THE IMPACT OF ENVIRONMENTAL MANAGEMENT OF THE INDUSTRIAL SECTOR ON SUSTAINABLE COMMUNITY DEVELOPMENT IN SELECTED MUNICIPALITIES IN THE MOPANI DISTRICT OF THE LIMPOPO PROVINCE

by

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DECLARATION

I, Tebogo Martha Manngwadi Mamabolo, hereby declare that this dissertation submitted to the University of Limpopo for the degree in Master of Development is the result of my research and investigation. I declare that the research on **The Impact of Environmental Management of Industrial Sector towards Sustainable Community Development in Selected Municipalities in the Mopani District of the Limpopo Province** is my own work in design and execution and that all material contained therein has been duly acknowledged by means of references.

Further, I declare that this work has not been previously submitted by me for a degree at any other university or institution.

……. ……..

Tebogo Martha Manngwadi Mamabolo Date

DEDICATION

I would like to dedicate this work to my mother, Ellen Molatela Mamabolo, for her unconditional love and support, and for prioritising my education unconditionally.

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I would like to give thanks to the Almighty God for the grace, mercy, guidance, support and love that He has showed me throughout my life, and through my education.

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ABSTRACT

Industrial development without proper environmental management is likely to have an environmental effect by impacting negatively on community sustainable development, the biological environment such as fauna and flora, heritage resources such as Modjadji cycard trees, the baobab and the physical environment, such as air, water and land. It could also potentially impact the quality of life and the natural resources, while, on the other hand, contributing positively to economic development. Exposure to environmental pollution remains a major source of health risk throughout the world. Risks are however generally higher in most developing countries where there is lack of knowledge of modern technologies, cleaner production. Furthermore, there is also often non-compliance with environmental legislation.

The above challenges have stimulated the current researcher to embark on this research study. The study seeks to investigate the impact of environmental management of the industrial sector on sustainable community development in selected municipalities of Mopani District in Limpopo Province.

Despite major efforts over recent years to clean the environment; pollution remains a major problem and poses continuous risks to health of the people. This study is concerned with how community sustainable development is impacted negatively by poor environmental management of industrial sectors. The study uses selected municipalities in Mopani District of Limpopo Province as the study area. Mopani District is a very sensitive area as it consists of protected areas, indigenous forests, biospheres, wetlands, endangered species (Modjadji cycads), as well as cultural heritage sites. Most people in the area depend on agricultural activities that are likely to be affected by climate change as a result of industrial pollution and non-compliance with environmental management.

In this study, the researcher adopts the mixed methods approach which includes both qualitative and quantitative research. The methods enabled the researcher to critically analyse the impact of environmental management of industrial sector on sustainable community development in selected municipalities of Mopani District in Limpopo Province. Both interviews and questionnaires were employed to conduct the study.

The objectives of the analysis are to identify and appraise aspects of environmental management that impact negatively on sustainable community development. Challenges that hamper the effectiveness of environmental management were also investigated.

The findings showed that bad odours emanating from the industries result in a lack of sustainability as well as symptoms of illness amongst community members. The study further finds that poor environmental management impacts negatively on local economic development. Based on the findings, the following recommendations were made to assist stakeholders with environmental management and sustainable community development:

- Owners of the industries should be encouraged to avoid issues that may have a negative impact on matters related to natural and human disaster, so as to achieve sustainable community development. They should be encouraged to adhere to environmental laws, so as to curb the generation of toxic waste.

- Policy makers should be encouraged to develop interventions and environmental strategies to compel owners of industries to adhere to all legislations related to environmental management. This process could assist local municipalities to achieve sustainable development in the Mopani District.

TABLE OF CONTENTS

CONTENTS **PAGE(S)**

LIST OF FIGURES

LIST OF TABLES

ABBREVIATION AND ACRONYMS

EIA	-	Environmental Impact Assessment
EMF	-	Environmental Management Framework
EMS	-	Environmental Management System
EMPs	-	Environmental Management Plans
MD	-	Mopani District
NEMA	-	National Environmental Management Act
NEMWA	-	National Environmental Management: Waste Act
SD	-	Sustainable Development

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1. Introduction

Since 1994 South Africa has been faced with a rapidly growing urbanised, industrialised, and consumerist population. This means that the country's commitment to sustainable development, including socio-economic and environmental sustainability, must be balanced. In terms of Section 24 of the Constitution of South Africa (1996) which states that everyone has the right to live in an environment that is not harmful to their health and well-being, and to have an environment protected for the benefit of the present and future generations through reasonable legislative and other measures that include prevention of pollution and ecological degradation; promotion of conservation; and secure ecologically sustainable development and use of nature resources, while promoting justifiable economic and social development.

In terms of the above paragraph, apart from pollution, industrial development could also have an environmental effect by impacting negatively on the biological environments such as fauna and flora, heritage resources, the physical environment such as air, water and land. Industrial development could have potential impact on the quality of life and the natural resources, while, on the other hand, contributing positively towards economic development. The above challenges are caused by various factors such as historical background and the legacy of past policies and legislations.

1.2. Background of the study

Prior to the 1994 democratic transition in South Africa, environmental management at local government level received very limited attention. After 1994, however, new local government structures began to emerge in response to the changing policy and legislative

environment. Among these were structures with a specific environmental management mandate and focus (Roberts, 2008:521).

With the emergence of new local government structures and more industrial developments, industries need to take environmental and health safety precautions, regardless of their rate of productivity or their profit margins. This means that industrial contingency or preparedness plans, which are environmental management tools, must be put in place and be monitored regularly for compliance, but how to do it becomes a problem to most of the industries because of lack of understanding of legislation.

Following the adoption of the Constitution of South Africa, the National Environmental Management Act (NEMA) was enacted to give effect to the environmental right contained in Section 24 of the Constitution. NEMA introduced a number of additional guiding principles into South African environmental legislation, for example, the polluter pays principle, the duty of care on any person who may cause significant pollution to institute measures to prevent pollution from occurring or minimise and rectify the pollution where it cannot be avoided.

1.3. Problem statement

Exposure to environmental pollution remains a major source of health risk throughout the world, although risks are generally higher in most developing countries, where there is lack of knowledge of modern technologies, lack of practice of cleaner production and non-compliance with environmental legislation. The combination of the above issues is likely to cause high pollution levels, if preventative steps are not taken. Levels of exposure, for example, are often uncertain or unknown, as a result of lack of detailed monitoring and the inevitable variations within any population group.

Despite the major efforts that have been made over the past years to clean up the environment, pollution remains a major problem and poses continuous risks to health. The problems are accelerating, especially in the developing world, where sources of

pollution, such as industrial emissions, poor sanitation, inadequate waste management, contaminated water supplies and exposure to indoor air pollution from biomass fuels affect large numbers of people. Even in developed countries, however, environmental pollution persists, most especially amongst the poorer sectors of society (Nyathi, 2015:8).

Various types of industrial pollution seem to be major cause of problems in the lives of the people. Both heavy industries and other industries in Mopani District are included in the above challenge. Most heavy industries seem to be the source of the pollution that causes major problems in the ecosystem. This result in causing various diseases in their surrounding communities. From the above statement, it is clear that communities around towns where industries are located seem to be most affected by the problem of pollution.

Nyathi (2015:8) attests that the following factors are the main causes of pollution:

- The discharge of wastewater into the environment. This impact negatively on the ecosystem, water resources and underground water, resulting in cholera outbreaks, malaria and other related diseases.
- The disposal of hazardous waste in general landfill sites poses a health hazard to the landfill reclaimers and results in land pollution.
- The release of industrial emissions, with criteria pollutants, to the atmosphere has a detrimental impact on the ambient air quality, health risks to neighbouring communities and are likely to cause climate change.
- Poor management of chemical spillages.
- The growing population and economy means increased volumes of waste and pressure on waste management facilities.
- Environmental transgression of conditions of environmental authorisations, water use licences, air quality and waste management licences.
- Commencement of activities without prior Environmental Impact Assessments.

From the above statements, it is clear that industrial activities seem to among the main causes of the land, water and air pollution that affect the livelihood of the surrounding

communities. Hence this study of the impact of environmental management of the industrial sector on sustainable community development in the Mopani District.

1.4. Aim of the study

The aim of this study is to investigate the impact of environmental management of the industrial sector on sustainable community development in selected municipalities of Mopani District. Industries are investigated with regard to environmental compliance in terms of the legislative documentation. The researcher examines Environmental Management Plans (EMPs) to see whether they are in line with the environmental legislation.

Furthermore, the sources, potential causes and consequences of water, land and air pollution are identified in order to develop feasible solutions to the problems.

1.5. Research objectives

The following objectives of the study are pursued to achieve its aims:

- To determine the impact of environmental management of industrial sector on sustainable community development in Mopani District.
- To identify factors that hamper the impact of environmental management for sustainable community development in area of the study.
- To determine the measures used by owners of industries to enhance the impact of environmental management for sustainable community development in the area of the study.
- To suggest strategies that may be used by policy makers to enhance the impact of environmental management for sustainable community development in Mopani District.

1.6. Research questions

With the above mentioned challenges facing the owners of industries on issues related to the environmental management of sustainable community development, the following research questions arise:

1.6.1. Main question:

- How much impact does environmental management have on sustainable community development in area of the study?

1.6.2. Sub- questions:

- What factors hamper the impact of environmental management for sustainable community development in area of the study?
- What measures are used by the owners of industries to enhance the impact of environmental management for sustainable community development in area of the study?
- What strategies can be used by the policy makers to enhance the impact of environmental management for sustainable community development in Mopani District (MD)?

1.7. Significance of the study

The study on the impact of environmental management of the industrial sector on sustainable community development will assist stakeholders in the following ways:

- The study may assist stakeholders to determine the impact of environmental management for sustainable community development in Mopani District.

- It may assist stakeholders to determine factors that hamper the impact of environmental management for sustainable community development in the area of the study.
- It may assist owners of industries to determine the measures they can use to enhance the impact of environmental management for sustainable community development in area of the study.
- It may assist policy makers to develop strategies to enhance the impact of environmental management for sustainable community development in the Mopani District.
- The study may also contribute to the existing body of knowledge and to environmental management as a field of study.

1.8. Definition of concepts

1.8.1. Community Development

Community development is a structured intervention that gives community members greater control over the conditions that affect their lives (Doreen 2015:193).

