants and environmental manager, and absence of waste-related data.

2.5. Barriers to improved municipal waste management in Gauteng

It is the constitutional obligation of the local government to ensure that the society gets adequate services such as solid waste management. In contrast, this has proven to be a complex task. This means that municipalities are largely unable to provide effective and sufficient services as mandated by their own founding values and objectives. Therefore, it is critical to establish the underlying reasons forcing the municipalities to massively fail to provide one of its key roles of municipal solid waste management.

2.5.1. Budget shortfalls: Analysing the characterization of municipal waste management in City of Johannesburg, Ayeleru et al. (2018) found that budget shortages have forced absence of proper systems to address waste management. Despite the municipalities being in charge of waste management in Gauteng, their budgets are inadequate to pay costs related to waste management (Mbulawa, 2019; Madubula & Makinta, 2015). The authors further highlight that the budget shortages has seen investment on waste management system to still remain low. The underlying effect of this has been perennial poor service delivery on waste management by the local government in Gauteng (Malope, 2019). Bharadwaj et al. (2020) acknowledge that absence of adequate funds in emerging markets such South Africa contribute to poor waste management. Additionally, waste management capital investment like purchasing compactor trucks and constructing new landfill sites remains low due to limited funds. This renders waste management inadequate.

Several studies in Gauteng have pointed to a number of reasons such as poor waste management costs, poor estimation of waste management costs and under budgeting of waste management costs among factors impeding waste management (SALGA, 2015; Pholose, 2019; Mbulawa, 2019; Madubula & Makinta, 2015; Malope, 2020; Gumbi, 2015). Other studies have unfortunately identified deficits in revenue by municipalities as financial challenges obstructing effective waste management

(Simatele et al., 2017; Ayeleru et al., 2018). In a related research, in studying the impact of funding on waste management in India, Bharadwaj et al. (2020) established that financing waste management is a prime problem facing municipalities.

To try resolving the financial crisis in municipalities, this brings in EMA to ensure that solid wastes cost identification and allocation is accurate and environmental costs are appropriately budgeted for and not underestimated. In addition, in these circumstances, EMA assists to ensure that residents are accurately charged for their waste levies. This ensures that there are no revenue leakages in form of waste levies being undercharged to residents. It is therefore critical to make waste management cost effective and financially sustainable. Sustainable financing, in my view, relates to waste management activities being sufficiently funded by residents through levies and income from material recycling to ensure a balance on the financial elements (revenue and cost). This is critical because in South Africa the Municipal Infrastructure Grant (MIG) does not cover solid waste operational costs. So, it can be concluded that municipalities in Gauteng need to discover innovative means to fund and produce revenue in order to maintain efficient waste management.

Also, Madubula and Makinta (2015) observed that budget shortfalls lead to municipalities in Gauteng experience challenges in fulfilling their ballooning wage bills. In this case, barely a year skips without strikes by waste management workers pushing for salary increases. This barricades efficient waste management.

2.5.2. Communication gap: A communication and coordination gap between the accounting department and other environmental management departments has been unearthed as leading to poor waste management (Qian et al., 2018). Absence of reliable waste-related information from other departments to the accounting department results in inaccurate information being used for waste management decision making. In Gauteng, Adeleke et al. (2021) recognise that the absence of a collective approach within municipalities is hindering collection of waste-related environmental data. To support this, Tsui (2014) in a study in China confirms that the communication and coordination between accountants and other environmental experts in corporate

organizations were typically lacking and this contributes to misallocation or inaccurate evaluation of environmental costs. For that reason, managers are left with incorrect environmental information for monitoring environmental costs for sustainability purposes. In the end, managers are forced to make waste management related decisions based on inadequate information thereby belittling the effectiveness of waste management.

With this in mind, numerous calls have emerged to consider collection of waste-related information in local government in conjunction with other departments in a bid to improve waste management (Qian et al., 2018). In this case, EMA becomes significant to narrow the communication gap between accountants and other environmental management departments. IFAC (2005) argues that EMA brings in experts from various departments under one table to discuss and make contributions that seek to improve environmental and financial performance of an organization.

2.5.3. Poor road network: Gauteng accounts for 20% of its population living in informal settlements (STATSSA, 2019). Informal settlements are areas without proper municipal infrastructure such as roads because they are built outside town planning regulations (Tsheleza et al., 2019). They are considered temporary residences. Contrary, informal settlements have now been regarded as alternative permanent accommodation. Their existence creates a conundrum for local government regarding service delivery. One of the critical factors impeding waste management service is the absence of road networks in most informal settlements mushrooming in Gauteng. Ayeleru et al. (2018) posit that with the increase in informal settlements and poor road network in informal settlements in Gauteng, municipalities are enforced to provide waste management in cells not at household level. Some of the cells are painfully too far from several households and the outcome is that these households generate an open dump site nearby. In this regard, this creates a condition difficult for the municipality to effectively handle solid waste. Malope (2020) concludes that this has hindered better waste management services in the informal settlements due to inaccessibility and absence of a structured waste management plan in place.

2.5.4. Absence of waste-related data: Effective waste management decisions rely on data. Qian et al. (2018) conclude that making available waste-related environmental data is a drive in the direction of sustainability in waste management. Adeleke et al. (2021) demonstrate that the absence of reliable, correct and trustworthy waste-related data remains among the factors that obstruct sustainable waste management in South Africa. In line with this, Dlamini et al. (2019) admit that unavailability and inaccurate waste-related environmental data has culminated in poor planning of waste management systems in South Africa. Therefore, having accurate waste-related environmental data is vital for effective planning. In this way, accurate information on waste may be used to project future quantities and characterization of wastes and this determines the suitability of the various waste management and treatment choices.

Fakoya (2014) contends that lack of reliable waste-related environmental data generates improper communication based on unrealistic circumstances within municipalities. Corporate decision makers in charge of waste management planning require correct information in order to develop an effective waste management strategy. Therefore, absence of accurate waste-related data in Gauteng municipalities is crippling waste management through poor waste management plans. Similarly, in China, Xin et al. (2020) report that non-existence of municipal solid waste plans are key barriers to attaining effective waste management.

EMA becomes relevant and imperative to collect the solid waste-related environmental information in municipalities in form of monetary and non-monetary. This remains one of the major strength of EMA to collect both monetary and physical information for corporate decision making in attempt to enhance sustainability. The developed EMA framework in Chapter 4 seeks to resolve the aforementioned barriers except poor road network as a drive towards accomplishing sustainability from waste management.

2.6. Definition of sustainability

The World Commission on Environment and Development (WCED) (1987) coined the term sustainability. Sustainability has also been referred to as sustainable development hence the two terms have been interchangeably used in literature. But this study chose

to use the term sustainability over sustainable development. This is due to some instances where sustainable development's definition has been shallow and without proper reference to waste management. Sustainability is defined as the "importance of ensuring the satisfaction of present need without compromising the ability of future generations to meet their requirements" (WCED, 1987). Sustainability aims to accomplish three major areas: "social equity, economic prosperity and environmental protection" (Ferdous, Adams & Boyce, 2019). Applying the three pillars concurrently in the real world remains a tough task.

The concept of sustainability was coined to help address imbalance on the interaction between the economy/finance, environment and social pillars of the natural environment. Several authors have mentioned that sustainability was conceptualized in early 1970s (IFAC, 2005; Isaac, Enuma & Okezie, 2019; Gibassier & Alcouffe, 2018; Gunarathne & Lee, 2015). But, the contemporary challenge remains that of identifying how the corporate sector can most successfully transform their conventional models and become sustainably relevant. This dissertation argues that sustainability within the municipalities can be effectively enhanced by adopting the accurate environmental management tools and practices.

2.6.1. Importance of municipal waste management in achieving sustainability

Literature has disclosed that waste management is a key component of sustainability. This means that waste management is critical in achieving sustainability (Qian et al., 2018). But, Bharadwaj et al. (2020) state that achieving sustainability in developing countries' municipalities is problematic due to factors such as lack of skills and inadequate funding.

Sustainability is accomplished in waste management once natural resources are consumed well to lessen the amount of produced waste in a fashion that supports sustainability goals (Bowen et al., 2020). This displays that sustainability performs a crucial role in the effort of accomplishing sustainability. To acknowledge importance of waste management on sustainability, the United Nations in 2015 developed Sustainable Development Goals (SDG) linked to waste management such as SDG 11-Safe and

sustainable cities, SDG 12–Sustainable consumption and production, and human settlements, and SDG 17–Reinforce partnerships for the sustainable development goals.

Qian et al. (2018) emphasise that any nature of development is considered sustainable if only the waste produced cannot amass but is “fully reused, recycled and recycled” (UN, 2001). Municipal solid wastes can be changed into energy. This can be responsible for renewable energy and make waste management more sustainable (Adeleke et al., 2021). Conversely, in emerging markets such as South Africa the collection, transportation and disposal of waste is still the main way of managing solid wastes. As such, the current waste management system leads to environmental problems such as public health challenges and greenhouse gas emissions. Therefore, this renders this sector a major supplier to climate change. This directly affects sustainability as the life of the future generations cannot be guaranteed. Thus, it implies that an efficient management of municipal solid waste helps reduce social, environmental and economic challenges. A poor municipal waste management negatively contributes to sustainability.

To ensure the most contribution of municipal waste management to sustainability, Bharadwaj et al. (2020) believes that a sustainable and combined waste management system must be developed that is economically sound, and environmentally responsible. In South Africa, the effort on the way to sustainability has culminated in the proclamation and ratification of numerous legislation and policies to compel organizations including municipalities to make waste management strategies aligned to sustainability. For instance, Dlamini et al. (2019) note that the “National Environmental Management Waste Act (No. 59 of 2008)” instructs that sustainability make creation of waste to be side-stepped or where it is unavoidable that it has to be “reduced, reused, recycled or recovered.” The act also advocate for usage of waste as a supply for forming economic opportunities. Also, Adeleke et al. (2021) report that the “White Paper for Integrated Pollution and Waste Management for South (Notice 227 of 2000) merged waste transportation, treatment and disposal in one plan” for pollution avoidance as an approach to enrich sustainability.

The critical analysis by Qian et al. (2010; 2018) avails valuable insights to develop a sustainable waste management. A need still remains to construct a framework to enhance waste management sustainability. This will help to guide collection of monetary and non-monetary environmental information in order to achieve sustainability. Therefore, a holistic framework that captures the interconnection of social, environmental and economic dimensions remains outstanding. But, Gray (2010) argues that once environmental and economic dimensions of sustainability are addressed, the social dimension would also be considered resolved. In addition, EMA incorporates two of the three dimensions of sustainability namely environmental and finance/economic (De Beer & Friend, 2006; IFAC, 2005; Le et al., 2019; Isaac et al., 2019). These two dimensions are affiliated to EMA due to their capacity to influence internal corporate decision making (CIMA, 2019; Kelsall, 2020; Jamil, Mohamed, Muhammad & Ali, 2015; Gunarathne & Lee, 2015). But, the empirical justification of these findings lacks in the context of local government sector. Hence, this study concentrates on only the environmental sustainability pillar. Therefore, environmental sustainability is reviewed.

2.6.1.1. Environmental sustainability

Ferdous et al. (2019) defined environmental sustainability as “the responsibility to conserve natural resources and protect global ecosystems to support health and wellbeing, now and in the future.” This puts environmental sustainability at the centre of guarding the lasting productivity of natural capital to achieve future economic and social needs.

Environmental sustainability is the third dimension of sustainability. Many scholars concur that the major purpose of environmental sustainability is the concern of the future of humanity (IFAC, 2005; Le et al., 2019; CIMA, 2019). Environmental sustainability describes in what way we have to learn and safeguard ecosystems, features that puts our environmental under pressure and maintaining of our resources. Therefore, it is important that waste management is properly managed to achieve

environmental sustainability. However, given the nature of environmental sustainability, it difficult to fully achieve it but concerted efforts is needed to keep it to a certain level.

The managing of environmental sustainability is amplifying attention to global environmental concerns (Kurapatskie, 2012). This is necessitated by the fact that environmental concerns in one country can be source of negative environmental in another country. For instance, carbon emissions in one country can contribute to climate change in another country (Kumar et al., 2017). This proves that unlike social and economic pillars, environmental sustainability has far reaching consequences across the globe. At this pace, it is critical that measures, policies and regulatory compliance towards environmental sustainability are strictly adhered to reduce the impact of unstable environmental sustainability. This is because majority source of environmental sustainability factors are man-made factors such emissions (Lee et al., 2016). Hence, at national level, global policy initiatives such as the Sustainable Development Goals (SDGs) and the Paris Agreement (COP22) were coined.

Given the complex nature of environmental sustainability is at the forefront of public policy debate in search of innovative scientific research solutions. Various research solutions were presented throughout the world but the negative impacts of environmental unsustainability are there for all to see. I believe the improvement of environmental sustainability should begin and more intensified at local government level that is closer to the citizens than most of the government departments.