1.8.2. Development

Development is seen increasingly to require reduction of inter-group disparity, or a ‘social transformation’ (alteration of society and culture), through the use of capital, technology and knowledge (Barrow 2006:04). According to Peet and Hartwick (2009:1) development means making a better life for everyone.

The researcher perceives development as a process of expanding people’s choices, by expanding human functioning and capabilities.

1.8.3. Environmental Management

Environmental management is a process concerned with human–environment interactions, and seeks to identify: What is environmentally desirable? What are the physical, economic, social and technological constraints to achieving that? and what are the most feasible options? (Environmental Management Strategies, 2017:4)

1.8.4. Sustainable Development

According to Roorda, Corcoran and Weakland (2012:9), sustainable development involves the distribution of prosperity between the various parts of today's world, and also the distribution of that prosperity between humans today and humans tomorrow.
Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Swanepoel and De Beer, 2011:54).

Schenck, Nel and Louw (2010:21) describe sustainable development as the capabilities, assets and activities required for a means of living and that the livelihood is termed sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, now and in the future, while not undermining the natural resource base.

The researcher perceives sustainable development as development which guides people to address current needs or problems without jeopardising the future generations. However, Swanepoel and De Beer (2011:54) argue that it is often unrealistic to expect poor people to conserve resources for the future when they are struggling to survive in the present moment.

1.8.5. Environmental Impact Assessment

Environmental impact assessment is a generic term for a process which seeks to blend administration, planning, analysis and public involvement in pre-decision assessment of the impact of activities on the environment (Goodland and Edmundson in Barrow, 2006:205).

1.8.6. Municipality

The Municipal Systems Act (2000:12) defines Municipality as an organ of state within the local sphere of government exercising legislative and executive authority within an area determined in terms of Local Government: Municipal Demarcation Act, 1998. It consists of the political structures, administration of the municipality and the community of the municipality.

1.8.7. Pollution

Pollution is defined as the introduction by humans, deliberately or inadvertently, of substances or energy (heat, radiation, noise) into the environment, resulting in a deleterious effect (O'Riordanas cited by Barrow, 2006:289).

The National Environmental Management Waste Act. Act no 59 of 2008 defines pollution as the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it:

(a) less fit for any beneficial purpose for which it may reasonably be expected to be used; or
(b) harmful or potentially harmful -
(i) to the welfare, health or safety of human beings,
(ii) to any aquatic or non-aquatic organisms,
(iii) to the resource quality, or

(iv) to property.

Pollution normally occurs when societies are ignorant and start dumping or littering wherever they choose. The ignorance may be due to people being unaware of their actions, although some may just choose to ignore the signs and litter anyway.

1.9. Outline of the study

Chapter 1: Introduction and background on environmental management

The researcher introduces the topic, explains its importance and provides the background of how the problem emerged. This summarising current understanding and background information about the topic enables the reader to establish the context and significance of the research.

Chapter 2: Literature Review

This chapter discusses the ideas of other researchers relating to concepts in the research topic. This assists the researcher to compare ideas of other authors and enables her to place the relevance of her research in the larger context.

Chapter 3: Research Methodology

The chapter describes the methods used to collect and analyse data. It also details the instruments utilised in collection and analysis of data.

Chapter 4: Data Presentation and analysis

Data from the interviews, questionnaires and observation is presented and analysed. The purpose of data presentation and analysis is to develop answers to questions through examination and interpretation of data.

Chapter 5: Conclusion and recommendations

The researcher makes recommendations and draws a conclusion from the findings and data analysis. In conclusion, the researcher helps the reader to understand the overall significance of the research.

1.10. Conclusion

In chapter one, the background to the problem of the impact of environmental management of industrial sector on sustainable community development in selected municipalities of Mopani District is outlined. The aim, objectives and the significance of the study are presented. The researcher outlines the research chapters in plan of study to give a clearer picture of the proceedings followed in the study.

In chapter two, a review of the literature relevant to the impact of environmental management of the industrial sector on sustainable community development in Mopani District is presented.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

The purpose of Chapter two is to expand on concepts from the literature that form the theoretical framework, to assist in analysing the impact of environmental management of the industrial sector on sustainable community development in selected municipalities in Mopani district of Limpopo province. The interdisciplinary nature of this study requires that information from a broad range of disciplines be brought together. A South African perspective of these issues, in relation to environmental management and other studies conducted around the related topics, is discussed.

Environmental management plays a vital role in the quest for community sustainable development and it is a wide, expanding, and rapidly evolving field, which concerns all humans. Non – prioritisation of environmental management could have a serious impact on sustainable development. This includes, but is not limited to, social, economic and environmental sustainability.

Environmental management in Australia has been increasingly privatised since the 1990s, as governments have offered incentives to enable private landholders to manage nature conservation. Since 1997, non-government organisations (NGO's) have been encouraged to purchase land for nature reserves through matching funds from the Natural Heritage Trust (Robin, Dickman and Martin, 2012:69-70).

Ribot et al. (2010:01) state that ten to twelve per cent of the world’s natural forests are officially managed with some degree of popular participation. This is also the case in at least 21 Sub-Saharan African countries which promote some form of popular participation in natural resources management through decentralisation or various Community-Based Natural Resources Management (CBNRM) approaches.

Transfer of forest management to democratic local government, as stipulated by Ribot, Lund and Treue (2010:08), is being promoted in policy and law in a large number of Sub-Saharan African countries on the grounds that democratic decentralisation will lead to improved forest management and rural livelihoods. A growing number of voices, however, are claiming that the anticipated benefits of increased popular participation are reflected more in government and donor discourses, than the experience of rural communities.

According to Robin (2012:71), the management of nature reserves and regional natural resources in many western nations is no longer regarded as the responsibility of a single specialist authority such as a national parks authority, forestry commission or scenic reserves commission, but rather, it is a matter for 'partnerships' and local networks. As a result, this research project seeks to investigate the impact of environmental management of the industrial sector on sustainable community development in selected municipalities in Mopani District of Limpopo Province.

To support the above paragraph, apart from pollution, industrial development could also have an environmental effect by impacting negatively on the biological environment such as fauna and flora, heritage resources, and on the physical environment such as air, water and land. Industrial development potentially could impact quality of life and the natural resources, while, on the other hand, contributing positively towards economic development.

2.2. Brief background of environmental management

From the 1750's, the belief gained hold in Western societies that human welfare could be improved through hard work, the application of technology and moral development. Natural resources were to be exploited to these ends, and some even believed that humans would conquer nature and control it. However, currently, companies are faced with the pressures of complying with various international environmental laws and regulations. The International Organisation for Standardisation (ISO 14001: 2004)

requires that a company keeps a legal register of laws that are applicable to its operation. By seeking to comply with these laws, companies are assured of protection and compliance with all legal requirements.

Over the years, various waste management systems and practices have been developed for appropriate handling and safe disposal of hospital waste. Some of these practices include landfills, incineration, autoclaving and recycling. Generally, there is no single practice as a solution to the problems of managing hospital waste (Nemathanga, 2008:123).

2.3. Background of environmental management in South Africa

South Africa is a developing country with a coal-based energy economy. The three main anthropogenic sources of air pollution in South Africa are industrial combustion of fossil fuels, domestic burning of fossil fuels and exhaust fumes from motor vehicles (Itzkin 2015:01).

Many South African cities, as Schäffler and Swilling (2012:01) postulate, are in the midst of service delivery protests, so that resilient ecosystems, and the citizen networks that sustain these, are largely overlooked in planning processes.

Waste management is also one of the critical elements of sustainable development, primarily, because sound waste management practices contribute to sustainability. Historically, legislation regulating waste management in South Africa has been fragmented, and it still is. However, the coming into effect of the National Environmental Management: Waste Act (Act No. 59 of 2008), presents more holistic approaches to waste management regulation (Zhakata, Gundani, Chauke and Odeku, 2016:229).

In South African hospitals, there is generally an emphasis on modern hospital waste practices that reduce risks of waste hazardous to humans or to the environment by treating it first before its being disposed of in a land-fill. So far, over 90% of South African

toxic hospital waste is incinerated, while hospital waste that is regarded as non-toxic is either dumped openly or as landfill (Nemathangani, 2008:1237).

South African coals and related carbonaceous rocks were deposited during the Mid-to-Late Permian age. One of the consequences of coal mining is the exposure of the coal to air and moisture, resulting in the ignition of the coal through the processes of chemisorption, oxidation, and spontaneous combustion. The ignition of coal is a global concern and burning coal may cause significant environmental problems (Pone, Hein, Stracher, Annegarn, Finkleman, Blake, McCormack and Schroeder, 2007:125).

Water supplies in South Africa continue to dwindle because of resource depletion and pollution, whilst demand is rising fast because of population growth, industrialisation, mechanisation and urbanisation (Falkenmark in Ochieng, Seanego and Nkwota, 2010:3351). They further assert that the situation is particularly acute in the more arid regions of the world where water scarcity, and the associated increases in water pollution, limit social and economic development and are linked closely to the prevalence of poverty, hunger and diseases.

Prior to the 1994 democratic transition in South Africa, environmental management at local government level received very limited attention. After 1994, however, new local government structures began to emerge in response to the changing policy and legislative environment. Among these were structures with a specific environmental management mandate and focus (Roberts, 2008:521).

In addition, Ochieng, Seanego and Nkwota (2010:3351) claim that acid mine drainage is recognised as one of the more serious environmental problems in the mining industry. Acid mine drainage is a major problem in coal and gold mines throughout the world and in South Africa. The water decanting from the mine companies is highly acidic and, as such, cannot be released into the natural watercourse (streams and rivers).

Zhakata et al (2016:228) maintain that the constitutional era brought about a lot of changes and transformation within South African communities, amongst these the right

to a clean environment. This has laid the foundation for effective and sustainable waste management frameworks.

Life cycle management, according to Blottnitz and Curran (2007:608), is quickly becoming a well-known and often used approach to environmental management. A comprehensive environmental assessment of an industrial system needs to consider both upstream and downstream inputs and outputs involved in the delivery of a unit of functionality. A life cycle approach involves a cradle-to-grave assessment, where the product is followed from its primal production stage, involving its raw materials, through to its end use.

In order to impart the importance of this research, the researcher needs to depict a clear background of the environmental management in Limpopo Province as the centre of the research problem.

2.4. Background of environmental management in Limpopo

According to the Limpopo Environmental Outlook Report (2016:56), in Limpopo Province, a number of government structures at different levels are mandated to manage the allocation and use of natural resources in the province. All three spheres of government, national, provincial and local, have specific roles. The role of the national government is to formulate policies and acts in order to give effect to the right of citizens to an environment that is not harmful to their health and well-being, and to have the environment protected for the benefit of the present and future generations. The national authorities provide leadership in environmental management, conservation and protection towards sustainable development.

Provincial authorities provide strategic direction to sectors such as spatial planning, human settlements, agriculture, tourism and environmental management. The local government authorities have on the other side mandate to implement individual developments and local level spatial planning.

The local sphere of the government is primarily responsible for waste collection and disposal from communities. However, there have been challenges noted as far as areas of competence are concerned. The Waste Act does not include certain types of waste, for instance, medical waste which is very hazardous to the environment. If the municipality cannot remove medical waste, the community must be notified that the service is to be outsourced and to whom the contract will be given (Zakhata et al., 2016:233).

Limpopo Province forms a vital part of freight logistics in South Africa, as it is situated within reach of three neighbouring countries (Botswana, Zimbabwe and Mozambique). The province, however, is faced with a number of challenges which, if not addressed, will impede it from fulfilling its key role as a gateway to Africa. Its strategic position as a potential regional hub brings a set of challenges with a lot vehicles passing through the province and using its facilities during the course of delivering goods in Southern Africa (Chakwizira, Mudau and Radali, 2014:655).

In light of the fact that the residents of Senwamokgope Township in Mopani District and the surrounding communal areas, do not have access to piped water but depend on groundwater (according to the GLM IDP, 2010/11) and water from rivers, contamination of water sources by sewage constitutes a significant health risk to community members and their livestock. Industrial development could have an environmental effect by impacting negatively on the biological environments such as fauna and flora, heritage resources and the physical environment such as air, water and land, if there is failure to understand the purpose of environmental management.

2.5. The purpose of environmental management

In terms of Section 24 of the Constitution of South Africa (1996), every citizen has the right to live in an environment that is not harmful to their health and well-being, and to have their environment protected, for the benefit of the present and future generations, through reasonable legislative and other measures that include the prevention of pollution and ecological degradation; promotion of conservation; and secure ecologically

sustainable development, and the use of natural resources, while promoting justifiable economic and social development.

Without proper environmental management, there may be adverse impacts both locally and globally. In this research, identifying the purpose of environmental management is vital, as it will help understand the principles, as well as the measures, that must be developed by industries in order to prevent pollution from occurring or to minimise and rectify the pollution problem, where it cannot be avoided. This includes, but is not limited to, cleaner technology, which is technology that may assist industries to reduce the amount of pollution emitted into the atmosphere.

2.5.1. Cleaner technology

The development of the municipality's first Clean Development Mechanism (CDM) project, initiated in 2002, involved the establishment of landfill gas-to-electricity installations at three of the city's landfill sites, as a form of engaging cleaner technology (Roberts, 2008:523).

Cleaner technology, as viewed by the researcher, demonstrates how technological innovation can influence the cycle of production in ways that can protect and benefit the environment.

2.6. The environment

According to Green Paper (1996:5), the word environment embraces the conditions or influences under which any individual or thing exists, lives or develops. These include the following categories of conditions and influences:

- the natural environment, including renewable and non-renewable natural resources, such as air, water, land and all forms of life;

- the social, political, cultural, economic and working conditions that affect the nature of an individual or community;
- the natural and man-made spatial surroundings, including urban and rural landscapes and ecosystems, and those qualities that contribute to their value.

The environment plays an essential role in determining future opportunities and constraints for growth and development. Past development has emphasised exploitation and optimisation of South Africa's mineral and natural resources, with little concern for long-term environmental impacts. It has neglected the development of the country's human resources and has largely ignored constraints arising from the finite character of non-renewable natural resources and the ecological cycles that sustain renewable natural resources (White Paper, 1997).

The current research defines environment as an area consisting of renewable and non-renewable resources which determine opportunities for growth. In order to obtain clear results in the environmental performance around Mopani District and to discover how poor performance may have a detrimental impact on sustainable development, the researcher examines the management within the industrial sectors.

2.7. Management within the industrial sector

Management within the industrial sector must be encouraged to improve its environmental performance continuously. According to United States Environmental Protection Agency (2017:20), the organisation first commits to an environmental policy, then uses its policy as a basis for establishing a plan, which sets objectives and targets for improving environmental performance. The next step is implementation. After that, the organisation evaluates its environmental performance to see whether the objectives and targets are being met. If targets are not being met, corrective action is taken. Management then revisits the environmental policy and sets new targets in a revised plan.

An Environmental Management System (EMS) is a framework that helps industries to achieve their environmental goals through consistent review, evaluation, and improvement of environmental performance. The assumption is that this constant review and evaluation will identify opportunities for improving and implementing the environmental performance of the organisation or industry. (EPA, 2017:22). Non-prioritisation of environmental management may impact negatively on the environment.

The researcher is of the opinion that management of nature reserves, regional natural resources, environment and socio- economic development should no longer be regarded as the responsibility of a single specialist authority, but as a responsibility shared among stakeholders, industries, the community and all other affected parties. Failure to take responsibility or accountability when environmental pollution has occurred could have detrimental impact on the whole environment.

2.8. The impact of poor environmental management

2.8.1. Air Pollution

According to South Africa Environment Outlook (2006:202), the atmosphere is a shared resource that is linked in many ways to ecosystems and human development. Its variable and unpredictable nature in South Africa directly affects food production, human health, and biodiversity. Consequently, the main issues of concern are indoor and ambient air pollution and the associated health impacts, climate change and variability, as well as its implications for ecosystems, human well-being and the depletion of stratospheric ozone.

Many of the rivers, lakes and seas around the world are so polluted that they pose a health risk and also affecting tourism and wildlife adversely.

Figure 2.1. Emissions from the stack and treatment of timber poles with creosote in Mopani District

Source: Nkuna (2016: 9)

Air pollution mostly occurs as a result of combustion or emissions from vehicles, industrial sites, refuse burning, mining activities, power stations, agricultural activities and other sources. These have a detrimental effect through the depletion of the ozone layer. The researcher is of the opinion that environmental management must prioritise people and their environmental rights. As a result, she has embarked on this study to investigate the impact of environmental management of industrial sector on sustainable community development.

2.8.2. Land Pollution (Waste Management)

Pollution and waste management focus on the waste management hierarchy, the prevention, minimisation and avoidance of pollution, the collection and disposal of waste and reclamation, treatment and mitigation of any land pollution.. Industries generate an immense variety of toxic substances which are not easily decomposed in the landfills. As

a result, these dumps have a huge impact on the environment, as well as on people's health. However, law enforcement aimed at polluters can assist to control the situation with positive outcomes. Below is a picture of oil waste containers that are poorly managed. This may cause environmental contamination with serious health hazards, if poorly disposed in water resources.

Figure 2.2: Oil waste that is poorly managed in Mopani District

Source: Motaung (2015:12)

According to the National Environmental Management: Waste Act (2008:37), no person may throw, drop, deposit, spill or, in any other way, discard any litter into or onto any public place, land, stream, watercourse, street or on any place which the general public has access to.

South Africa has an intensive, growing industrial and manufacturing economy, which results in the generation of general and hazardous wastes, increasing at an estimated rate of 2-3% annually. The disposal of general and hazardous waste to landfill is currently the country's primary option for waste management. (National Environmental Management: Waste Act, 2008:125).

Figure 2.3: Fluorescent tubes containing mercury temporarily stored in drums in Mopani District

Source: Nyathi (2015:11)

In most cases, industries produce hazardous waste in large quantities that contain toxic substances and that pose a threat to human health, the environment and community development. According to the National Waste Management Strategy (2011:13), waste management is a crucial element, in a suite of environmental interventions, to sustainably manage development in South Africa. Reduced greenhouse gas emissions, climate change and improved air quality, as well as waste minimisation, diversion of waste from landfills, composting, and reduced resource consumption will all help to reduce carbon dioxide emissions. It further highlighted that less and better managed waste is a key component of sustainable environmental management.

Industries do not generate hazardous waste with the intention of polluting the environment. Some industries fail to receive technical support from government with regard to the collection and disposal of waste containing hazardous substances. Lack of infrastructure development, such as hazardous landfill sites, could also contribute negatively towards condoning the storage of hazardous waste within industrial facilities.

This poses a serious threat to the neighboring communities (Emmanouil, Kalliopi, Dimitrios and Evangelos,2009:108).

In support to the above statement, from the researcher's observation, lack of infrastructure could cause various problems such as the disposal of asbestos in areas not designated for such type of waste. Asbestos may be introduced into natural waters by erosion of asbestos-rich rock formations or from the disposal of industrial asbestos wastes. Atmospheric pollution may also contribute to the asbestos content of natural waters. It is well established that exposure to airborne asbestos represents a hazard to health.

Figure 2.4. Temporary storage of asbestos pipes in Modjadjiskloof

Source: Mawila (2015:12)

The National Environmental Management: Waste Act (2008:162), indicates that any person who wishes to dispose of any asbestos, or asbestos-containing material in his or her possession, must dispose of it in accordance with Section 20 of the Act. The Act further stipulates that the lack of policy direction in asbestos waste management has resulted in, or contributed to, a number of constraints. In many instances, these constraints include poor environmental performance related to waste management in the country. According to the National Waste Management Strategy (2011:12), implementing the waste management hierarchy and achieving the objectives of the Waste Act will require coordinated action by many players, including households, businesses,

community organisations, NGO's, parastatals. The three spheres of government. Industry, organisations and households have critical important roles to play in managing their own waste streams.

The researcher concurs with the Waste Management Strategy that everyone has a role to play in order to achieve the objectives of both the Act and the strategy. In order to achieve sustainable development, the researcher investigates the impact of industrial wastewater as another source of pollution which is likely to impact negatively on community sustainable development.

2.8.3. Industrial wastewater

Most of the common methods used for active treatment of mine water are lime neutralisation, ion exchange and carbonate neutralisation, but these methods are quite demanding in chemical use, energy input and mechanical parts, as well as the skilled manpower that is often unavailable, especially in rural areas of developing countries such as South Africa (Ochieng et al., 2010:335).

Non- prioritisation of environmental management of wastewater treatment works seems to be the major cause of problems in sustainable development and may lead to pollution that causes havoc in the ecosystem; also causing various diseases in the surrounding communities. From this statement, it is clear that communities around areas where most wastewater treatment works are located, seem to be most affected by the problem.