However, scholars (Le et al., 2019; IFAC, 2005; Christ & Burrit, 2013) concurred that proactively responding to environmental proxies such as waste management, greenhouse gas reduction and water conservation improves environmental sustainability. But, the actual actions to improve these environmental proxies remain a tight challenge within communities.

In this manner, EMA can be seen as a tool to improve environmental sustainability through mitigating waste management problems. Therefore, this research acknowledges that EMA is a major tool to improve waste management sustainability, a

proxy of environmental sustainability. As such EMA can enhance waste management through different facets such as ensuring accurate waste management related information and accurate waste management. The next section seeks to discuss the conceptualization of EMA.

2.7. EMA definition and concept

Scholars have defined EMA in various ways. In spite of EMA prominence, EMA has no single definition commonly accepted yet. This is despite a general conceptualization of EMA for the past two decades (Gunarathne & Lee, 2015). Different perceptions, conceptions, approaches and lenses have been adopted by various researchers to explain the meaning of EMA. For example, Rikhardson et al. (2005) coined EMA as a “form of managerial technology” consisting of different systems and practises of targeted information gathering and evaluation. Whilst, other researchers like De Beer and Friend (2006), Gibassier and Alcouffe (2018), Schaltegger (2018), CIMA (2019), Le et al. (2019) and Kelsall (2020) consider EMA as a “sustainability initiative”. Another stream of researchers looks at EMA as a field of innovation (Ferreira et al., 2010; Ariffin, 2016; Jasch, 2006). Without doubt, all researchers in the field agree that EMA is an extension of conventional management accounting in dealing with environmental matters (Birkin, 1996; IFAC, 2005; Gale, 2006; Burrit et al., 2019; Latif et al., 2020; Gibassier & Alcouffe, 2018; Schaltegger, 2018; Christ & Burrit, 2013). The researcher views EMA as a tool that promotes sustainability due to its ability to provide environmental information in both monetary and non-monetary terms for decision making.

Conventional accounting centres mainly on profit-making and disregard additional key operational effects like climate change and other environmental issues. This has motivated scholars to condemn traditional management accounting system and made EMA in recent years to be more popular. In this way, EMA is seen as a convenient platform to get to the bottom of the protracted conflict existing between economic development and ecological impairment (De Beer & Friend, 2006; Burritt et al., 2019).

In my view, EMA was therefore developed to enhance sustainability from various facets.

Many researchers believe that the key aim of EMA is to administer environmental costs in order to improve environmental and financial performance (Burrit & Saka, 2006; Jasch, 2009; Mokhtar, Jusoh & Zulkifli, 2016). In line with this view, EMA in this study is viewed as the “identification, collection, analysis and use of a broad scope of information for internal decision-making” (Schaltegger & Burrit, 2000). Analysing definitions of EMA reveal that its important feature as mirrored in its oft-cited definitions is that of focusing on both monetary and physical information to support management decision making. In this way, EMA remains a critical element of achieving environmental sustainability through providing of relevant environmental information for consideration by corporate decision makers. The researcher opines that in addition to managing environmental costs, EMA can be important in providing information for external reporting. This may go against the founding principles of EMA of providing information for internal decision making. Furthermore, the researcher can put forward that EMA can be useful for both internal and external decision making because as soon as stakeholders receive EMA reports are in a better position to make decisions based on the reports.

2.7.1 Information provided by EMA

The principal characteristic of EMA is the ability to integrate data accounted for in monetary and physical terms for internal corporate decision makers (Qian et al., 2018; Bouma & Van der Veen, 2002; Burritt, Herzig & Tadeo, 2009) and external decision makers (Gunarathne & Lee, 2015; IFAC, 2005; UN, 2001). There is a common understanding among scholars that two key environmental effects linked to organizational actions exist namely: “environmentally related impacts on the economic situation of companies (provided for by Monetary EMA), and company related impacts on environmental systems (provided for by Physical EMA)” (Schaltegger & Burrit, 2000).

2.7.1.1. Physical Environmental Management Accounting (PEMA)

PEMA reveals corporate's environmental impacts expressed in physical units such as kilograms. PEMA tools emerged with the prime intention of gathering ecological impact information in non-monetary components for in-house application by management (CIMA, 2019). PEMA data comprises of flow of energy, water, materials, greenhouse gas produced in tones and wastes which is vital to the naming of various environmental facets. PEMA is also relevant to the local government. Municipalities are involved in solid waste management and solid waste management collected for a certain period can be expressed in kilograms.

Physical environmental information enable corporates to account for output and input of materials therefore ensuring none of them are unaccounted for. The physical environmental information produced by organizations can then be applied to develop environmental performance indicators (Schaltegger, 2018, Muza, 2018). In turn, this assists company management to decide on or project environmental objectives, plan and communicate ecological performance to different stakeholders.

2.7.1.2. Monetary Environmental Management Accounting (MEMA)

MEMA is designed to avail in monetary terms the effect of activities linked to the environment. MEMA measures company-related environmental impacts in monetary terms (Gibassier & Alcouffe, 2018). These are, for instance, the costs incurred to treat waste, spending on cleaner production, and penalties in dollar value of violating environmental regulations. Based on these, Kelsall (2020) and Burritt et al. (2002) argue that MEMA is built on conventional management accounting practices that have been modified to comprise of environmental features. This renders MEMA to be a key product of traditional management accounting system.

Researchers reveal that the primary focus on adopting EMA is usually on getting monetary information because corporate managers greatly value it due to the monetary information's direct link with profitability (IFAC, 2005; Lee & Schaltegger, 2018; Schaltegger, 2018). Generally, MEMA happens when a financial value is allocated to

PEMA data (Gunarathne & Lee, 2015). These two types of information work hand in glove due to PEMA supplying information to MEMA (UN, 2001; Burrit et al., 2016). PEMA and MEMA offer a solid ground for decisions relating to attaining of established goals and targets. Also, IFAC (2005) unearth that physical and monetary environmental data enables the establishment of the quantification and impact of an organization's ecological effects.

PEMA and MEMA are both in-house environmental management tools which link well with external reporting. If external reporting is done, PEMA and MEMA are known as "Physical External Environmental Accounting and Reporting (PEEA) and Monetary External Environmental Accounting and Reporting (MEEA)" (IFAC, 2005).

A study by Chaudhry, Amir and Hussain (2020) indicate that managers are reluctant to align PEMA with MEMA during decision making processes. The study further concludes that managers will arrive at uninformed environmental decisions. By the way, PEMA should be interrelated to MEMA to improve the quality of decision making. However, Phan et al. (2017) reject that linking of PEMA and MEMA is not important in making decisions as the information is used by various internal stakeholders for various purposes. Phan et al. (2017) contend that for instance, an environmental manager would be interested in knowing the quantity of waste generated within specific period whereas a finance manager will be focused on the monetary value of wastes generated.

However, most organizations maintain the traditional management accounting system as the mainstream accounting system providing information for environmental information such as MEMA. This information from the traditional management accounting system is not adequate to effectively influence environmental management decision making. As such, it is critical to identify the role of the traditional management accounting system in EMA.

IFAC (2005) argue that the type of environmental information used by various organizations in making environmental decisions is not clearly known. This was consistent with the finding by Chaudhry et al. (2020) and Phan et al. (2017) who

observed that it remains vague on the nature of environmental information adopted by management in making environmental decisions.

Consequently, the study centres on this question:

1. What is the nature of information used to report solid waste management in the municipalities of Gauteng?

2.8. Role of traditional management accounting system in EMA

The key role of management accounting has been restricted to providing monetary information in EMA (IFAC, 2005; Setthasakko, 2010). The monetary information prepares financial reports used by management to arrive at informed business decisions. But, the monetary information from the traditional management accounting system is not adequate to evaluate environmental information because of the incorrect allocation and hiding of environmental costs into overhead accounts (IFAC, 2005; Schaltegger, 2018). In this case, EMA helps to collect and accurately allocate both monetary and non-monetary environmental information (IFAC, 2005; De Beer & Friend, 2006). In practice, this has been difficult due to a communication gap existing between management accountants and environmental managers.

Communication and coordination between management accountants and other environmental management departments are frequently not well developed (Tsui, 2014; Muza, 2018). For instance, the production department may be involved in generating wastes but lacks data on the costs of waste disposal. On the other hand, the accountant possesses little understanding on the existing physical flow of materials and energy through production leading to wastes and other environmental impacts (IFAC, 2005). This lead to the management accountants to unintentionally “hide” environment-related costs by assigning them in general overhead accounts (Kelsall, 2020). In summary, the accounting department and the environmental management department need to cooperate and share information. This is crucial for organizations to be successful in EMA adoption.

In case of municipalities, a smooth communication and coordination between the accounting section and other departments will enhance environmental performance. This will be achieved through accurate identification and allocation of monetary and physical waste-related environmental information. As such, the proposed EMA framework incorporated narrowing the communication gap between the accounting department and other environmental management departments. This is due to absence of collaboration between management accountants and environmental managers established as a key barrier of EMA adoption (Jalil, Abar & Dadashian, 2016; Kurapatskie, 2012; Tsui, 2014). Also, this communication challenge between the accounting department and other environmental management departments impedes an effective selection and adoption of EMA practices.

2.9. EMA practices in the local government

Environmental management accounting practices have, of late, drawn a lot of scholarly attention over the recent years due to their capacity to address two of the three pillars of sustainability—environmental and financial. Without a scholarly consensus on the definition of EMA, EMA practices also remains without a common definition. Other scholars (see Singh, Ma & Yang, 2015; Teles et al., 2015; Chen, Tang & Feldmann, 2015; Bananuka et al. 2021) have also named EMA practices as environmental management practices (EMP). The commonality between the two terms has been anchored on the premise that all the practices' underlying goal is to improve environmental performance by reducing environmental impacts. Also, EMA practices have been named as green initiatives (Yacob, Wong & Khor, 2018). But, this study adopts EMA practices in place of EMP because EMA practices broaden its scope on environmental management. EMA practices are one of the ways that organizations can aid themselves to manage the environmental activities and achieve the organization's bottom line. This is rooted in the hypothesis that environmental management improves environmental performance of organizations (De Beer & Friend, 2006; Isaac et al., 2019; Voinea et al., 2020; Le et al., 2019; Chathurangani & Madhusanka, 2019).

To achieve waste management sustainability, municipalities will need to adopt EMA practices relevant to their specific operations or customised to meet their situational contexts. Jamil et al. (2015) defined EMA practices as tools that assist to improve environmental performance and environmental information approach. While, on the other hand, Phan et al. (2017) view EMA practices as a way of “reducing of waste of energy, materials and costs in producing goods and services”. Therefore, the researcher believes that from the mentioned definitions, EMA practices can assist municipalities to increase environmental benefits and accomplish waste management-related improvements if correctly adopted. Ferreira et al. (2010) point out that “simply” identifying of waste is also considered an EMA practices with the intention to augment environmental performance.

However, EMA practices applied by organizations are little known. That is, extant empirical studies to confirm EMA practices used within industrial sectors remains scarce in the contemporary literature. For instance, Fuadah, Kalsum and Arisman (2021) in a study of 54 Indonesian manufacturing companies conclude that EMA practices in the manufacturing sector are unidentified and remain unknown. As such, managers remain confused on the best EMA practices to implement within their operations. This is based on the argument that different industrial sectors apply different EMA practices appropriate for their sector (Mokhtar et al., 2016). In consistent with this finding, Phan et al. (2017) establish that EMA practices in Australian companies remain unknown due to absence of empirical studies to ascertain them and their effectiveness on environmental and financial performance. In addition, from an emerging market perspective, Bananuka et al. (2021) report that lack of practical knowledge on EMA practices used by hotels in Uganda hinders managers from effectively applying EMA because managers are not aware of EMA practices at their disposal and whether they can enhance environmental and financial performance. Sari, Fazi and Fayoi (2020) posit that EMA has so far been clearly conceptualised and theorized but the EMA practices used to achieve sustainability within organizations remains a theoretical assumption in literature. Hence, Le et al. (2019) concede that identifying of EMA practices within the corporate sector remains a gap in prior literature particularly in the

public sector. To support this, Qian et al., (2018; 2010) also identified that the nature of EMA practices used in the local government are unidentified in literature.

In studying of Indian waste management, Kumar et al. (2017) admit that there is a scarcity of empirical research on identifying initiatives that can address environmental concerns within the municipalities. The authors concurred with Ferdous et al. (2019) that environmental management research in the public sector is still missing. Similarly, Gunarathne and Lee (2015) recommend that researchers should put more attention on the public sector on matters to do with EMA. This is because as the sector is the largest employer in most emerging markets such as South Africa its actual environmental impacts may be underestimated. To fill this research gap, an assessment of EMA practices used to improve waste management in Gauteng municipalities was undertaken.