Figure 2.5. Industrial wastewater discharged to the environment without prior disinfection in Ga- Kgapane Village.

Source: (Motaung 2015:7)

According to Batia (2007:265), eutrophication is accelerated as a result of human activities near or in a body of water. These generate residential waste, untreated or partially treated sewage, agricultural runoff and urban pollutants. Sewage or residential waste, consisting largely of phosphate containing detergents, is a major source of nutrients in bodies of water. The flow of nutrients into the water may over stimulate the growth of algae. This creates conditions that interfere with the recreational use of lakes and adversely affect the diversity of indigenous fish, plants and animal populations.

Figure 2.6. Raw sewage discharged into the river in the Mopani District.

Source: (Mawila 2015:9)

Food-processing industries in South Africa are under increasing pressure to reduce the impact of their wastewater streams on the environment. This was indicated by the Department of Environmental Affairs' promulgation of the National Environmental Management Act, Act 107 of 1998 (Republic of South Africa, 1998:2) and the National Water Act, Act 36 of 1998 (Republic of South Africa, 1998:21). They both have adopted the polluter-pays principle which makes the polluter pay for the treatment and disposal of the effluent produced.

Organisations and industries need to be monitored to ensure that they adhere to the environmental management Act and polluters need to be fined heavily in order to control the situation. According to Mawila (2015:7) most of the land pollution that are seen in South Africa are caused by poor environmental management. In the next section, the researcher outlines the effects of poor environmental management.

2.9. The effects of poor environmental management

2.9.1. Community development in agriculture and food security

According to the World Development Report (2008:02-03), agriculture can work in concert with other sectors to produce faster growth, reduce poverty, and sustain the environment. Agricultural production is important for food security because it is a source of income for the majority of the rural communities.

Natural resource degradation and biodiversity loss are undermining livelihoods such as daily human activities that is livestock, agricultural activities, etc. required for means of living. Underpinning food systems, agricultural activities constitute an indispensable pillar of sustainable development. This is especially true in South Africa, where the economic, social and environmental opportunities for sustainable agriculture are yet to be fully exploited (Zwane and Montmasson-Clair, 2016:02).

Employment in rural areas is likely to be negatively affected by climate change and in particular by changes in production systems and climate-related damage and crop failures. For example, if it takes a long time to rain, farmers find it hard to retain their employees due to low production and less income.

2.9.2. Climate change

According to the Intergovernmental Panel of Climate Change (2008:9) 3rd Assessment report, climate change is already happening, and will continue to happen even if global greenhouse gas emissions are curtailed significantly in the short to medium term. There is now more certainty that global climate change is a threat to sustainable development, especially in developing countries, and that it could undermine global poverty alleviation efforts and have severe implications for food security, clean water, energy supply,

environmental health and human settlements. Acknowledging the overall vulnerability of South Africa to climate change impacts, it is necessary to carry out adaptation measures in this country (IPCC, 2008:9).

Figure 2.7. Agricultural activity affected by drought as a result of climate change in Mopani District.

Source: (Nkuna 2016:8)

Agnolucci (2004:53) states that measurable changes in climate can be expected to have significant effects on various sectors of South African society and the economy. Further, urban air pollution from low-level sources, such as domestic emissions, will become a greater problem, due to the enhanced occurrence of temperature inversions resulting from climate change. These inversions serve to trap the smoke from such sources near ground level giving rise to excessive ambient concentrations.

Climate change poses a significant threat to South Africa's water resources, food security, health, infrastructure, ecosystem services and biodiversity. In South Africa, climate change projections to 2050 show significant warming (Zwane and Montmasson-Clair, 2016:2).

Climate change threatens the objective of sustainably eradicating poverty. Poor people and poor countries are exposed and vulnerable to all types of climate-related shocks, natural disasters that destroy assets and livelihoods; waterborne diseases and pests that become more prevalent during heat waves, floods, or droughts; crop failure from reduced rainfall; and spikes in food prices that follow extreme weather events (Anderson, 2007:36).

2.9.3. Human health effects

The gases released from gas vents at the Witbank and Sasolburg coalfields consist of a complex mixture of hydrocarbons, halocarbons and greenhouse gases that are associated with negative effects on the environment and on human health. These toxic compounds are carbon monoxide, carbon dioxide, methane, benzene, toluene, and xylene (Pone et al., 2007:135).

Emmanouil et al. (2009:108) assert that exposure to asbestos in drinking water correlates highly with gastrointestinal or respiratory cancers. Moreover, asbestos-contaminated drinking water has been known to affect the quality of household air and the concentration of airborne asbestos in home. Health effects associated with common pollutants range from irritation effects to systemic effects and carcinogenic risks (South African Environment Outlook, 2006:202).

The researcher is of the opinion that since, during the apartheid era, black people were forced to relocate closer to the industrial mines, it means their health was in danger of contamination, causing several diseases, resulting from industrial activities. For example, most people in Mafefe Village in Sekhukhune District of Limpopo Province were killed and crippled by asbestos. The community claim that their lives remain in danger because government has failed to clear the asbestos debris left behind by decades of mining activities.

2.9.4. Tourism development

Tourism is a major contributor to the economies of many countries but the negative impact sometimes overshadows the benefits. Seldom is development as environmentally sound as it could be. Tourists' wasteful and damaging habits are easily learned and sound traditions cast aside (Barrow, 2006:333).

Moreover, rapidly expanding cities, such as those in Sub-Saharan Africa, urgently need to consider the importance of green assets as part of their broader infrastructure development programmes. This will only happen if the value of the ecosystem services provided by these assets are formally recognised in city budgeting and accounting systems, and if the ecological economy of citizen greening networks is integrated into city-planning processes (Schäffler and Swilling, 2010:02).

Tourism also brings about its own set of environmental pressures, since tourism facilities need to be developed, access to the facilities ensured, and services provided within sensitive natural environments (North West Environment Outlook Report, 2013:15).

Most countries, including South Africa, depend on tourism for survival. However, but the researcher believes that tourists need to be guided as to how to behave while they are on tourism sites, in order to avoid harming the species that are found there. Industry owners also need to take precautionary measures to ensure that pollution does not impact negatively on tourism sites.

2.10. Legislative framework

According to the Department of Local Government and Traditional Affairs (2014:14) in South Africa, no government or individual is above the law. All of government, including local government, must act according to the Constitution and the laws passed by government. The Department of Local Government and Traditional Affairs (2014:16)

further indicates that Section 1(c) and Section 2 of the South African Constitution mean that government, politicians and officials at any level can be ordered to obey the law.

The following is a broad overview of the relevant policy and legal requirements that are important to this study:

2.10.1 Constitution of South Africa (Act no 108 of 1996)

According to Section 24 of the Constitution of South Africa (1996), it is the right of every citizen of South Africa to have or to live in an environment that is neither polluted nor harmful to their health and well-being. The primary legislation governing the environment in South Africa is the Constitution. Government has developed legislation that is aimed to encourage and promote sustainable development, as well as law enforcement where there is non-compliance.This section of the Act is applicable to and vital for this study because it encourages sustainable environmental development, as well as protection of the communities around the local municipalities of the Mopani District.

2.10.2. National Water Act (Act no 36 of 1998)

Section 19 of the National Water Act, Act 36 of 1998 requires that all reasonable measures be taken to prevent any water pollution from occurring, continuing or recurring. The Act further describes a number of water users and requires that a Water Use License be obtained for the specified water use. This Act is relevant for industries producing wastewater that could have a detrimental impact on the environment and sustainable development in the Mopani District. It requires such facilities to apply for a Water Use License and to comply with its conditions. In terms of the Act, Water Use includes the following:

- Taking water from a water resource;
- impeding or diverting the flow of water in a watercourse;

- Discharging waste or water containing waste into a water resource through a pipe, canal or sewer;
- Disposing of waste in a manner which may detrimentally impact on a water resource;
- Disposing in any manner of water which contains waste from or which has been heated in any industrial or power generation process.

2.10.3 National Environmental Management Act (Act no. 107 of 1998)

Section 28 (1) of the National Environmental Management Act (Act no. 107 of 1998) outlines that every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

This, Act in its preamble, defines the concepts of sustainability, to ensure that any social or economic development will take place in such a way as to preserve the environment for the present and future generations.

2.10.4 Conservation of Agriculture Resource (Act no. 43 of 1983)

Section 6 of this Act provides guidelines for the control of the utilisation of the natural agricultural resources of the community in order to promote the conservation of the soil, the water resources and the vegetation, and to combat weeds and invader plants. The Act is relevant and useful in this study in looking at compliance by industries that generate and use sludge as compost, as well as the utilisation of wastewater for irrigation.

2.10.5 National Environmental Management: Waste Act (Act no. 59 of 2008)

Waste is defined as any substance, irrespective whether it has the potential to be reduced, re-used, recycled or recovered, that is surplus or that the owner or generator no longer needs. This critically exposes the fact that the definition of waste excludes other types of waste, for instance medical waste, which may not be recycled. This brings about legal challenges with regard to cases involving the excluded types of waste. The Waste Act does not apply to areas that are regulated by other sectoral legislation. For example, radioactive waste residue deposits and residue stockpiles of explosives and the disposal of animal carcasses (Department of Environmental Affairs, 2012:69).

2.10.6 Hazardous Substance Act (Act no. 15 of 1973)

Rules and Regulations of Hazardous Substance Act (Act no. 15 of 1973) under section 7 state that any Category B Group I hazardous substance manufactured or packed in the Republic must bear a label which has been approved by the Registering Officers, appointed under the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act 36 of 1947). The label must include directions regarding the disposal of the container when empty. The objective of the Hazardous Substances Act 15 of 1973 is to provide for the control of substances which may cause injury or ill heath to, or death of, human beings through their toxic, corrosive, irritant, strongly sensitising or flammable nature.

This study is guided by the above legal framework. Section 8 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) indicates that employers must provide and maintain, as far as is reasonably practicable, working environments that are safe and without risk to the health of their employees.

2.10.7 National Environmental Management: Air Quality Act (No. 39 of 2004)

The act provides for a more comprehensive decision-making and management framework for air pollution. It acknowledges that many areas of South Africa do not provide a healthy environment for people and, furthermore, that the burden of ill health associated with polluted ambient air falls most heavily on the poor. It also acknowledges that air pollution carries a high social, economic and environmental cost that is seldom borne by the polluter, and that atmospheric emissions of ozone-depleting substances, greenhouse gases and other harmful substances damage the environment.

2.10.8. National Environmental Management: Biodiversity Act (No. 10 of 2004)

This Act provides the framework, norms and standards for the conservation, sustainable use and equitable benefit-sharing of South Africa's biological resources. It instills an ecosystem approach to planning and management and requires the mainstreaming of biodiversity into sectoral policy and planning.

The objective of the act, as stated in its aims, is to provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998. It provides for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources,; the fair and equitable sharing of benefits arising from bio prospecting involving indigenous biological resources, the establishment and functions of a South African National Biodiversity Institute and for matters connected therewith.

The effectiveness of the above Act depends on the role of the government in environmental management, sustainability and implementation of strategies.

2.11. The role of authorities

Democratic decentralisation entails representative local authorities being entrusted with significant powers, such as the transfer of powers to local authorities such as the local municipalities and district municipalities. It is envisioned that this will improve local decision-making efficiency and equity (Ribot et al., 2010:02). Section 40 of the Constitution of South Africa (1996) stipulates that government is constituted of national, provincial and local spheres of government such as local municipalities and district municipalities. In terms of Section 151 of this Constitution, a municipality has the right to govern the local government affairs of its community in a democratic and accountable manner. It provides the national government and provincial government with the legislative and executive authority to monitor the effective performance of municipalities of their functions.

The role of local government is to develop the relevant local by-laws to ensure that all the relevant environmental aspects are governed within legislative framework that is in line with the national and provincial principles. The municipality also has an executive function that is linked with law enforcement functions such as air pollution, waste management and wastewater treatment. (Mngoma, Pillay and Reddy, 2011:110). Environmental managers must ensure that there is an optimum balance between environmental protection and allowing human liberty. Government needs to promote capacity-building programmes and projects that will assist people, particularly those from disadvantaged sectors of society, to develop social and organisational skills, and that will employ local and other knowledge in assessing and addressing the environmental concerns.

2.12. The environmental strategies

South Africa Environment Outlook (2006:56) explains that the National Treasury has embarked on a process of environmental fiscal reform, largely aimed at reforming government's revenue-raising approach in line with environmental economic principles of

higher taxes for environmentally harmful activities. The green taxes seek both to raise revenue and alter behaviour, encouraging fewer environmentally harmful activities by increasing taxes on environmentally harmful goods, such as pesticides, or practices that can damage the environment. The following are some of the strategies developed by government:

2.12.1. Climate Response Strategy 2011

The first National Climate Change Conference was held in October 2005 and brought leading national and international scientists together with policy- makers so as to develop material for South Africa's Second Communication under the United Nations Framework Convention on Climate Change (UNFCCC). The Deputy Minister stated that climate change considerations would be incorporated into national growth strategies and policy (National Climate Change Response White Paper: 2011).

2.12.2. Polluter Pays Principle

The polluter-pays principle, according to Barrow (2006:292), aids prevention of pollution, and waste control, by ensuring that manufacturers, agriculturalists and the public realise and pay the full costs for goods and services (i.e. incorporating pollution damage and pollution control costs into prices). Prevention involves proactive prevention of waste or pollution, while avoidance seeks development without generating waste or pollution.

Those responsible for environmental damage, both to the environment and human health, must pay the repair costs, and the costs of preventive measures to reduce or prevent further pollution and environmental damage (Nemathangana et al., 2008:124).

2.12.3. Waste Management

The Department of Health has developed national guidelines for the management of hospital waste. (Nemathanga, Maringa and Chimuka, 2008:124). Colour is used to

differentiate containers for storing various types of hospital waste at the generation point. Infectious waste should be stored in a yellow marked, strong leak-proof bag or container. Chemical and pharmaceutical waste is to be stored in a brown marked plastic bag or container. Black marked plastic bags in containers are to be used for storing general waste. Radioactive waste should be stored in a red lead box, labeled with a radioactive symbol. Sharp objects are to be stored in a yellow marked, puncture proof, lidded containers (Nemathanga, Maringa and Chimuka, 2008:124).

Schäfler and Swilling (2010:03) state that decisions about implementing resilient urban infrastructure may greatly benefit from a green infrastructure approach that designs cities for the resilient provision of ecosystem services, including ecological systems. Infrastructure service providers may lessen the reliance on the often irreversible, costly investments in technical connections, and their associated water and embodied energy requirement. Due to these system-wide benefits, the strategic placement of a green infrastructure in urban planning can assist in creating a more flexible urban infrastructure.

Traditional practices for dealing with waste management, explicated by Season (2010:1639) fall short in the following ways:

- Effort is spent collecting and analysing immaterial data. For example, conducting annual surveys of household waste composition when waste management practices do not change.

- Interventions may be irreversible, rather than providing for mechanisms to deal with emerging correctable side effects. For example, when Auckland City (New Zealand) increased waste collection containers, it did not anticipate the resultant increase in waste quantities and did not plan for it (Season 2010:1639).

- Solutions are based around short-term goals rather than longer term sustainability thinking. For example, reporting container recycling quantities while ignoring packaging reduction (e.g. the New Zealand Packaging Accord).

- The focus on fixing individual problems rather than the viability of the Waste Management System (WMS). An example of this is the litter problem in New Zealand, caused by the proliferation of one-way packaging in the 1990s. This was corrected by instituting a Packaging Accord that focused on recycling used beverage containers.

- Reliance on linear extrapolations of recent short-term events. This is exemplified by a comparison of the trends in waste disposal in New Zealand (Season 2010:1639).

Waste management, as viewed by the researcher, must minimise and avoid the creation of waste at source, especially in the case of toxic and hazardous waste. Government should encourage waste recycling, separation at source and the safe disposal of unavoidable waste.

2.12.4. White Paper 1997

According to the White Paper (1997:4), Government has developed the following strategic goals and their supporting objectives which address the major issues government faces in its drive to achieve sustainable development and to ensure an integrated system of environmental management:

- *Goal 1: Effective Institutional Framework and Legislation*

Create an effective, adequately resourced and harmonised institutional framework and an integrated legislative system, and build institutional capacity.

- *Goal 2 Sustainable Resource Use and Impact Management*

Promote equitable access to, and sustainable use of, natural and cultural resources, and promote environmentally sustainable lifestyles. Integrate environmental impact

management with all economic and development activities to achieve sustainable development with the emphasis on satisfying basic needs and ensuring environmental sustainability.

- *Goal 3: Holistic and Integrated Planning*

Develop mechanisms to ensure that environmental considerations are effectively integrated into the development of government policies and programmes, all spatial and economic development planning processes, and all economic activity.

- *Goal 4 Participation and Partnerships in Environmental Governance*

Establish mechanisms and processes to ensure effective public participation in environmental governance.

- *Goal 5 Empowerment and Environmental Education*

Promote the education and empowerment of South Africa's people. Increase their awareness of, and concern for, environmental issues, and assist in developing the knowledge, skills, values, and commitment necessary to achieve sustainable development.

2.13. Review of the environmental tools

According to Harris (2013:1), environmental issues are traditionally well established in Local Authorities (LA's) through public policies for functions such as environmental health, land-use planning, transport and conservation. The increasing recognition of the importance of the role LA's play in environmental protection, and consequent public and political pressure has led many authorities to take steps to extend their role into environmental management. The government's commitment to sustainability is

dependent on the actions of local government which require LA's to act as educators and facilitators to businesses in their locality.

2.13.1. *Environmental Impact Assessment (EIA)*

Internationally, throughout North America and Western Europe, the 1960's were characterised by a sudden growth in awareness of the relationship between an expanding industrial economy and local environmental change. While many characterise the 1960s as an era of environmental idealism, triggered by a number of environmental challenges, the decade did lead to increasing environmental awareness and public demand and pressure on central governments for environmental factors to be explicitly considered in development decision-making (Noble, 2010:14).

In order to maintain the environmental sustainability, as well as the socio-economic sustainable development, it is vital for an Environmental Impact Assessment to be conducted prior to every development or activity to identify any potential impact that could emerge during such developments.

Environmental Impact Assessment (EIA) can be thought of as a process that systematically examines the potential environmental implications of development actions prior to the project approval. EIA is an iterative process in which discussions with stakeholders, public review, scoping processes and post-project evaluations continue to refine impact predictions resulting from management actions. (Noble, 2010:15)

New developments may produce harmful wastes, but they also produce much-needed employment in areas of high unemployment; however, the correlation does not always apply. A project may bring physical benefits when, for example, previously polluted and derelict land is brought back into productive use. Similarly, the socioeconomic impact of a major project on a community could include pressure on local health services and on the local housing market, and increases in community conflict and crime. One can see that EIA is moving away from being a defensive tool of the kind that dominated the 1970's

to a potentially exciting environmental and social betterment technique. (Glasson, Therivel and Chadmick, 2012:18).

2.13.2. *Environmental Management Framework (EMF)*

The Environmental Management Framework Regulations (2010), Section 24 (3) of the National Environmental Management Act, states that the EMF's must be taken into account by competent Authorities, and Section 24 states that they must be used by competent authorities in decisions about applications for environmental authorisation. This supports the undertaking of environmental impact assessments by indicating the scope of potential impacts and the information needs that may be necessary for environmental impact assessments. If the above legislations can be implemented effectively, there can be sustainable development.

2.14. Sustainable development (SD)

Barrow (2006:286) states that when people suffer poverty they are unlikely to give much attention to environmental issues. Sustainable development demands the investment of some current resources into maintaining things in the future, and for poor people with little to spare, this can be a dilemma (and one they will need aid to deal with).
According to Roorda, Corcoran and Weakland (2012:9) sustainable development involves the distribution of prosperity between the various parts of today's world and also the distribution of that prosperity between humans today and humans tomorrow. The above process can only be successful if the government can have sustainable waste management system.

The necessary elements for a sustainable Waste Management System, as suggested by Season (2010:164), are as follows:

- Negative feedback loops dominate positive feedback loops. Negative feedback provides an element of self-monitoring and self-regulation. For example, in

Auckland City, halving the mobile garbage bin size, plus an added cost to dispose of excess weight, (negative feedback) had a better effect than years of messages extolling the virtues of recycling (positive feedback);

- Wastes are not emitted by society at an increasing rate;
- Wastes are not disposed of to the earth faster than they can break down through natural processes;
- Resources are used fairly, and with waste minimisation, to meet the basic human needs globally;
- Usage of existing forces, instead of opposing forces. The use of leverage supports a Waste Management System, but uses less effort to achieve a desired change.