Furthermore, contemporary literature remains unclear on the actual benefits of employing EMA practices within the local government. Qian et al. (2018) during studying of EMA in Australian municipalities concluded that the actual benefits of adopting EMA practices in the municipalities remains theoretical. Similarly, Ong et al. (2018) reveals that the practical contribution of EMA implementation is still imaginary in some sectors. Burrit et al. (2016) concurs that this is because EMA is still at a development stage.

Further, EMA remains at the initial stage in emerging markets such as South Africa (Nyide, 2019). This suggests and supports initial emphasis by scholars (such as Fuadah et al., 2021; Phan et al., 2017; Le et al., 2019; Sari et al., 2020) that EMA practices used in emerging markets' industrial sectors remains unknown due to absence of empirical studies focusing on the subject area of EMA practices. Given this background, it becomes relevant to identify EMA practices applied in Gauteng municipalities and what benefits accrues from the implementation.

As a result, the study focuses on these questions:

1. What are the EMA practices used by municipalities in Gauteng to improve solid waste management?
2. What are the environmental benefits of applying EMA practices in the municipalities of Gauteng?

2.10. The role of EMA in municipal solid waste management

Waste management sustainability and pathways require apt and reliable accounting information (Qian et al., 2018). This is to assist substantiate efficiency of environmental and economic waste reduction initiatives (Ball, 2005). To make sound decisions require a good understanding of costs “than available in conventional accounting systems” (Qian et al., 2010). EMA becomes significant to provide this information in the local government. Hence, United States Environmental Protection Agency (USEPA) (2006) contend, that with only traditional accounting system in existence, only overhead costs are integrated into waste management decisions. This proves the significance of EMA in availing both monetary and physical information in addressing waste management issues. Additionally, this helps to expose “hidden” environmentally generated costs and revenues. Ball and Craig (2010) acknowledge that EMA expose waste-related costs hidden in other overheads accounts. The authors furthermore conclude that EMA also uncover the numerous costs incurred by waste management on its trip through the organization such as machine hours, internal transport and administration. Further, EMA can assist to internalise external waste management costs (Qian et al., 2018). These costs are overlooked by the traditional accounting system. Therefore, EMA is a fundamental tool to assessing externalities (IFAC, 2005). Given this, the researcher posits that EMA remains a critical tool in Gauteng municipalities in bringing in their externalities such as GHG emissions in accounting.

Under waste management, an extension of EMA will be to embrace indirect costs and effects from the related physical processes such as legal service and fines and site clean-up (IFAC, 2005). In this regard, EMA assists to ensure that adequate pricing and charging structures of levies are maintained (Osborn, 2001). So, EMA can be utilised to make the full costs of the municipalities’ waste flow clearly visible and ensure that these

costs are reported to both internal and external stakeholders. EMA can therefore ensure that waste management costs are not lost or misallocated to other overhead accounts.

The researcher opines that without a system to track environmental costs and environmental information, municipalities in Gauteng face a deficiency to proficiently address their waste management sustainability issues with implications for long term sustainability. Therefore, it can be argued that the opportunity for increasing environmental performance from waste management is being ignored in Gauteng's municipalities. Consequently, to overcome waste management problems it is therefore vital to incorporate both monetary and non-monetary waste-related environmental data for sound decision-making. As such, a system to track environmental information is needed in Gauteng municipalities to minimise waste management-related challenges, reduce environmental constraints and thereupon enhance financial performance.

Also, another established body of literature contend that the absence of sufficient and relevant environmental information acts a major impediment to improving waste management (Qian et al., 2018; Bharadwaj et al., 2020; Bartolacci et al., 2018; Bowan et al., 2020). This implies that Gauteng municipalities are making decisions without the essential and necessary first-hand waste-related environmental information hence the rapidly increasing negative economic, environmental and social impacts such as pollution, public health challenges and flooding from blocked drain. However, lack of an EMA framework also hinders combining of environmental issues, both in monetary and non-monetary form, in the current accounting system of organizations (Sethhassako, 2010; Chaturangani & Madhusanka, 2019; Ong et al., 2014). In essence, an EMA framework to specifically enhance waste management in Gauteng is missing in current literature. So, the study attempts to close this gap.

Therefore, the study considers the following question:

1. What EMA framework can be developed to improve waste management sustainability in municipalities of Gauteng?

The proposed framework is important to ensure availability of waste-related environmental data in form of monetary and non-monetary. This data can be vital to predict future trends of waste management for planning resolutions in accordance with economic development. According to Xin et al. (2020) waste data is critical for appropriate management planning.

2.11. Research gaps in contemporary literature

Globally, EMA in the local government has not been much subjected to scientific studies (Qian et al., 2018). Besides, the available studies (Qian et al., 2018; Ball, 2005; Ball & Craig, 2010; Osborn, 2001) mainly focus on the developed countries. For instance, using an exploratory case study method on 12 municipalities in Australia, Qian et al. (2010) discovered that EMA information was used on waste management. Furthermore, Qian et al. (2018) applied a survey to collect primary data from 141 councils in Australia to investigate the factors motivating application of EMA in the municipalities. Other studies by researchers such as Ball (2005), Ball and Craig (2010), and Osborn (2001) also focused on EMA in local government. Unfortunately, in direct contrast to global needs (Burrit et al., 2016); a large number of the prior studies were carried out in developed countries, the results of which may offer some valuable insights but cannot be strictly extrapolated to emerging markets such as South Africa. This is due to some differences in cultural, institutional and socio-economic contextual factors. Hence, this study becomes crucially important and relevant to close this gap from an emerging market perspective. To fill this gap, this study focuses on EMA in the local government in Gauteng, South Africa; an emerging market economy.

Regrettably, previous EMA frameworks have either focused on generic models (IFAC, 2005; Muza, 2018; Nyide, 2019) or were designed for other sectors other than the local government. The generic EMA frameworks by Burritt et al. (2002), UN (2001) and IFAC (2005) were all developed with the perspectives of developed countries in mind (Nyide, 2019). Regardless of the significance of this subject, to date, it has commanded comparatively very limited consideration in the local government particularly in emerging markets like South Africa. So, in South Africa, a key knowledge void remains within the realm of EMA research in local government. This leaves a gap for developing

a local government sector-specific EMA framework for enhancing waste management sustainability in Gauteng. To close the opening, this study develops and proposes an EMA framework for waste management sustainability of municipalities in Gauteng.

Locally, a myriad of studies has been done on the waste management such as those done by Dlamini et al. (2019), Gumbi (2015), Mbulawa (2019), Adeleke et al. (2021), Ayeleru et al. (2018), Malope (2020), and Rasmenia and Madyira (2019) among others. But the studies have focused much on the disclosure (Maleka et al., 2017), waste management's environmental effects and analysis (Gumbi, 2015; Malope, 2020) more than the financial aspects. As can be seen, how EMA can improve waste management remains under-explored (Qian et al., 2018). Thus, the question that remains unanswered is, "how EMA can be applied in Gauteng local government to improve their waste management." This study, thus, expects to disentangle a practical problem by examining how EMA can improve waste management through sound environmental performance in Gauteng local government.

2.12. Chapter summary

This chapter reviews literature on waste management, sustainability and EMA. It is established that developing countries in contrast to developed countries face a critical waste crisis. This has been no exception to South Africa in general and Gauteng in particular. This has been attributed to lack of sufficient funds by municipalities, absence of waste-related environmental data and poor management of waste costs. The bottom line negative impacts stemming from the poor waste management include GHG emissions, climate change, associated diseases and blocked drains. This shows that waste management is vital to achieve sustainability. To overcome the waste management challenges, EMA is proposed as a possible pathway. This puts its major sight on accurate collection of both monetary and non-monetary waste-related environmental information for management decision making centred on enhancing environmental performance. Literature review shows that EMA can assist municipalities to ensure correct levies for residents, appraise environmental investments and ensure accurate allocation of environmental costs. However, contemporary literature shows that an absence of a local government sector-specific EMA framework remains missing

hence the study propose an EMA framework for the waste management sustainability of Gauteng municipalities. The framework seeks to stimulate and improve waste management through making available monetary and non-monetary waste-related environmental information. Lastly, the study is underpinned by the institutional and stakeholder theory. The following chapter centres on the research methodology of the study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Introduction

Chapter 2 provided the theoretical framework underpinning this research and a survey of contemporary literature on EMA and municipal solid waste management. Figure 3.1 underneath depicts the arrangement of this chapter.



Figure 3.1: Chapter layout

Source: Author's own compilation

3.2. Research design

Research design is viewed as an outline for achieving the research objectives and solving research questions. Creswell (2015) suggested that research designs are forms of inquiry positioned within “qualitative, quantitative, and mixed-methods approaches” These approaches dictate a particular course for procedures in a research design. The researcher employed a qualitative, constructivist grounded theory research design to understand EMA specifically on waste management in municipalities in Gauteng. This qualitative research uses the grounded theory design. The aim of grounded theory is to have a theory, model or framework emerge from data where little is known about the subject topic (Glaser & Strauss, 1967). The constructivist grounded theory research design was identified as suitable research design. This is because the primary objective of the study is to develop an EMA framework for the waste management sustainability of the municipalities in Gauteng.

The constructivist grounded theory research design used constant data gathering and evaluation to develop the proposed EMA framework. Charmaz (2014:1) stated that “Grounded theory methods consist of systematic, yet flexible guidelines for collecting

and analysing qualitative data to construct theories from the data themselves". Grounded theory can be defined as the "systematic discovery of theory from data obtained during the social research process" (Glaser & Strauss, 1967). Glaser and Strauss (1967) and Creswell (2013) view grounded theory as finding of theory from data scientifically acquired with the main purpose of developing or determining a theory of actions or processes. The data are constantly put under questioning, till the theory develops (Charmaz, 2014). In this research, the researcher was only having research questions that were used to concurrently collect and analyse data, a process that was echoed by Strauss and Corbin (2008). An EMA framework is established from the data gathered from annual reports of municipalities and subjected to the grounded theory processes.

3.3 Research approach

3.3.1. Qualitative method

Creswell and Plano Clark (2011) show that by employing a qualitative research method the researcher strives to better understand a difficult situation. Saunders et al. (2012) uphold that qualitative method applies an inductive approach. Scholars perceive qualitative research as an opposition to quantitative method. In this case, Stringer (2014) notes that qualitative methods are applied when the problem has to be explained using words. That is, the problem entails discussion and description. As this study intends to answer the research problem on the EMA practices, type of environmental information used to report waste management and benefits of adopting EMA practices, qualitative method is appropriate for this study. This is because for instance, the problem requires that EMA practices by municipalities to improve waste management be expressed in words and not in figures.

This study specifically uses documentary analysis as a qualitative research method. To support this, Creswell and Plano Clark (2011) and Corbin and Strauss (2008) show that qualitative research is the gathering of data through the analysis of text through several methods. Even so, Thienel (2014) contend that qualitative research method centrally

concentrates on establishing an opinion emanating from various sources about the research problem.

3.4. Research paradigm

A philosophical stance often lies behind the methodology in questions (Saunders et al., 2012). It could be positivism, constructivism/interpretivism or pragmatic in nature.

Positivism paradigm: This paradigm observes the social world as external to the researcher (Leedy & Ormrod, 2014). It also embraces that scientific method remains the single way to find the truth and objective reality. By implication, proponents of positivism argue that which is unobservable or unmeasured like public's thoughts and attitudes does not qualify as proof of knowledge. This avoids personal bias by not influencing results of a specific study (Kurapatskie, 2012).

Positivism is grounded upon the understanding that science is the only basis for accurate facts (Creswell, 2015). As such, the observations based on positivists, can be performed again under similar circumstances and it is this element that permits the estimation of connections among research variables grounded on prior observations. According to Creswell (2015), a lot of attention is focused on internal validity, reliability and generalizability by the positivist researcher as opposed to the subjectivist researcher who ignores them.

Ivankova (2015) holds that the approaches, procedures and systems applied in the natural sciences avail the greatest framework for probing the social world. In this case, positivism generally uses scientific method in studying of human action. At present, positivism is looked at as being objectivist-meaning objects in our surroundings exist and with meaning, free from our awareness of them (Creswell & Plano Clark, 2011). Research linked to this paradigm depends on deductive logic, construction of hypotheses, evaluating those hypotheses, mathematical models and terminologies to develop conclusions. Saunders et al. (2012) argue that the positivism paradigm provides details, create forecasts and estimates grounded on quantifiable results. Given this background, this paradigm promotes the adoption of quantitative research methods as the basis of analysing and interpreting the collected data in order to grasp the

connection embedded in the data analysed. Tashakkori and Teddlie (2008) state that the main assumption of positivism paradigm is that reality and knowledge is “out there to be discovered” by research in order to look for objective evidence.

Interpretivism paradigm/Constructivist paradigm: The major effort of the interpretivist paradigm is to comprehend the subjective world of human experience (Saunders et al., 2012). This paradigm attempts to “get into the head of the subjects being studied” (Creswell, 2015) and to grasp and deduce what the subject is thinking or the inference s/he draws from the circumstances. Attention is aimed to attempt to grasp the perspective of the matter being studied as opposed to the perspective of the observer. Importance is shifted on comprehending the individuals and their understanding of the world around them. So, the major ideology of the interpretivist paradigm is that the truth is “socially constructed” (Creswell, 2015). This gave rise and emerging of the interpretivist paradigm to also be known as the constructivist paradigm.

Pragmatism paradigm: The pragmatism paradigm has been considered an alternative paradigm. Stringer (2014) argues that this paradigm avoids the contested subject of truth and reality as it positions itself in the direction of resolving hands-on difficulties in the “real world.” In this manner, pragmatism permits a researcher to be void of psychological and practical restrictions enacted by the compulsory option between interpretivism and positivism. Under pragmatism, researchers are not compelled to be hostage of a specific research method (Creswell & Plano Clark, 2011). Tashakkori and Teddlie (2008) described pragmatism as a philosophical approach putting the research question as the most important focus.

Pragmatism emerged among scholars who opined that it was not highly possible to get the reality concerning the real world merely by means of one scientific method as supported by the positivist paradigm nor it was likely possible to identify social reality as built under the interpretivist paradigm. Scholars such as Tashakkori and Teddlie (2008), Saunders et al. (2012) and Creswell (2015) put forward that it is critical to establish a worldview that would make available methods of research that are viewed to be best suitable for tackling the problem at hand. As such, the aforementioned scholars searched for tactics to research grounded in practicality that may tolerate integration of

methods which could assist to expose the research problem in different angles. This led to emergence of a paradigm that promotes the adoption of mixed methods as a pragmatic approach to grasp human actions-hence pragmatic paradigm. In a way, this paradigm emerged to stop the two completely divergent approaches of the positivist and interpretivists. This brought to an end the wars termed “paradigm wars” (Wang et al., 2020).

A link subsists between paradigm and methodology as the methodological effects of paradigm choice invade the research question/s, data collection instruments and collection techniques plus data analysis. For instance, this study concentrates on qualitative data (constructivist philosophy) to identify EMA practices used by Gauteng municipalities to improve solid waste management. In addition, the qualitative data is utilised to establish the nature of environmental information used to characterise EMA and the benefits of adopting EMA practices. Therefore, the philosophical assumptions of this study are embedded within the framework of interpretivism. This, by inference, means that the study subscribes to benefits of a qualitative study.

3.5. Rationale for choosing the interpretive paradigm

The interpretive paradigm was considered the best appropriate paradigm for the research because of its possible capabilities to produce new understandings from which a novel framework can be established. This study establishes from the municipalities’ views through annual reports, an EMA framework for the waste management sustainability of the municipalities in Gauteng. This research wanted the real-world knowledge that is entrenched in the sphere of human interface and meanings, thus additionally justifying the suitability to examine under the interpretive paradigm. It is this research’s plan to deduce content in documents to discover meanings. Also, in this study real-world knowledge emerged from the annual reports prepared by the municipalities in Gauteng.

3.5. Population

Yin (1994) defines population as the total number of objects or set where the study’s individuals and subgroup are selected from. The study uses all 11 municipalities from

Gauteng province as its population to identify annual reports to analyze. Gauteng has a total of 11 municipalities (SALGA, 2020). These are listed in Table 3.1.

Table 3. 1:Population of the study

Name of municipality	Annual reports used
Sedibeng Municipality	X
City of Ekurhuleni	X
City of Johannesburg	X
City of Tshwane	X
Emfuleni Local Municipality	
Merafong Local Municipality	
Lesedi Local Municipality	
Midvaal Local Municipality	
Mogale City Local municipality	X
Rand West City Local Municipality	
West rand district municipality	

Source: Government of South Africa website (www.gov.za)

3.5.1. Sampling

In grounded theory design, the criteria to decide on sampling are not static or cannot be scheduled before beginning of the study (Charmaz, 2014). This suggests that sampling decisions progress as data is gathered and evaluated. In essence, sampling decisions are directed by the developing conceptual categories: the up-and-coming concepts then define “who” follows next in terms of sampling. This assists the researcher to simplify understanding and produce the theory of phenomenon of interest (Corbin & Strauss, 2008). Hence, the sampling framework in grounded theory is known as theoretical sampling. Theoretical sampling is directed by emerging ideas. Theoretical sampling means that no new data can emerge from the sample.

The annual reports were sampled in the confinements of the 11 municipalities listed in Table 3.1. The 36 annual reports were collected from 2015 to 2021. In this study,

theoretical saturation was achieved with 32 documents. This means the documents after the 32nd document could not provide new data pertaining to the research questions at hand. This is line with Corbin and Strauss (2008) that documents in excess of 30 can be suitable to attain theoretical saturation.

As defined by Saunders et al. (2012:252), “a sample is a subgroup of the whole population”.

The selection criterion of the Gauteng municipalities to use their annual reports from was based on:

1. Municipalities that report on waste management information from 2015.
2. Municipalities that publicly and actively report on EMA practices and if their annual reports provide data essential for the study between 2015 and 2021.

Therefore, five municipalities (ticked on the right side in Table 3.1) were selected from a population of 11 based on the above mentioned criteria. So, purposive sampling was applied in this study. This means a total of five municipalities’ annual reports from their websites from 2015 to 2021 (seven years) were reviewed to answer the research questions. The reason for using this period is that municipalities had no waste management data in their reports prior to 2015. Seven municipalities had met the requirements above but theoretical saturation was achieved on annual reports of the fifth municipality.

Table 3.1 below shows the number of documents each that were used per each municipality to achieve theoretical saturation.

Table 3. 2: Demographic structure of annual reports collected

Municipality	2015	2016	2017	2018	2019	2020	2021	Total
City of Johannesburg	1	1	1	1	1	1	1	7
City of Tshwane	1	1	1	1	1	1	1	7
Ekurhuleni Municipality	2	1	1	1	1	1	1	8
Sedibeng Municipality	1	1	1	1	1	1	1	7
Mogale City Municipality	1	1	1	1	1	1	1	7
Total	6	5	5	5	5	5	5	36

Source: Author's own compilation

3.6. Qualitative data collection and analysis

Primary data relates to first-hand information whereas secondary data arises from information gathered beforehand (Creswell, 2015). The study's data is all extracted from secondary data sourced from the annual reports and environmental reports of the municipalities in Gauteng from 2015 to 2021. Secondary data is used due to easy and readily availability on Gauteng municipalities' websites. The secondary data and use of documentary analysis as a data collection tool were driven by absence of human objects due to COVID-19.

Qualitative data was sourced from documentary analysis of five Gauteng municipalities' annual reports and notes to the annual financial statements spanning from 2015 to 2021. Scholars have reported that annual report is one of the most critical disclosure medium (Corbin & Strauss, 2008; Bowen, 2009). Documentary analysis is a logical process "for assessing and appraising documents—both printed and electronic material" (Bowen, 2009). Thus, documentary analysis dictates that data be scrutinized and interpreted so as to draw meanings, increase understanding and develop field

knowledge (Corbin & Strauss, 2008). Yin (1994) emphasises that documentary analysis is a stable method and can be read repeatedly. In this study, a total of 36 reports were gathered between 2015 and 2021. So, it is a proper sample based on Strauss and Corbin (2008) that at least 30 documents can be a sufficient sample.

Municipalities in South Africa have been directed by the government and King code III and IV to submit annual reports as part of corporate governance and accountability mechanism. The introduction of King III in 2009 in South Africa mandated that municipalities should also make sure that disclosures such as economic, social and environmental information are included in their annual reports (Price Waters Coopers, 2018). This was to promote sustainability through reporting and corporate governance. This was further reinforced by the King IV in 2016. In addition, the National Treasury in South Africa requires environmental reporting to be incorporated by municipalities in their annual reports (Price Waters Coopers, 2018). Consequently, municipalities have been extensively disclosing their waste management practices and also environmental practices to address solid waste management. This is important to allow stakeholders to make an informed evaluation of the environmental performance of the municipalities.

3.7. Data analysis using the grounded theory process

Grounded theory uses a concurrent data collection and analysis (Charmaz, 2014). What this implies is that the study follows a twist and turn style that involves each documentary analysis to be done soon after data collection. In this study, documentary analysis was therefore adopted as a data collection tool.

As data is gathered and evaluated, the developing theoretical categories may lead to the alteration of the guiding focus areas to integrate all unexpected questions; the intention being to augment new matters or documentary analysis questions. This leads to saturation of the emerging theory as data gathering carries on. All data analysis performed were noted and transcribed. After transcription, every data analysis was coded and analysed before the next one was performed so that new information might be integrated into ensuing encounters. Developing concepts established through the coding of initial documentary analysis were as well examined in a follow-up

documentary analysis. The emergence of the theory or EMA framework was a continuing practice. Data gathering was only concluded as soon as the theoretical saturation was achieved.

Figure 3.2 indicates the grounded theory process and evaluation that was used.

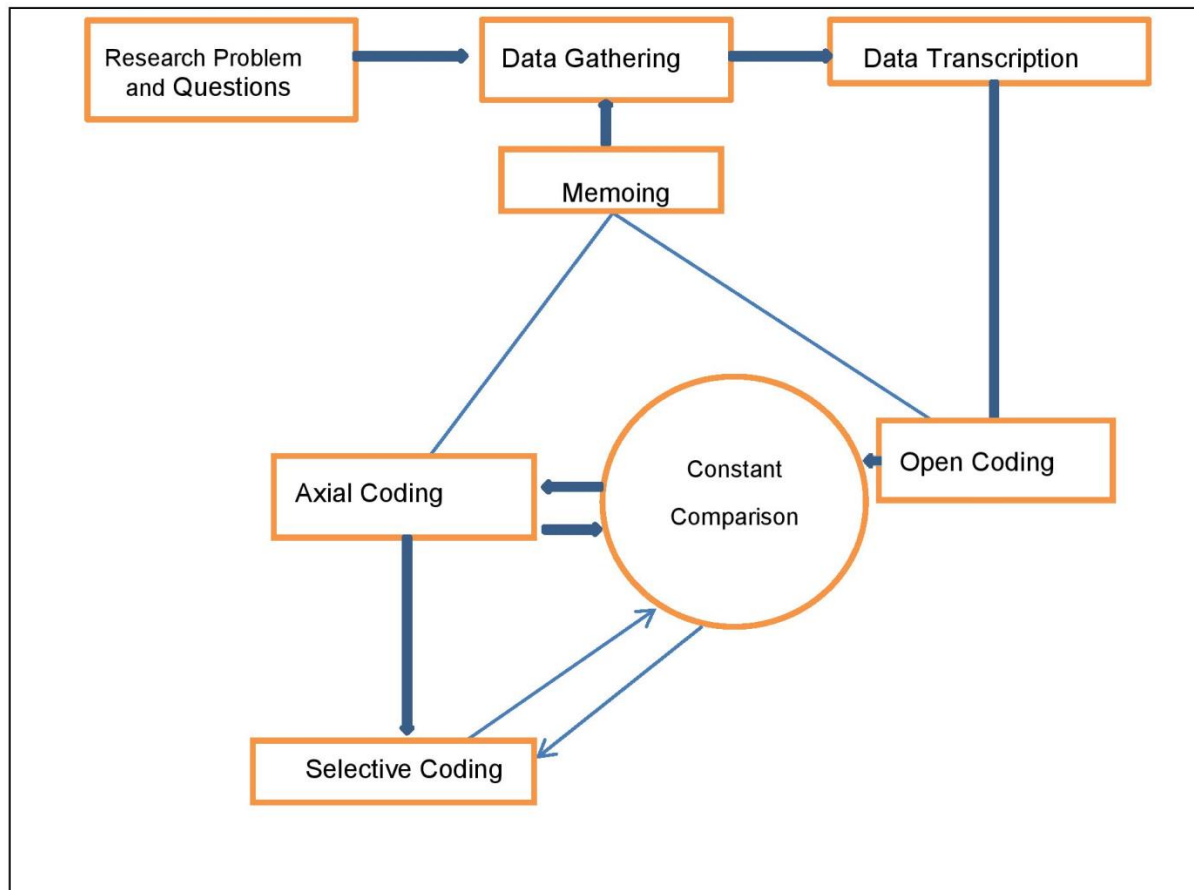


Figure 3. 2: Grounded theory process and analysis

Source: Researcher's own compilation

Memoing was also performed for the duration of and after data collection plus during the coding process. The memoing process was conducted in line with suggestions by Corbin and Strauss (2008). Corbin and Strauss (2008) suggested that memoing ought to be performed from the commencement of the research up to the concluding report. Memoing assisted the researcher in sanitizing the style to exploring questions during data gathering. This also assisted to take note of key subjects that were developing.