Apart from the above elements, there are also development programmes that can contribute towards sustainable community development.

Masser (2013:48) describes sustainability as a development programme that aims to integrate the local people's requirements, desires, motivations and identity in relation to the surrounding landscape. It also means that local people, responsible for development initiatives and their effect on the immediate environment and the surrounding landscape design, must participate equally and fully in all debates and discussions from the local level to the national.

2.16. Conclusion

This chapter reviewed literature related to the impact of environmental management of industrial sector on sustainable community development. From the above literature, it is clear that sustainable community development can only be successfully maintained if the industrial owners can adhere to environmental management legislations. Aspects such as poor environmental management, pollution, human health effects, environmental hazard and other related factors need to be taken into consideration for sustainable development. In the next chapter, the description and analysis of research methodology is presented.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Introduction

In the previous chapter the researcher reviews relevant literature on the impact of environmental management of the industrial sector on sustainable community development.

This chapter focuses on the research methodology used in this study, and looks at how the research process will unfold. The chapter explains the research paradigm, research methods and research design used, and includes ethical considerations, selection of participants, data analysis, and data collection methods.

3.2. Rationale for methodology

In order to understand the concept of methodology, one has to first define a research method and understand what it entails. Perri 6 and Bellamy (2012:9) define research method as a set of techniques recognised by most social scientists as being appropriate for the creation, collection, coding, organisation and analysis of data. Research methodology implies more than simply the methods you intend to use to collect data. It is often necessary to include a consideration of the concepts and theories which underlie the methods.

According to Silverman (2014:54), methodology refers to the choices we make about cases to study, methods of data gathering, forms of data analysis, planning and executing research design.

In this research study, the researcher adopts the mixed method approach which includes both qualitative and quantitative research. This method assists the researcher to critically

analyse the impact of environmental management of the industrial sector on sustainable community development in selected municipalities in Mopani District of the Limpopo Province. The researcher works according to Silverman (2014:54), who attests that methodology is the style we use as to plan, gather, study and arrange the collected information to analyse a research design.

3.3. Research design

According to Creswell (2014:12), research designs are types of inquiry within qualitative, quantitative and mixed methods approaches that provide specific direction for procedures in a research design. Marshall and Rossman (2011:7) explain that research design can stipulate phenomenological, in-depth interviewing as the sole method of data collection.

A mixed-methods research study requires more of a researcher's time and energy than a strictly qualitative or quantitative study. Below are several reasons why a researcher would want to go to the trouble of collecting, analysing, interpreting, and integrating both quantitative and qualitative data (Leedy and Ormord, 2015:330):

- Completeness: A researcher can fully address a research problem and its sub-problems only by collecting, analysing, and interpreting both quantitative and qualitative data.

- Complementarity: Quantitative aspects of the study can compensate for weaknesses in qualitative research, and vice versa. For example, the results of unstructured interviews with only a small number of individuals can be replicated by administering a questionnaire to a larger, more representative sample.

- Development of appropriate research tools and strategies: One type of data can inform and guide the subsequent collection of another type of data. For example, unstructured interviews can guide the construction of appropriate questions for a survey.

- Resolution of puzzling findings: In a quantitative study, various results may seem inconsistent or contradictory; qualitative data may reveal underlying nuances and meanings that can help the researcher make sense of the numbers.

- Triangulation: A researcher can make a more convincing case for particular conclusions if both quantitative and qualitative data lead to those conclusions.

Mixed methods research is an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks. The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone (Creswell, 2014:33).

The researcher has chosen the mixed methods approach because the weaknesses of the qualitative research approach can be addressed using the quantitative approach and the weaknesses of the quantitative research analysis can be addressed by making use of qualitative research. She believes that the mixed method approaches give a concise understanding of a research problem.

The researcher has adopted both the qualitative and quantitative research methods, also referred to as the mixed methods, in order to examine the impact of environmental management of the industrial sector on sustainable community development. The researcher fully investigates the issue by collecting, analysing, and interpreting the outcome of the research, using both quantitative and qualitative methods.

3.3.1. Qualitative research method

This type of research method involves describing in detail a specific situation using research tools like interviews and observations. Creswell (2014:32) asserts that the process of qualitative research involves emerging questions and procedures, data

typically collected in the participant's setting, data analysis inductively building from particular to general themes, and the researcher making interpretations of the meaning of the data.

According to Leedy and Ormrod (2015:271), qualitative researchers rarely try to simplify what they observe. Instead, they recognise that the issue they are studying has many dimensions and layers, and they try to portray it in its multifaceted form.

Advantages of the qualitative approach as suggested by Leedy and Ormrod (2015:279) are as follows:

- Exploration - it can help the researcher to gain initial insights into what has previously been a little-studied topic or phenomenon.

- Multifaceted description - it can reveal the complex, possibly multilayered, nature of certain situations, settings, processes, relationships, systems, or people.

- Problem identification - it can help the researcher to unfold key problems, obstacles, or enigmas that exist within the phenomenon.

- Verification – it allows the researcher to test the validity of certain assumptions, claims, theories, or generalisations within real-world contexts.

- Evaluation - it provides a means through which the effectiveness of particular policies, practices, or innovations can be judged.

- Theory development – it may enable the researcher to develop new concepts or theoretical perspectives related to a phenomenon.

The researcher recognises that qualitative research occurs in a social context and its main aim is to know more about the experiences of people in a particular situation. Qualitative researchers regard people whom they interact with as participants. The

researchers try to understand other people's worlds and how they make meaning of the world around them.

3.3.2. Quantitative research method

According to Fawct and Pockett (2015: 72), quantitative research is about determining the relationship between facts and measures of reliability, generalisability and validity. These are backed up by established statistical tests which are seen as externally verifiable and are central to the methodology. One of the strengths of quantitative research is the production of large data sets that can be appraised for the purposes of further research and policy development.

Quantitative research consists of those studies in which the data concerned can be analysed in terms of numbers, and research is based more directly on its original plans and its results are more readily analysed and interpreted (Hughes, 2006:02).

Characteristics of quantitative research, according to Burns (Hughes 2006:03), are indicated as follows:

- Control: This is the most important element because it enables the researcher to identify the causes of his or her observations. Experiments are conducted in an attempt to answer certain questions and they represent attempts to identify why something happens, what causes some event, or under what conditions an event does occur. Controlled inquiry is absolutely essential to this, because without it the cause of an effect cannot be isolated.

- Operational definition: This means that terms must be defined by the steps or operations used to measure them. Such a procedure is necessary to eliminate any confusion in meaning and communication.

- Replication: To be replicable, the data obtained in an experiment must be reliable; that is, the same result must be found if the study is repeated. If observations are not repeatable, the descriptions and explanations are thought to be unreliable.

- Hypothesis Testing: The systematic creation of a hypothesis and subjecting it to an empirical test.

The researcher understands quantitative method as an approach that can be used to gain insight of other people's opinions concerning the topic under investigation and the results are analysed in terms of numbers. In this research project, the researcher uses both quantitative and qualitative research in order to gain better into other people's experiences or situations in relation to the impact of environmental management of the industrial sector on sustainable community development in selected municipalities of the Mopani District. The effectiveness of a good research design depends on the research philosophy on which the researcher bases the study.

3.4. Research philosophy

The most important reason for understanding philosophical arguments is that they are important for understanding the kinds of guarantee that we can claim for our conclusions, especially when we want to confirm or undermine a model or theory (Perri and Bellamy, 2012:49).

There are various philosophical arguments underpinning research:

3.4.1. Positivism

This approach believes that there is a reality outside us, which we absorb and therefore gain knowledge about it as it really is. It implies that we absorb knowledge from the environment and get to know it in an objective way (Grobler, 2009:01). Neuman (2011:95) postulates that positivism is described as the approach of the natural sciences which is

associated with several social theories and structural- functional, rational choice and exchange- theory frameworks.

Furthermore, Waller, Farquharson and Dempsey (2016: 12) attest that the task of a positivist is to find objective truth because the researcher aims to see things as they really are and is like a scientist looking through a one-way mirror, able to conduct the research without having any effect on what is being researched. Positivists believe that it is right to use our knowledge of casual social laws to help society progress (Van Rensburg et al., 2010:23).

The researcher understands positivism as an approach which allows researchers to know that there is a reality outside our own worlds whereby we can engage and gain knowledge of the way it is, without interfering so that we can judge whether it is truth or not. As a result, the researcher was able to use the positivist approach because she managed to go to the people of the Mopani District and engage with them in order to get their reality, based on the impact of environmental management of the industrial sector on sustainable community development.

3.4.2. Phenomenology

According to Costley, Elliott and Gibbs (2010:87), phenomenological approaches are powerful for understanding subjective experience, gaining insights into people's motivations and actions. They further attest that the phenomenological approach is particularly good at exposing limitations in current thinking, action or policies, developing widened or alternative perspectives, and testing complex systems. Marshall and Rossman (2011:19) view phenomenology as seeking to explore, describe and analyse the meaning of individual lived experience. It aims at gaining a deeper understanding of the nature or meaning of our daily experiences.

Phenomenology, as viewed by the researcher, is a method which can be used for understanding the lived experiences of participants in order to gain insight concerning

day-to-day experiences. Thus, the researcher uses the approach to go to the people and gain understanding of what they experience daily concerning the impact of environmental management of the industrial sector on sustainable community development in their area.

3.4.3. Hermeneutics

This is the origin of understanding of texts, both at the level of the meanings conveyed and through attempting to get below the surface by understanding the perspective and context from which the text is produced (Costley, Elliott and Gibbs, 2010:87). According to Sharkey Kafle (2011:192), hermeneutic phenomenology challenges the researcher to reflect deeply on what it is that the texts of the field have to say and the researcher is called on to play with the texts, to get lost in deep conversation with them. The goal of this type of research is not to clone the texts of the field for the reader of the research but to invite the reader to enter the world that the texts disclose and open up in front of themselves.

This paradigmatic concern of conducting phenomenological (hermeneutic) research is drawn not from a single author but it is based on ideas floated by different scholars at different times (Kafle, 2011:192).

The researcher understands hermeneutics as an approach which causes the researcher to engage in different literature or texts written by different scholars at different settings when compiling a research project. Therefore, the researcher was able to derive information from different literature or texts written by different authors in different settings and time.

Due to the nature of the study, the researcher uses both phenomenology and positivism to collect qualitative and quantitative data in order to achieve her intended goal.