Figure 3.3.and Figure 3.4 shows some of these memos.

Memo 1: EM3 Waste management benefits 13 April 2022

Environmental management practices are effective in waste management improvement. *“Sedibeng Municipality uses key environmental strategies to: Achieve waste management planning.”* (Sedibeng Municipality Annual Report, 2019/2020, EM3). Thus, to achieve benefits from EMA practices on waste management it is also important to comply with other legislations. *“Our measures ensure effective compliance with waste management legislation to protect the environment.”* (City of Johannesburg Integrated Annual Report, 2016/2017)

Figure 3.3: Memoing: Waste management benefits

Source: Researcher’s own compilation

Memo 9: SW6 Waste management practices 13 April 2022

Waste management practices help to achieve improved waste management. *“The City during 2020/21 financial year, continued to encourage waste minimisation as well as improving the regulatory performance and reporting of Waste Management Activities (WMA).”* (City of Johannesburg Integrated Annual Report, 2020/2021, SW6). Regulatory compliance and waste management reporting can be effective practice to attaining better waste management.

Figure 3.4: Memoing: Waste management benefits

Source: Researcher’s own compilation

3.7.1. Data coding

To develop the EMA framework from grounded theory, constant comparison technique was employed. This process involves coding and evaluating data through three stages namely “open, axial and selective coding” (Corbin & Strauss, 2008). This process allows the researcher to discover patterns and describe patterns and differences as the theory develops. A summary of the three stages of grounded theory utilized in throughout data analysis is discussed below:

3.7.1.1. Opening coding

Open coding was the beginning stage in the coding process. At open coding stage, the researcher established the key words used, that linked to the similar part and coded these in view of that. The researcher applied Birk's and Mills' (2011) method which a collection of words are extracted verbatim to reveal what the documents were communicating. Sentence-by-sentence coding was applied on specific areas that focused on waste management, EMA practices and benefits so as not to omit major areas that the documents were emphasizing on. Additionally, the transcribed data was subjected to opening coding. Figure 3.5 depicts an example of opening coding process.

“Our measures ensure effective compliance with waste management legislation to protect the environment, improve the quality of life of Johannesburg residents, and to contribute to Johannesburg's economy and aesthetic character”



Figure 3. 5: In-vivo codes

Source: Author's own compilation

Besides using in-vivo words, the researcher also applied various colours to outline the various areas being investigated; for example, the colour blue used for the theme *Environmental benefits of applying EMA practices* as shown in Figure 3.6 below.

	Colour coding	
City of Johannesburg	Mogale City	Sedibeng Municipality
EMA practices help municipalities through waste management to protect and manage the environment.	Initiatives reduces environmental impacts	Environmental measures lessens contribution to climate change
Quality of life improves by adopting environmental management practices	EMA practices contributes to a decrease in pollution	EMA practices amplifies compliance
Forces adoption of waste reduction hierarchy	Protect resources	Upswing in environmental performance from adoption of environmental practices
Emissions tonnage	Percentage of decrease in GHG	Total of waste diverted to landfill
Waste management plan reviewed	Waste recycling and Green Waste Diversion are valued	Environmental audits are performed

Figure 3. 6: Coding using important words

Source: Researcher's own compilation

3.7.1.2. Axial coding

After the coding process, the next step was axial coding that had to link codes that concentrated on a similar area, applying a different colour for each area. The researcher applied Onion's (2006) technique for axial coding which is linking codes to each other. Constant comparison was also employed during open and axial coding with the aim of making sure that core themes emerge from the data. For example, green was used to establish the character of EMA information used to reporting waste management issues. Figure 3.7 shows an example of axial coding.

To quantify wastes averted from landfill	City of Tswane
Amount of wastes disposed at landfill	City of Johannesburg
Information in physical units to express waste generated	Ekurhuleni Municipality
The information quantifies tonnes of wastes per day	Sedibeng Municipality
The data in figures shows tonnes of waste per day producing GWh per year	Mogale City Municipality

Figure 3. 7: Axial coding: Character of EMA information used to reporting waste management issues

Source: Author's own compilation

Theoretical saturation occurred at document number 32, when the documentary analysis could not provide any new information. Strauss and Corbin (2008) noted that theoretical saturation can be achieved with at least 30 documents depending on the nature of the questions.

3.7.1.3. Selective coding

The study used the method highlighted by Onions (2006) which vouch for core themes to be chosen and other similar themes linked to the core themes. The researcher used final themes drawn up from data sets (Charmaz, 2014). In this study, core categories are also major themes developing from data whereas sub-themes were viewed as supplementary categories. For example, *Waste management practices emerged as one of the core themes* and supplementary categories/sub themes to emerge were: *Problems identification practices, Quantification practices, and Operational practices*. In the table below, data in the first box to the left reflects axial coding, the middle box shows sub- themes (other categories), and the last box to the right indicates the core category, in this instance, *Waste management practices*. Table 3.3 shows axial coding as well as selective coding for *Waste management practices portfolio*.

3.7.1.3.1 EMA practices to improve waste management

The study's first objective wanted to know the key EMA practices used to improve waste management by the municipalities in Gauteng. This was important as it formed a key part of the research study. The annual reports revealed the following EMA practices:

"The City during 2020/21 financial year, continued to encourage waste minimisation as well as improving the regulatory performance and reporting of Waste Management Activities (WMA)." (City of Johannesburg Integrated Annual Report, 2020/2021)

"15 Environmental audits were conducted during the period under review" (Sedibeng Annual Report 2018/2019)

Research on waste management remains one of the strengths of the municipality (Ekurhuleni Municipality Annual Report, 2019/2020).

"We continue training our staff on sustainability and waste management matters" (Ekurhuleni Municipality Annual Report, 2019/2020)

"Our Annual Report is important to providing Environmental, Governance and Social factors..." (Mogale City Local municipality Annual Report, 2018/2019)

"Management reviews the Waste Management Plan periodically" (Sedideng Municipality Annual Report, 2018/2019)


"The total waste diverted is a result of the various initiatives including the Dry Waste Recycling and Green Waste Diversion and Builders Rubble Diversion." (City of Tswane, Annual Report 2017/2018)

“During the year under review a total of forty-one (41) new waste management activities were registered and fifteen (15) audits were conducted.” (Ekurhuleni Municipality Annual Report 2019/2020).

“The municipality has approved a research budget on waste management” (Sedibeng Municipality Annual Report, 2015/2016).

“The Sedibeng District’s Integrated Waste Management Plan was approved by the Province for inclusion in the IDP as per the Waste Act, in November 2014” (Sedibeng Municipality Annual Report, 2015/2016)

Table 3. 3: Core themes and sub themes on EMA practices to improve waste management

AXIAL CODING	SELECTIVE CODING	
	Sub-themes	Core theme
Environmental audits were performed Waste management research is our strength Research on waste management is important Waste management system is at the centre of our waste management The Sedibeng District’s Integrated Waste Management Plan was approved Employee training is part of our system Environmental reporting in our Annual reports speaks to our stakeholders Waste recycling converts our waste	Problems identification practices Quantification practices Operational practices	

Source: Author’s own compilation

3.7.1.3.2. Character of EMA information to report waste management issues

The study's first empirical objective was to identify how municipalities in Gauteng characterise EMA information to report waste management issues. The inherent role of EMA has been to provide monetary and non-monetary environmental information (CIMA, 2019). Findings from the annual reports of the five municipalities in Gauteng indicated that the major form of environmental information used to report waste management issues is in non-monetary or physical terms. The extracts emerging from environmental reports of the municipalities' reports illustrate the type of information used to report waste management issues:

"For the year under review, the overall total of waste diverted from landfill was 234 845 tonnages against 1 646 249 tonnages of waste generated resulting in 14% reduction of waste to landfill." (City of Tshwane Annual Report 2018/2019)

"The City disposes over 1.4 million tons of waste annually and all the waste generated is disposed at the City's four (4) operational landfill" (City of Johannesburg Integrated Annual Report 2018/2019)

"For the year under review, the overall total of waste diverted from landfill was 234 845 tonnages against 1 646 249 tonnages of waste generated resulting in 14% reduction of waste to landfill." (Ekurhuleni Municipality Annual Report 2019/2020)

"The three landfill sites are currently generating over 4 MW collectively. Robinson Deep is generating 2.6MW, Marie Louise generating 1.7MW and Goudkoppies generating just under 1MW. A total of 5280MWh has been produced by the three landfill sites." (City of Johannesburg Integrated Annual Report 2017/2018)

"A combined total of 2131 tons CO₂ has been diverted from the three landfill sites, leading to an average percentage of GHG offset of 15%." (Mogale City Local Municipality Annual Report, 2018/2019)

“The City collects and removes 1.53 million (92.6%) households’ refuse weekly.” (City of Tshwane Annual Report 2017/2018)

“The City disposes over 1.4 million tons of waste annually and all the waste generated is disposed” (City of Johannesburg Environmental Report 2019/2020)



“For the year under review, the overall total of waste diverted from landfill was 218 133 tonnages against 1272 515 tonnages of waste generated resulting in 17% reduction of waste to landfill” (Ekurhuleni Municipality Annual Report 2015/2016)

“The possible impact assumes that 400 tonnes of recyclables are processed per day, with 60% diverted from landfill.” (Ekurhuleni Municipality Annual Report 2019/2020)

“The possible impact considers that approximately 650 tonnes of waste is processed per day, producing 136 GWh of electricity per year.” (Mogale City Local municipality Annual Report, 2019/2020)

The sub-themes and core themes that emerged from the data are presented in Table 3.3.

Table 3. 4: Core themes and sub themes on EMA information to report waste management issues

AXIAL CODING	SELECTIVE CODING	
	Sub-themes	Core theme
Tonnage of waste generated Tonnage of waste disposed Reduction of waste to landfill in tonnes Energy generated from landfill sites in MW 400 tonnes of recyclables are processed per day Producing 136 GWh of electricity from wastes 2131 tons CO ₂ has been converted from landfill sites	Non-monetary information 	

Source: Author's own compilation

3.7.1.3.3. Environmental benefits of applying EMA practices

This study through research objective 3 sought to identify the benefits that municipalities in Gauteng are earning from the adoption of various EMA practices with specific focus on waste management. The annual environmental and sustainability reports of the theoretically sampled municipalities identify the following benefits:

“The current initiatives promote waste minimization, effective and efficient delivery of waste services, grows the contribution of the waste sector to the green economy, achieves integrated waste management planning, sound budgeting and financial management for waste services” (City of Tshwane Annual Report 2019/2020)

“Our measures ensure effective compliance with waste management legislation to protect the environment, improve the quality of life of Johannesburg residents, and to

contribute to Johannesburg's economy and aesthetic character" (City of Johannesburg Integrated Annual Report 2016/2017)

"Our city's waste management strategies have shown the following benefits:

- 1. Reduce impacts of climate change*
- 2. Diversification of energy mix*
- 3. Improved & protected water courses*
- 4. Water conservation."* (City of Johannesburg Integrated Annual Report 2019/2020).

"Sedibeng Municipality uses key environmental strategies to:

- 1. Achieve waste management planning*
- 2. Ensure sound budgeting and financial management of waste services*
- 3. To ensure effective compliance with the enforced Waste Act"* (Sedibeng Municipality Annual Report 2019/2020).


"Protect and manage the environment, conserve resources, minimise asset losses, and improve Ekurhuleni Metropolitan Municipality environmental performance.

Minimise the environmental impacts of the activities of the Ekurhuleni Metropolitan Municipality;

Minimise the contribution to climate change, and adapt to the consequences of global climate change;

Ekurhuleni Metropolitan Municipality use various practice to improve the quality standard of the environment through the reduction of pollution, implementation of a waste reduction hierarchy, an increase in social benefits in terms of health and resilience, and increased access to environmental resources" (Ekurhuleni Municipality Annual Report, 2019/2021)

Table 3. 5: Core themes and sub-themes on environmental benefits of applying EMA practices

AXIAL CODING	SELECTIVE CODING	
	Sub-themes	Core theme
<p>Our practices minimize the contribution to climate change</p> <p>Current initiatives promote waste minimization</p> <p>Our practices promotes efficient delivery of waste services</p> <p>The current strategies have proven to be assisting to reduce climate change</p> <p>Water conservation is increased from adopting of our environmental measures</p> <p>Current strategies improves Ekurhuleni Metropolitan Municipality environmental performance</p> <p>Environmental management measures used are minimizing the contribution to climate change</p>	<p>Ecological benefits</p>	 <p>Environmental management benefits</p>
<p>Financial management is improved</p>	<p>Monetary benefits</p>	
<p>Compliance with waste management plan</p> <p>Our environmental measures lead to compliance with national legislation</p>	<p>Compliance benefits</p>	

Source: Author's own compilation

3.8 Summary of sub-themes and core themes

Table 3.6 encapsulates the findings on the sub-themes and ten core themes which emerged from data using the principles of grounded theory.