3.5. Population

According to Welman et al. (2005:52), population refers to the study object consisting of individuals, groups, organisations, human products and events or things of interest that a researcher wishes to investigate. Neuman (2011:241) defines population as a selected small collection of cases or units that closely reproduces or represents features of interest in a larger collection of cases.

Examples of populations, according to Van Rensburg et al (2010:150), may be first year university students, residents in a specific area, single parents, crime victims, all secondary schools around Limpopo Province, etc.

The researcher understands population to be the entire group of people who meet the criteria for inclusion in the particular study in which the researcher is interested. The target population of this study is the people who live within the municipalities of Mopani District. The population size of Mopani District is 1, 092, 507 people and the number of industries in the study area is approximately 50.

Mopani District is one of the five district municipalities of Limpopo Province in South Africa. It replaces the Bohlabela District Municipality. The district consists of five local municipalities: the Greater Tzaneen Local Municipality, Maruleng Local Municipality, Phalaborwa Local Municipality, Greater Letaba Local Municipality and Greater Giyani Local Municipality.

According to Mopani District Municipality IDP (2011/16), the Greater Tzaneen Local Municipality is situated in the eastern quadrant of Limpopo within Mopani District Municipality area of jurisdiction. It consists of 125 rural villages, with almost 80% of the households residing in these villages. The area encompasses the main towns of Tzaneen, Nkowankowa, Lenyenye, Letsitele and Haenertsburg. Maruleng Local Municipality is the smallest municipality in the district of Mopani in terms of population size, and Giyani Local Municipality is the largest centre of population concentration with ten traditional authority areas, comprising 91 villages.

The Ba-Phalaborwa Local Municipality is a municipality found in Mopani District of Limpopo Province. It is populated by mining activities, industries and sewage treatment plants. It is situated in the north-eastern part of Mopani, less than 1 km from the Kruger National Park border. It includes the towns of Phalaborwa, Namakgale, Lulekani and Gravelotte.

The Greater Letaba Local Municipality incorporates proclaimed towns of Modjadjiskloof and Ga-Kgapane, situated in the south of the municipal area, and Senwamokgope towards the north-west of the area. This municipality is the third largest municipality in terms of population in Mopani District. (Mopani District Municipality IDP: 2011/16).

It is also notable that the population size of Mopani grew steadily by 3% between the years 2000 to 2011, with a significant increase in 2005 when Maruleng and part of Kruger National Park were incorporated into Mopani. As per the Census 2011, the overall population size of Mopani District stands at 1 092 507 (STATSSA data, 2011).

3.6. Study area

The study covers selected industrial sectors of Mopani District. The Mopani District consists of five local municipalities in Limpopo Province that are highly
industrialised, and populated with protected species of fauna and flora. The Global Positioning System (GPS) coordinates of Mopani District are S23°45’59.8” E30°50’9.6”. The climatic conditions of the area are warm and humid.

Mopani District Municipality is situated in the north-eastern part of Limpopo Province, a few kilometres away from Polokwane, the main city of Limpopo Province, along the provincial roads R81 and R71.

The District Municipality has a good comparative advantage of Eco-tourism due to its proximity to Kruger National Park, an Eco-tourism hotspot of international importance. It

boasts of indigenous forests, biospheres, wetlands, endangered species (Modjadji cycads), as well as a cultural heritage site in Modjadji Nature Reserve. The Mopani District is a very sensitive area and it consists of protected areas. It is impractical for a researcher to gather data from the entire population, hence it is vital to sample from the study population.

3.7. Sampling

According to Fawcett and Pockett (2015:75), sampling in its broadest sense relates to the selection of respondents for the research project. Sampling is a process of selecting units from the population of interest so that by studying the sample, a researcher may fairly generalise the results to the population from which they were chosen.

A sample is described as a part of a whole or a subset of measurements drawn from the population; it is a selected group of elements from a defined population (Van Rensburg, Alpaslan, Duplooy, Geldeblom, Van Eeden & Winston, 2010:151).

According to the researcher's understanding, sampling is a small group of people whom the researcher handpicks to represent a particular population of his or her choice when conducting a research project. Therefore, for the current study, the researcher selected a sample of 60 participants of the population of different municipalities in the Mopani District in Limpopo.

3.7.1. Sampling methods

3.7.1.1. Probability sampling

Depending on the field situation, probability sampling can either be very simple or extremely difficult, time consuming and expensive. However, it remains the most effective method for the selection of study elements because it allows researchers to avoid bias in element selection and it permits estimates of sampling error (Babbie, 2011: 213).

Moreover, this type of sampling involves selection of a “random sample” from a list containing the names of everyone in the population being sampled (Babbie, 2010:192).

Floyd and Fowler (2014:14) attest that a probability sampling procedure must be used to designate individual units for inclusion in a sample. They further indicate that if the researcher’s discretion, or respondent characteristics such as respondent availability or initiative, affect the chances of selection, there is no statistical basis for evaluating how well or how poorly the sample represents the population.

However, although probability sampling remains the primary method of selecting large, representative samples for social research, it may be impossible or inappropriate in many research situations (Babbie, 2010:192).

The researcher interprets probability sampling to be a method which ensures that every person in the population stands an equal chance of being included in the sample.

The following are the types of probability sampling:

- Simple random sampling

  According to Babbie (2011:200), simple random sampling is the basic sampling method used in the statistical computations of social research. Once a sampling frame has been properly established, to use simple random sampling the researcher assigns a single number to each element in the list, not skipping any number in the process.

  Once the population has been defined, the sampling frame is drawn and each element of the sampling frame, therefore, has an equal chance of being included in the sample (Van Rensburg et al., 2010:156).

The researcher has not used this method because it involves too many subjects from too many places, which is expensive and time consuming (Van Rensburg et al., 2010:159).

- Systematic sampling

This type of sampling method is seldom used in practice. In systematic sampling, every element in the total list is chosen (systematically) for inclusion in the sample. In order to insure against any possible human bias in using this method, the first element should be selected at random. (Babbie, 2011:200).

Systematic sampling relies on the availability of a complete population list (sampling frame) and elements are selected at equal intervals (for example, every sixth, tenth or nineteenth element) (Van Rensburg et al., 2010:157).

The researcher understands systematic sampling as a method whereby the researcher obtains a list of the total population and then determines the population, taking careful consideration that the population list is not biased.This type of sampling was not suitable for the study because the industries within the focus are scattered and located far away from each other.

- Stratified sampling

According to Neuman (2011: 272), stratified sampling creates a frame for each of several categories of cases, drawing a random sample from each category and then combining the several samples. When a simple random sample is drawn, each new selection is independent, unaffected by any selection that came before. As a result of this process, any of the characteristics of the sample may, by chance, differ somewhat from the population from which it is drawn (Floyd and Fowler, 2014:19).

- Cluster sampling

  Cluster sampling is particularly useful when the relevant population is widely dispersed because it economises on the time and costs incurred by travel (Seale, 2012:141).

  Cluster sampling, as described by Van Rensburg et al. (2010:159), requires that the population be divided into groups and is used when a complete list of elements (sampling frame) is not available.

  The researcher views cluster sampling as a method that can be used to group participants, regardless of their rank (if they are employees from the same company or students from the same university), instead of selecting individuals. The cluster sampling method can be used when researchers do not have sufficient funds or time to select members individually.

3.7.1.2. Non- probability sampling

According to Seale (2012: 144), non-probability techniques are often used to access groups whose activities are normally hidden from public or official view, so that a sampling frame may not exist. Non-probability sampling techniques include relying on available subjects, purposive sampling, snowball sampling and quota sampling.

Non-probability sampling, according to Babbie (2010:192), is any technique in which samples are selected in some way not suggested by probability theory. Examples include reliance on available subjects, as well as a purposive (judgmental), quota, and snowball sampling.

Non-probability sampling is a sampling approach used where the population may or may not be accurately represented and is used when probability sampling is extremely expensive, difficult, or when representativeness is not essential (Van Rensburg et al., 2010:160).

The current researcher understands that non- probability sampling may take place when the sampling of the population cannot be defined. It is mostly preferred by researchers because it is less expensive and saves time.

As has been stated, non-probability sampling is a technique that can be used to save money and time. It may also be used when it is uncertain that every element of the population has been included in a sample. Non-probability sampling was chosen in this study because the researcher found it useful as it saved her time and money. The following are the types of non-probability sampling:

- Handpicked sampling

  This type of sampling involves the selection of a sample with a particular purpose in mind. Its representativeness depends on the researcher's ability to select cases that meet particular criteria, including typically wide variance, expertise, etc (O'Leary, 2010: 170).

  The researcher hand-picked participants who met the criteria relevant to the topic of this study. She ensured that the handpicked participants were experts in their fields and had the information that was valuable to the understanding of the impact of environmental management of the industrial sector on sustainable community development in selected municipalities in Mopani District of Limpopo Province.

- Snowball sampling

According to Neuman (2011: 268), snowball sampling is a method used for sampling the cases in a network. The method uses the analogy of a snowball, which begins small but becomes larger as it is rolled on wet snow and picks up additional snow. The sampling begins with one or a few people or cases and spreads out, based on links to the initial cases.

Babbie (2011:180) maintains that the snowball sampling procedure is appropriate when the members of a special population are difficult to locate, such as homeless individuals, migrant workers or undocumented immigrants.

In snowball sampling, the researcher collects data on the few members of the target population he or she can locate, and then asks those individuals to provide the information needed to locate other members of that population whom they happen to know. Snowball sampling is based on social networking and provides an informal method of accessing the required population (David and Sutton, 2011:232).

The researcher defines snowball sampling as a technique used by researchers to enquire of previously interviewed participants if there are other potential participants whom they know, who might be willing to partake in the research study. This type of technique is useful to find the hidden population which is not easy to identify. Thus, the researcher was able to use this method.

- Quota sampling

Quota sampling addresses the issue of representativeness. According to Fawcett and Pockett (2015:77), quota sampling is a form of non- random sampling where quotas from groups are identified on the basis of key social factors which may include gender, age, class, ethnicity and so on. Seale (2012:144) indicates that

market researchers tend to use quota sampling techniques because they are relatively quick and cheap to carry out. Quota sampling is a procedure in which the researcher sets a quota of respondents to be chosen from specific population groups, defining the basis of choice and determining its size.