Table 3. 6: Research findings on core themes and sub themes

Sub themes	Core theme
Problem identification practices	
Operational practices	Waste management practices
Quantification practices	
Monetary information	Waste management environmental information
Monetary benefits	
Ecological benefits	Environmental management benefits
Compliance benefits	

Source: Author's own compilation

3.9. Reliability and validity

Numerous validation strategies such as constant comparison in the coding process particularly in the course of open and axial coding were applied in this study to guarantee credibility and authenticity of qualitative research. The validity of study results refers to the magnitude to which the results are a truthful symbol of the phenomena they are supposed to represent (Leedy & Ormrod, 2014). In other words, validity speaks of righteousness and authenticity of the research data. To reduce the impact of interpretive bias, the researcher used the verbatim principle to extract the direct specific words within documents (Stringer, 2014). Every document was examined independently and, in some cases, in combination with other documents. Bryman

(2012) notes the forms of validity as descriptive interpretive, theoretical, generalisation and evaluative validity.

In this study, descriptive validity stems from the analysis of the correctness of the established themes whereas the examination of the phenomenon involves interpretive validity. Theoretical validity was accomplished by investigating the link between established constructs of the conceptual model. Hale (2016) claims that the application of documents will improve the theoretical validity. Generalisation validity is attained in the course of selective coding whereas evaluative validity is identified through the coding process, gathering of data and deductions arrived at in equating to a substitute method.

The rigour of grounded theory approach can be witnessed in both data gathering and analysis. This originated straight from the documents and was assessed (coded) line-by-line or word-by-word on section with environmental and sustainability issues to guarantee that no construct was overlooked. These codes were then formulated into concepts which later integrated into categories since more data was gathered and evaluated till the core categories were identified. By gathering more data, the application of constant comparison make sure that biases, guesses and deductions were given attention, since each slice of data to substantiate its significance. Every category were simply established when numerous data points established an identical code (Charmaz, 2014).

3.10. Ethical issues

This study did not include any human objects as study participants but instead used information available from the public sphere. As such, the ethical clearance application was categorised as “exemption from ethics review”. The ethical clearance was approved referenced 15234. A copy is found in Appendices section.

3.11. Chapter summary

Chapter 3 examined grounded theory as far as its components are concerned and the methods of coding data from open coding to selective coding. I described in detail in what way I conducted the qualitative data analysis centred on the principles of grounded theory. Results from the grounded theory processes were provided and evaluated in conjunction with current literature on key elements of EMA. Three themes emerged from the data regarding EMA practices used to improve waste management, character of EMA information and benefits of adopting EMA practice were *Waste management practices; Waste management environmental information; and Environmental management benefits.*

The next chapter, Chapter 4, discusses results and analysis and results. This involves developing of the proposed EMA framework to improve the waste management sustainability of the municipalities in Gauteng. Chapter 4 proffers the concluding remarks and recommendations for municipalities on waste management, coupled with recommendations for future research.

CHAPTER 4: RESULTS AND ANALYSIS

4.1 Introduction

This chapter focuses on the findings from the qualitative results reported in Chapter 3. This chapter discusses results from the grounded theory processes based on documentary analysis. Discussion of the findings and results is aimed at answering the following research questions of the study:

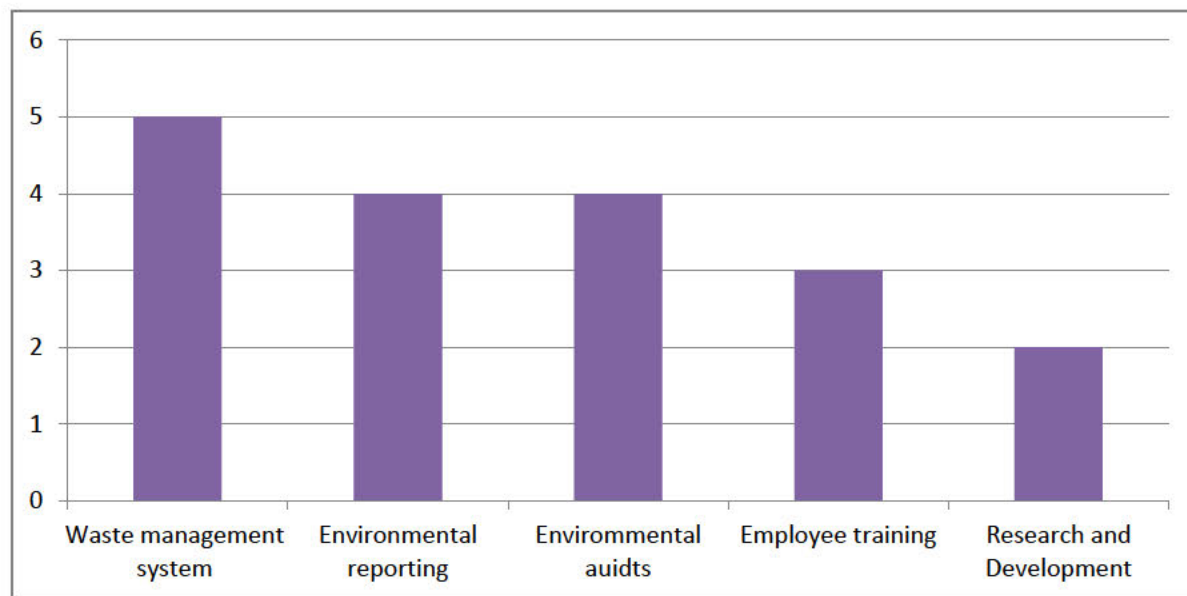
1. What are the EMA practices used by Gauteng municipalities to improve waste management?
2. What is the nature of information used to report waste management in the municipalities of Gauteng?
3. What are the environmental benefits of applying EMA practices on in the municipalities of Gauteng; and
4. What EMA framework can be developed to improve waste management of municipalities in Gauteng?

4.2. Results from the grounded theory processes

Question 1: *What are the EMA practices used by municipalities in Gauteng to improve waste management?*

In order to answer the Research Question 1: What are the EMA practices used by municipalities in Gauteng to improve waste management, secondary data from annual reports spanning from 2015 to 2021 were used. This arises from King Code III and IV requiring that organizations in South Africa including municipalities should extensively report on environmental and sustainability activities in annual reports. In order to collect this data, documentary analysis is conducted on annual reports of five municipalities in Gauteng from 2015 to 2021. The five municipalities were identified through theoretical saturation that was achieved at document number 32. Grounded theory was applied to identify the EMA practices used to improve waste management by the municipalities in Gauteng. The most applied EMA practices in Gauteng municipalities are depicted in Table 4.1.

Table 4. 1: EMA practices adopted by the municipalities



Source: Author's own compilation

The graph shows that waste management system has been reported as used by all five municipalities within a 7 year period (2015 to 2021). Equally, four of the five municipalities are using environmental audits as a measure to improve waste management. Three municipalities report in their annual reports between 2015 and 2021 as using environmental training to boost waste management. Unexpectedly, two municipalities are using research and development as an EMA practice to find techniques to lessen the effect of waste management. The results are in consistent with findings by Qian et al. (2018) and Ball (2005) that waste management system remains the mostly used EMA practice by the local government. This is important because it is frequently assumed that the adoption of environmental practices is integrated in day-to-day operations as a result of the presence of a waste management system (Nogueiro, 2014).

With the current levels of improper waste management within the Gauteng municipalities, it is important that municipalities check if there is no strategic gap between waste management system and other municipal departments. Martins et al. (2000) and Williams et al. (2011) report that waste management systems of the municipalities were not in sync with the other departments of the municipality such as

the environmental strategy hence environmental problems from the waste management increased. Linking this result with the high waste related impacts, one can argue that the municipalities might not be putting the waste management system into full practice. This could be ascribed to insufficient waste knowledge, political interference in decision-making, a slow decision making process and a low priority afforded to waste. This reduces the waste management system/plan to be a mere policy document. In one study, Lozano and Vallés (2007) identify that various factors such as political interference and lack of adequate educational qualifications were impeding municipalities from executing various plans leading to poor service delivery.

In addition, the results in Table 4.1 and the high solid waste-related negative impacts could also be explained by the fact that some of the larger municipalities are not adopting and implementing the Waste Management Systems. Also, the environmental training on staff could be inadequate to improve waste management, among other practices that occur more in large municipalities. A review of the annual reports of the municipalities in Gauteng indicates low environmental training of all employees in a municipality as inhibiting successful implementation of the environmental strategy. This infers that the environmental training being reported in the annual reports could be catering for very few employees. This pattern could explain the apparently bad environmental integration of the large-sized local authorities used in the study.

These results in Table 4.1 may be further explained by various factors, particularly the fact that many of the EMA practices considered for waste management evaluation are voluntary, and local government decision-makers will give priority to mandatory practices. However, there is a variance between what is reported in the municipalities' annual reports and the negative solid waste-related environmental impacts on the ground. This can be described by the need to present a very noble level of environmental practices to safeguard the authorities' image. Demirer et al. (2003) noted that with reference to other public sector organisations, these results may also be explained by overoptimistic view projected in the municipalities' annual reports.

Another possible explanation of the high number of EMA practices and the low waste management efficiency witnessed in the municipalities in Gauteng can be attributed to

lack of proper regulatory guidelines and compliance for waste management in the municipalities. Dumay et al. (2010) and Keating (2001) argue in favour of the researcher that despite being custodians of waste management, municipalities need to be constantly monitored on regulatory compliance. Therefore, the researcher recommends that municipalities should focus more on sustainably aligning the waste management system with other key objectives of the municipality so as to reduce the related environmental impacts. This ensures that there is no operational gap and that the waste management components such as segregation, collection, treatment, and disposal are closely interrelated.

When a waste management system is in place, environmental audits are more likely, as these two practices are very much related. When a waste management system is in operation, the municipality must conduct periodic environmental audits (Dickinson et al., 2005). In addition, before the waste management system design and implementation, an initial review or audit of the organisation should be accomplished. The environmental audits reflected on Table could be explained to high due to the operations of the waste management system that requires audits to be often conducted.

However, a careful analysis of the annual reports of the municipalities from 2015 to 2021 shows that this result is probably glorified. This is because the solid waste management activities are mainly annual activities reports with thematic sections on environmentally related issues similar from year to year. A similar finding was observed by Williams et al. (2011) in the Australian public sector, wherein in excess of 50% municipalities sampled had their environmental information overvalued.

However, considering the results versus the negative impacts of the solid waste management, it is possible to admit that integration of environmental practices into these municipalities in Gauteng is quite new. It is acceptable that it is still at an initial stage, although with a negative trend of environmental impacts.

Given the above justifications, the residents' anticipations on environmental issues can impact municipalities through a normative procedure. This can involve making modifications of EMA in municipalities' solid waste management. Also, the community may inspire municipalities through a coercive procedure, as defiance with residents' expectations may culminate in a loss of power. On the other hand, stakeholders can join hands at professional level and pile pressure on the municipalities to fully implement the respective measures in place such as waste management system.

The core theme emerging from Research Question 1 is Waste Management Practices.

Question 2: *What is the nature of information used to report waste management in the municipalities of Gauteng?*

Through documentary analysis it was overwhelmingly discovered that municipalities may be partially aware of the EMA concept. In spite of this, waste management information is being gathered and applied in municipalities' waste management as non-monetary information. All the theoretically sampled municipalities have shown to apply non-monetary or physical information on waste management issues. This is also depicted in Table 3.4 (Chapter 3). No monetary information was reported and identified on solid waste management in the annual reports from 2015 to 2021 of the used municipalities in Gauteng.

The lack of reporting the waste management issues in monetary terms in some isolated cases could be attributed to protecting the image of the organization. This stems from the fact that the large number of stakeholders understands and value environmental impacts when expressed in monetary terms. Qian et al. (2018) affirm that it is easy to understand some environmental impacts such as carbon emissions when reported in dollar value as opposed to the mass. However, the reporting of environmental information in monetary terms requires sophisticated systems such as valuing the carbon emissions in monetary value.

The municipalities mostly used non-monetary environmental information to report instances such as tonnes of waste produced per day or week, tonnes of CO₂ converted from the landfills and the amount of energy produced from landfills in Mega Watts (MW). This result was consistent with Phan et al. (2017). Phan et al. (2017), in studying 208 Australian organisations, indicate that physical EMA (PEMA) was applied more than monetary EMA (MEMA). Such findings are in line with Christ and Burrit (2013). However, Phan *et al.* (2017), Christ and Burrit (2013) and Ferreira *et al.* (2010) agree that usage of PEMA more than MEMA signals low levels of EMA usage. This suggests that the municipalities in Gauteng have a low and weak level of EMA implementation.

The researcher suggests that this can be attributed to the fact that EMA is a new system particularly in the developing countries such as South Africa. This is supported by Doorasamy (2019) and Nyide (2019) that EMA adoption and implementation is still limited in South Africa. This emerges from assertions by IFAC (2005), Qian et al. (2018), Le et al. (2019), and Christ and Burrit (2013) that in order to arrive at informed environmental performance decisions it is important that both monetary and non-monetary environmental information are collected. This allows managers from diverse backgrounds to fully understand the nature of the environmental costs and impacts. So, this suggests that by having only non-monetary information used to report on waste management issues some managers may not be able to clearly understand the level of environmental impacts from solid waste management.

This persistence of municipalities in reporting solid waste issues in non-monetary terms signifies the absence of a system to accurately convert the non-monetary information into monetary information. The proposed EMA framework for the waste management sustainability of the municipalities in Gauteng seeks to ensure that there is adequate collection of non-monetary and monetary environmental information. Subsequently, the monetary and non-monetary information can assist the municipality management to make sound decisions cognisant of accurate environmental impacts. Various scholars have empirically confirmed that this increases environmental performance of an organization through reduction of environmental degradation, emissions and pollution (Le et al., 2019; Qian et al., 2018, CIMA, 2018; Chathurangani & Madhusanka, 2019).

However, based on the grounded theory processes described in detail in Chapter 3, Research Question 2 saw Waste Management Environmental Information emerging as the core theme.

Question 3: *What are the environmental benefits of applying EMA practices in the municipalities of Gauteng?*

Relying on the evaluation of the yearly sustainability reports through principles of grounded theory, various organizational benefits of applying EMA practices were found. Results of the study show that by applying EMA practices in the municipalities in Gauteng certain benefits are forthcoming such as minimising contribution to the climate change, waste minimization, improvement in environmental performance. Also, the results show that the EMA practices are assisting to improve financial management and compliance with legislation. These were core themed as Environmental Management Benefits in Table 3.5 (Chapter 3).

From a theoretical perspective, it is clear that that the environmentally positive impacts derived from the benefits of EMA practices go beyond the activities that the municipality is in charge. The researcher stresses that these systems could have effects on all of the economic activities settled in the municipal territory, which could be amplified in the medium-and long-term perspectives.

Question 4: *What EMA framework can be developed to improve waste management of Gauteng municipalities?*

The main aim of the study is to develop an EMA framework for the waste management sustainability of municipalities in Gauteng. The framework is predominantly designed based on two approaches: literature review and findings of the qualitative grounded theory in Chapter 3. The empirical findings in this study are essential for appropriate conceptual development and providing original reliable notions to an emerging field of EMA-sustainability link within the context of municipalities in Gauteng.

Built on the qualitative grounded theory-oriented empirical results and the analysis of literature, the framework developed is of a diagrammatic nature. The grounded theory processes of open, axial and selective coding identified three core themes and seven sub-themes from answering the research questions. The three core themes are Waste Management Practices, Waste Management Environmental Information, and Environmental Management Benefits. This helped developing the proposed EMA framework by identifying the relationship between the core themes. If adopted, the EMA framework is anticipated to effectively influence waste management decision making from an all-stakeholders' perspective in the municipalities. Therefore, the main aim of the proposed EMA framework is to improve waste-related environmental performance of the municipalities by making available monetary and non-monetary environmental information.

Not any of the prior studies has offered a framework that avails monetary and non-monetary waste related environmental information in municipalities. This framework is diagrammatically shown in Figure 4.1. Having surveyed the literature pertaining to application of EMA tools and the grounded theory results, this study proposes the implementation of the framework as portrayed in Figure 4.1. Therefore, having before them contradictory objectives and numerous other options, municipalities' decision makers must have tools that accurately structure their choices. The proposed EMA framework is one such.

The proposed EMA framework's stages are discussed in detail:

First stage: Data collection

Firstly, in Figure 4.1 below, the primary step would be the collection of data. This can be in form of monetary and non-monetary environmental data. The collection of data helps to ensure that waste levies are accurately charged on to residents because all the required waste-related information will be readily available (Qian et al., 2018). With adequate and accurate charging of waste levies ensures that municipalities have sufficient funds to carry out activities that reduces waste related environmental concerns. Ball (2005) argues that without accurate waste-related data municipalities are

set to face acute financial challenges in the long term originating from inaccurate waste levies and other waste management costs recouped from residents. Therefore, as demonstrated by Le et al. (2019), monetary and non-monetary data help improve environmental performance in organizations.

Literature shows that the collection of the data is, in most cases, hindered by a communication gap between the accounting department and other environmental management departments (Tsui, 2014). The proposed EMA framework narrows the gap by linking the collection of waste-related data from the environmental management and accounting departments. The collection of waste related data in Figure 4.1 is considered a critical foundation of the proposed framework. This is anchored on the idea that absence of reliable and adequate environmental data leads to improper decision making creating poor environmental performance (Setthasakko, 2010; CIMA, 2019; Chathurangani & Madhusanka, 2019).

Second stage: Refer to EMA

Once all the relevant data has been collected, as reflected on Figure 4.1, it is important that the traditional management accounting system is merged with the EMA system. This is to ensure that the collected waste-related environmental data can be processed to produce specific environmental information such as environmental costs. These costs can be directly associated with waste management that cannot be generated from the traditional management accounting system. At this stage, externalities aligned to a cost centre responsible for environmental costs creation can be captured into the EMA system (IFAC, 2005). Externalities are the gains or losses experienced by stakeholders emanating from corporates' actions where no compensation is availed (UN, 2001). On this note, environmental costs emerge when municipalities internalize externalities that means taking the obligation to avert the harm inflicted on residents. So, these have to reflect in municipalities' accounting. Unlike the traditional management accounting system, the incorporation of EMA systems allows environmental costs to be accurately allocated and reported. This avoids the misallocation or "hiding" of environmental costs into overhead accounts. At this point, by

integration of traditional management accounting system and EMA systems, municipalities ensure that accurate environmental waste-related information is available for sound decision making.

This stage's key objective is the incorporation of environmental impacts into EMA systems. So, the main purpose of this framework is to make available and incorporate both monetary and non-monetary waste-related environmental for management decision making. Also, as reflected on Figure 4.1, the accounting department must ensure that it maintains constant communication and coordination with environmental management departments so as to improve data collection and categorisation of environmental costs. The communication gap between accountants and other departments has remained a critical problem within companies (Tsui, 2014; CIMA, 2019). This hinders effective EMA adoption therefore leading to poor environmental performance due to opportunities being missed to reduce costs (Tsui, 2014; IFAC, 2005; CIMA, 2019) such as waste-related costs.

Also, the integration of traditional management accounting system and EMA systems enable municipalities to establish the size of their waste management impacts such as pollution, emissions and cost of solid wastes chemicals in monetary and physical terms. This information cannot be produced from the traditional accounting system. The information will assist to identify and motivate proactive action towards reducing the impacts for the benefit of society and the environment. Reports from third stage on Figure 4.1 will, in the long run, act as a benchmark on the municipalities' efficiency on lessening and addressing poor municipal solid waste management.

Third stage: Quantification of environmental impacts

The quantification of EMA impacts is vital in reducing social, environmental and financial impacts. This is because environmental impacts are the crucial components to be incorporated and shown in an organization's accounting system as shown in Figure 4.1. This brings in the materiality concept of accounting in selecting environmental impacts material enough. However, Gray (2010) argues that by addressing environmental and financial impacts, social impacts would also have been resolved.

Hence, the model framework focuses on environmental impacts of solid waste management. Environmental impacts are the positive or negative outcome that operational activities may produce on the environment (Le et al., 2019). After quantifying environmental impacts, monetary or physical value of the organization's environmental costs will be established to minimise or prevent waste-related environmental challenges such as emissions and blocked drains. Establishing environmental costs linked to a product, production process or service is required for accurate corporate decision making (IFAC, 2005). Fundamentally, quantifying of environmental impacts is a critical step leading to accurately estimating and setting of environmental goals (Jalil et al., 2016).

Fourth stage: Reporting

After being able to quantify environmental impacts in monetary and non-monetary terms, municipalities will be expected to provide a detailed report generated from EMA systems to both interested internal and external stakeholders. This report details waste-related environmental issues such as volumes of wastes collected at a certain period or monetary value of chemicals used to treat wastes during a certain time frame. This provides stakeholders an opportunity to hold municipalities to account for their actions on environmental impacts stemming from poor municipal solid waste management (Qian et al., 2018). Also, this assists to exert pressure on municipalities to extensively adopt measures such as EMA tools as an answer to calls to reduce waste-related environmental impacts.

Fifth stage: Decision making

Lastly, as shown in Figure 4.1, with all accurate and adequate environmental waste-related data at the disposal of stakeholders, a decision need to be taken. This involves the course of action required should there be material negative environmental impacts emanating from waste management. This is an all-stakeholders' involvement. The idea is to explore any improvement opportunities on solid waste management from various stakeholders. It is at this time that it can be identified on what is hindering the municipalities from attaining proper municipal solid waste management. In this regard, action can then be taken to root out the major obstacles standing in the way of

achieving better municipal solid waste management. In this way, enhanced solid waste management would be closer to achievement. To remain effective on municipal solid waste management, municipalities need to constantly maintain and repeat this cycle of activities.

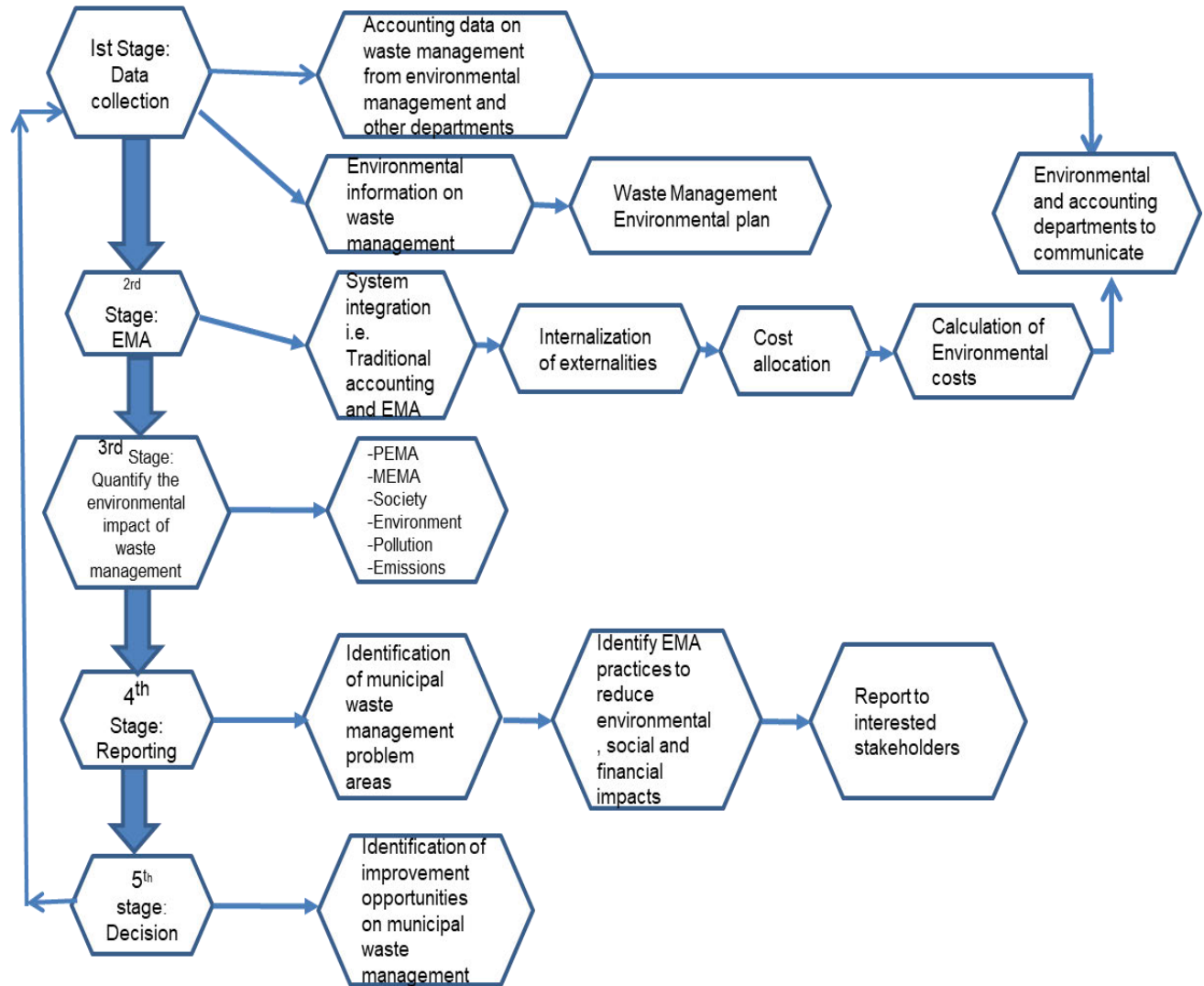


Figure 4.1: Proposed EMA framework for the waste management sustainability of municipalities in Gauteng

Source: Author's compilation

4.3. Chapter summary

This chapter focused on explaining in line with literature the study's results. EMA practices such as waste management system, environmental audits, environmental

reporting and environmental training were found to be the most practices within municipalities in Gauteng. The study's results confirm that municipalities in Gauteng are mostly using non-monetary information that monetary information. In the last question, the results indicate that the municipalities are enjoying benefits of adopting EMA practices that range from reduction in contribution to climate change, improved environmental performance and ensuring compliance with legislation. After taking into the literature review and the study results from the principles of grounded theory, an EMA framework to for the waste management sustainability of Gauteng municipalities was developed and proposed. The next chapter looks at the summary, conclusion and recommendations stemming from the research study.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter closes the research by providing a summary of the study findings, recommendations and conclusion.

As shown in chapter 4, the research's objectives are attained by way of assessment of extant literature and evaluation of the empirical data from Chapter 3. Literature is unclear on EMA practices used by municipalities to improve solid waste management (Qian et al, 2018). The study opines that by improving the solid waste management of municipalities in Gauteng this will inevitably reduce the negative environmental impacts linked to waste management.

5.2. Summary of findings

In addressing the study objectives, qualitative research is adopted in this study based on secondary data. The data is gathered from annual reports of five municipalities over a seven-year period from 2015 to 2021. This period was determined by reporting of waste management in the municipalities' annual reports starting from 2015 and beyond.

The results and findings are therefore concisely summarized in sequence based on research objectives:

Objective 1: To identify the EMA practices used to improve waste management among Gauteng municipalities in Gauteng.

From the documentary analysis of annual reports from 2015 to 2021 of the five municipalities, it is identified that municipalities are in some way employing EMA practices to lessen waste management related problems on the society. But, however, the findings are primarily based on their reporting documents found on their Annual Reports.

Therefore, in ascending order of mostly applied EMA practices within municipalities, the following observations answer the question: What are the EMA practices used by Gauteng municipalities to improve waste management?

- i. Waste management systems
- ii. Environmental reporting
- iii. Environmental audit
- iv. Employee environmental training
- v. Environmental research and development

The researcher uses grounded theory processes, and the EMA practices were identified verbatim, that is, the above identified EMA practices are extracted as direct words within texts from the Annual Reports of the municipalities in Gauteng.

Objectives 2: To identify the nature of information used to report waste management within Gauteng municipalities.

The study results in Chapter 3 (Table 3.4) depict that the municipalities in Gauteng are using non-monetary information on reporting waste management-related environmental impacts. This puts the monetary environmental information less popular within the municipalities. However, scholars (IFAC, 2005; Phan, et al., 2017; Chirst & Burrit, 2013) put forward that the constant use of non-monetary information as a form of information to report environmental impacts symbolises low implementation of EMA tools.

Objective 3: To ascertain the environmental benefits of applying EMA practices in the municipalities of Gauteng.

Based on the annual reports of municipalities, municipalities are enjoying the following benefits for applying EMA practices with waste management operations:

- i. Reduction to climate change contribution
- ii. Improved environmental performance
- iii. Efficient delivery of waste services

- iv. Financial management is improved
- v. Compliance with waste management plan

Objective 4: To develop an EMA framework to improve waste management from the environmental sustainability of Gauteng Municipalities.

A framework on Figure 4.1 (Chapter 4) is developed primarily to address waste management challenges by taking into account both monetary and non-monetary waste-related environmental information in management decision making. Availability of this information increases environmental performance of the municipalities by ensuring that accurate waste-related environmental information is available to be considered for decision making by municipal management. In addition, environmental costs related to waste management such as internal transport and administration costs are appropriately allocated and thereof accurately budgeted for. Ball (2005) argues that with all these processes in place, environmental sustainability of the municipalities will abundantly improve. Also this, in itself, will be assumed to enhance waste management due to availability of adequate financial resources to address waste management and sufficiently funding waste management activities. The proposition is anchored on findings by Madubula and Makinta (2015) that municipalities in Gauteng are failing to properly address waste management due to limited financial capacity.

Also, the proposed EMA framework seeks to reduce waste management-related negative environmental impacts such as associated diseases, growing emissions leading to climate change and blocked drains, to name a few. The critical underlying basis of the EMA framework is to make available both monetary and non-monetary waste-related environmental information for improved management decision making. Previous studies such as by Le et al. (2019), De Beer and Friend (2006) and Phan et al. (2017) demonstrate that EMA improves environmental performance of organizations.

5.3. Research contributions

This study contributed in the following ways:

5.3.1. Academia

This study identifies EMA practices used to improve waste management in the municipalities in Gauteng. Results from the current study are built on to the contemporary body of knowledge on EMA and solid waste management. This is because Qian et al. (2018) argue that EMA practices used to improve municipal waste management remain unknown in literature. It will also open future studies in the field of sustainability for those researchers who may decide to conduct research on EMA and waste management. In addition, this study added to literature on how EMA can address waste management in municipalities, a phenomenon that has been overlooked in the literature (Qian et al., 2018).

In addition, from an academic angle, the modern contribution of the study is development of an EMA framework underpinned by EMA theories. The expected main benefit of the proposed EMA framework to the Gauteng municipalities will be to facilitate incorporation of monetary and non-monetary environmental information into waste management decision-making. In turn, literature argues that this improves environmental and financial performance. Also, the proposed EMA framework can assist monetize environmental effects to champion waste management investment and development initiatives.

5.3.2. Industry

This research can amplify awareness and support Gauteng municipalities in evaluating and incorporating of certain environmental practices into their day-to-day operations and therefore reduce the negative environmental impacts. This study might encourage and influence the local government in Gauteng to adopt and implement EMA initiatives such as environmental costs administration. This will lead to improved solid waste management and municipal financial performance. In this context, municipalities' environmental impacts might be reduced through improved financial performance. Improved financial performance helps to make available adequate financial resources for waste management activities such as waste transportation and labour costs.

5.3.3. Policy makers

EMA data can be applied to appraise policy design or government program. Panya et al. (2020) argue that waste management data performs a critical part in policy making and planning in municipalities. Examination of various stages of EMA used in solid waste management provides a basis for finer public policies guidance to environmental benefits. Adeleki et al. (2021) argue that due to absence of accurate waste-related data, policy makers are left to develop policies based on incomplete information leading to ineffectiveness on yielding the intended goals. The proposed EMA framework seeks to overcome that and ensure availability of accurate waste related data for policy makers at corporate and national level.

5.3.4. Society

This study might motivate and help society to garner more awareness into the work of municipalities on matters of waste management because waste management requires cooperation of multiple stakeholders (Malope, 2020). With absence of knowledge on concealed costs, life-cycle costs and externalities, stakeholders may be unable to exert adequate force and enforcement to local government to administer EMA information. However, availability of environmental information subjects local government under extreme pressures to increase efficiency. This is because such environmental information gives stakeholders the opportunity and solid ground to question the environmental sustainability practices and thereof environmental performance of the local government. Such actions highly contribute to reduction of environmental challenges from waste management in the form of reduced emissions, public health challenges and environmental degradation.

It is argued that residents and citizens' frame of mind expect to be directed by a transparent examination of costs, benefits, and risks, if ever the community is to get the better of municipal waste management policy (Qian et al., 2018). Thus, this study will assist to make available information on waste management costs and benefits to all stakeholders in order to make informed assessment of the municipalities.

5.4. Limitations of the study

Due to time constraints, the research study is limited to municipalities in Gauteng. This marginalisation is prompted by the largest environmental impacts presently existing in municipalities in Gauteng in comparison to municipalities in other provinces in South Africa. As such, care should be exercised when generalising results for other municipalities. This opens up an opportunity for further studies in municipalities in other provinces and the country at large towards enhancing decision making that would stimulate environment management.

Most of the information on the waste management in Annual Reports was only available from 2015 in most municipalities. Therefore, this limited the period of the study from 2015 to 2021. A longer period would have been best, but this was not practical due to non-availability of waste management information. In this regard, future studies can use other methods such as interviews and questionnaires to combat the short period of annual reports available in the public domain.

Absence of sufficient information on waste management was another important limitation. Waste management information in municipalities is not considered a priority hence data is also not a priority.

5.5. Future research and recommendations

This study primarily focused on only secondary data. In some cases, it was reported that organizations mostly report on EMA practices considered to be favourable to their reputation and image (Fuadah et al., 2021). Based on this, it is therefore important that the same study be conducted in future, grounded on case study and primary data of respondents within municipalities. This helps to unearth evidence that cannot be disclosed in corporate documents (Falack et al., 2020).

Based on the proposed EMA framework (Figure 4.1, Chapter 4), the following can be cited for future research:

- i. What impedes effective integration of the traditional management accounting system and EMA systems in municipalities?
- ii. Which type of EMA information is most appropriate and relevant to municipalities?
- iii. Why are municipalities not adopting EMA system as a mainstream accounting system?
- iv. Experimental research may be conducted to examine and assess if the adoption of the EMA framework impacts on the decision-making processes of municipalities' stakeholders.

Future research that provides answers to the above questions would present additional awareness and understanding into the interrelationship between traditional management accounting system, EMA systems and EMA information in municipalities.

Additionally, future research can focus on comparisons among diverse stages of EMA practices and how these are integrated as strategic and operational level in South Africa's provincial municipalities.

Recommendations:

To resolve the anticipated absence of landfills in future, municipalities can begin charging disposal fees. This can be reserves put aside to buy land for landfills.

The study recommends a development of national or provincial waste information database, including definition and classification of different kinds of waste to overcome the limitation of absence of waste management data in municipalities. This is makes it cheaper for improving waste management by interested stakeholders since municipalities can be linked to one information source at provincial level.

The study recommends that municipalities' top management must essentially commit to adopting the proposed EMA framework and EMA implementation to ensure that municipals' waste-related management problems are curtailed and detected at an early stage due to availability of monetary and non-monetary waste related environmental

information to enhance management decision making. Tsui (2014) affirms that EMA adoption is expected to fail if promotion and support by top management is lacking.

The study recommends that municipalities must ensure that staff is sufficiently trained and with necessary skills on EMA and environmental accounting. This ensures that lack of sufficient skills and education will not deter application and use EMA within the municipalities. Literature is flooded with findings that absence of adequate skills and training hampers effective adoption of EMA within organizations (CIMA, 2019; Setthassako, 2010; Phan et al., 2017; Tsui, 2014).

5.6. Chapter summary

The study contributed that municipalities the world over have a special role to play on reducing environmental impacts through waste management. Results from the study confirmed that municipalities in Gauteng are doing enough to reduce environmental impacts from waste management. This is evidenced by the use of only non-monetary environmental information to report waste management issues. To combat this, this study proposed a new EMA framework to facilitate gathering of monetary and non-monetary environmental information for the waste management sustainability of the municipalities in Gauteng. A practical implementation of the proposed framework is expected to improve the environmental performance of the municipalities. This then reduces solid waste-related impacts such as flooding, GHG emissions and related communicable diseases.

To conclude, the study has presented an insightful discourse on EMA in the municipalities regarding the theoretical, methodological, and practical contributions to different constituencies which include the academia, policy makers as clearly articulated and adduced from the preceding evidence and discussion.

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APPENDICES

Editor's certificate

DECLARATION OF LANGUAGE EDITING

The Writer's Corner

Independently contracted editing



To whom it may concern

I, Paul Randals, hereby declare that I have completed a light language and format editing for dissertation titled:

Developing an environmental management accounting framework for waste management sustainability of municipalities in Gauteng.

For **T. Nyahuna (221118570)** for the purpose of submission as a dissertation in order to meet the requirements for the degree of *Master of Commerce in Accounting* at the University of KwaZulu Natal.

Changes were suggested in the form of electronic track changes and comments. The implementation thereof was left to the discretion of the author.



Independently accredited editor (C-Trans SATI Accredited)
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Ethical clearance



25 Oct 2021

Mr Thomas Nyahuna (221118570)
School Of Acc Economics &Fin
Westville

Dear Mr Thomas Nyahuna,

Original application number: 00015234

Project title: Developing an environmental management accounting framework for waste management sustainability of Gauteng municipalities

Exemption from Ethics Review

In response to your application received on 17 Oct 2021, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW**.

Any alteration/s to the exempted research protocol, e.g. Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

Yours sincerely,

[Redacted Signature]

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