Lune, Pumar and Koppel (2010:82) disagree with Seale that quota sampling is cheaper to carry out. They indicate that it works well for diverse populations where the groups are of an unequal size, however, it is time consuming and potentially expensive to carry out.

The researcher states that quota sampling is a technique that depends on accidental choice in which the researcher has a hypothesis about a sub population. For this reason, the researcher did not select this type of sampling. In addition, it is time consuming and expensive.

- Purposive or judgemental sampling

In this technique, the researcher purposely chooses subjects who, in their opinion, are relevant to the project. According to Waller, Farquharson and Dempsey (2016:67), purposive sampling is often used when there are only a limited number of potential participants based on the selection criteria. It refers to selecting participants with particular criteria that will enable researchers to answer their research questions.

Silverman (2014:60) indicates that purposive sampling allows us to choose a case because it illustrates some feature or process in which we are interested. It provides a good basis for finding respondents for an interview or focus group study.

The researcher understands purposive sampling as the type of sampling whereby the researcher selects participants by means of judgment. The researcher actively

judges the participants and picks those whom she/he thinks are information rich. It is also based on people's knowledge of the relevant topic.

Due to the nature of the current study, the researcher chose to make use of non-probability sampling because it can be regarded as the only sampling method that makes a representative sampling design possible (Jakuja, 2009:72). Furthermore, purposive sampling was also used for the study, because it was convenient for the researcher in terms of time. By using purposive sampling, the researcher was able to include participants according to the relevant criteria based on the emerging research questions. The researcher targeted a certain number of participants that includes, but is not limited to, the community members and the industry owners.

3.7.2. Sample size

Sample size is one element of research design that investigators need to consider as they plan their study. The sample size for this research project comprised 60 participants (10 industry owners and 50 community members).

The National Defense Research Institute (2012:09) suggests that if the data collection is to be completed, and the researcher can resolve the logistical considerations, then he/she needs to consider the following sampling issues:

- Is there a sampling frame that exists for the population you are interested in studying? If not, do you have the ability and/or time to create one?

- How do you decide who is to be included in your population?

- How large a sample do you need? Here, the researchers have to consider what they want to be able to say about the data. How generalisable do they want their results to be?

3.8. Research instruments

3.8.1. Survey

Surveys involve asking people predesigned questions and usually asking them to choose from among the answer choices that the researcher has provided. (Gordon, 2016:96). He further indicates that answers are turned into numeric codes so that statistics can be calculated from them. Surveys are designed to gather very specific yet standardised information from a number of people, and to get the same information from everyone surveyed.

Neuman (2014:36) further explains that in survey research, people are asked questions in written questionnaires or during an interview, the answers are recorded. Surveys give a picture of what many people think or report doing. Survey researchers often use a sample or a smaller group of selected people and generalise results to the large group from which the smaller group was selected. Survey research is very widely used in many fields of study and applied research.

Surveys, according to the National Defense Research Institute (2009:06), are fixed sets of questions that can be administered by paper and pencil, as a web form, or by an interviewer who follows a strict script. Surveys are defined as an instrument used to collect information obtained from asking participants similar questions to get information based on how people operate.

- Questionnaires

  According to Thomas (2013:207), questionnaires may be tightly structured but may also allow the opportunity for more open and discursive responses if required. Questionnaires may be read out by interviewers or sent to the respondents for them to complete themselves. They may be sent by post or email, or may be presented online.

A questionnaire is a "printed document that contains instructions, questions and statements that are compiled to obtain answers from respondents in field research (Van Rensburg et al., 2010:186).

A questionnaire as described by the current researcher is a set of structured questions used by researchers to get needed information from respondents. She made sure to provide a group of respondents with questionnaires which they filled out during the data collecting process.

- Interviews

According to Costley, Elliott and Gibbs (2010:93), interviews involve asking people questions that are open ended. Interviewing is a widely used research technique that can be adapted to work in a wide range of situations to gain information about people's perceptions, experiences or preferences. Interviews can be conducted face-to-face, on the telephone or, in some cases, through online chat.

Floyd and Fowler (2014: 71) concur with the above authors on how interviews may be conducted by the researcher; however, they emphasise interviewing as having the strengths and weaknesses of the main approaches to collecting data.

The researcher defines interviews as a face-to-face interaction or communication taking place between two people in a form of inquiry. In order to have a better, deeper understanding and detailed information about the perspectives of the research participants, the researcher distributed interview guides to management within the industrial sectors.

- Observation

Costley, Elliott and Gibbs (2010:95) indicate that observation may cover a wide range of situations including specific instances, such as meetings, practitioner-client interactions and the performance of specific tasks. Observation involves watching people to document their behaviour.

Marshall and Rossman (2011:139) attest that observation captures a variety of activities that range from lingering in the setting, getting to know people and learning routines, to using strict time sampling to record actions and interactions and using a checklist to tick off pre-established actions.

Observation, according to the researcher's point of view, takes place when the researcher takes note of the verbal and non-verbal communication of the participants, for example, dress code, physical space and what does not happen, especially if it was supposed to have happened, during the research process.

The researcher combined observation with interviews and questionnaires. She also left open the possibility of verifying interpretations with participants. This was important because non-verbal behaviours are easily misinterpreted, especially cross-culturally.

3.8.2. Administration of instruments

In order to have a better, deeper understanding of and gain detailed information about the perspectives of the research participants, the researcher distributed interview guides to the industrial owners within selected municipalities of the Mopani District. She also used observation. The researcher made prior appointments with the participants within the various local municipalities of the Mopani District. This process assisted the researcher to derive the sample from the target population. Further, she ensured that she

provided a group of respondents with questionnaires which they filled in during the process of data collection.

3.9. Data collection

The National Defence Research Institute (2009:02) asserts that primary data collection is an important part of many research projects and that using proper techniques ensures that qualitative data are collected in a scientific and consistent manner. Improving data collection techniques enhances the accuracy, validity, and reliability of research findings. Ultimately, using these methods helps to achieve the goal of carrying out high-quality research with credible findings.

In this study, the researcher used both primary and secondary data. Primary data collection was achieved through observation, distribution of questionnaires and interviews during site visits and inspections. To activate this process, the researcher used questionnaires to collect quantitative data from 10 industrial owners. To obtain more information, she used structured interviews to collect qualitative data from 50 members of the community. To supplement the above data, the researcher obtained secondary data from various sources such as books, the internet, journals and other sources. For the purpose of obtaining usable and useful information, it is necessary for the researcher to analyse the data.

3.10. Data analysis

Data analysis is the process of bringing order, structure, and meaning to the mass of collected data. It is time consuming, creative, and fascinating. Analysis procedures typically fall into the following eight phases: Organising the data, familiarising oneself with the data, identifying categories, coding the data, generating themes, interpreting, searching for alternative understanding and writing the report (Rossman & Rallis, 2012:273).

According to Van Rensburg et al. (2010:239), working with data means organising it, breaking it into meaningful units, synthesising it, searching for patterns, discovering what is important and what is to be learned, and deciding what to tell others.

Data analysis can be treated both as science and as art. When the emphasis is on science, the analysis should be rigorous, disciplined, systematic and methodologically documented, as in the case of grounded theory, typological analysis and analytic induction. When data analysis is treated more like an art, it does not mean that it is a less empirical procedure, but it also allows for an ambiguous, creative and fascinating process (De Vos et al., 2011:399).

Data collected through structured interviews has been classified according to themes, transcribed, translated, coded and interpreted. The researcher has also used tape recorded information for clarity on the data collected. To augment the above data, the researcher used a 5 point Likert scale to analyse data and to check the degree of understanding from agree, strongly agree, disagree, strongly disagree and uncertain. The researcher further analysed data through the use of graphs, frequencies, percentages and statistical analysis.

3.11. Validity and reliability

3.11.1. Validity

According to Neuman (2011:208), validity refers to how well an idea fits with reality. The absence of validity means that the fit between ideas we use to analyse the social world and what actually occurs in the lived social world is poor. Moreover, validity addresses the question of how well we measure social reality using our construct about it. Validity is a measure of quality of the process.

Creswell (2014:201) indicates that validity does not carry the same connotations in qualitative research as it does in quantitative research. He further views validity as one of the strengths of qualitative research as it is based on determining whether the findings are accurate from the standpoint of the researcher, the participant and the readers.

Below are the types of validity in detail:

3.11.2. Types of validity

- Face validity

  Kumar (2011: 385) asserts that face validity is the process that justifies the inclusion of a question or item in a research instrument by linking it o the objectives of the study, thus providing a justification for its inclusion in the instrument. According to Neuman (2011:212), face validity is a type of measurement validity in which an indicator makes sense as the measure of a construct in the judgment of others, especially in the scientific community.

- Content validity

  Content validity occurs when the experiment provides adequate coverage of the subject studied. This includes measuring the right things, as well as having an adequate sample. Samples should be large enough and should be taken from appropriate target groups (Changingminds, 2013: 2-4).

  Van Rensburg et al. (2010:197) assert that content validity of a scale involves answering the following question: To what degree does the content of items in the measuring scale correspond with the content of the domain being measured?

  The researcher believes that content validity occurs when what was examined produces the required results of the phenomena under investigation.

- Interpretive validity

This type of validity refers to the match between the meaning attributed to participants' behaviour and their own perspectives on their behaviour. This includes the accuracy of the researcher's analysis vis-à-vis the lived experience of the participants in the study. In addition to interpretive decisions made during data collection, interpretive validity is affected by the way the entire corpus of data is analysed. Methods for achieving interpretive validity include trying to use the words and concepts of the people studied. (Ravitch and Carl, 2016:190).

- Concurrent validity

Concurrent validity measures the relationship between measures made with existing tests. For example, a measure of creativity should correlate with existing measures of creativity (Changingminds, 2013:02). In addition, Kumar (2011:180) maintains that concurrent validity is judged by how well an instrument compares with a second assessment concurrently done.

Concurrent validity as Van Rensburg et al. (2010:196) point out, is estimated by administering the attitude scale and criterion measure at approximately the same time.

- Theoretical validity

According to Ravitch and Carl (2016:191), theoretical validity is the ability of a study to explain the phenomena studied, including its main concepts and relationships between them. This concept explores the relationship between the empirical study, other empirical studies and other theories that may or may not be empirically based. Theoretical validity is about the ability to have data speak to existing theory and/ or to have existing theories inform data. Methods for achieving

theoretical validity include ensuring that an applicable theory is provided and that it explains the data.

3.11.3. Reliability

Reliability of the research includes the extent to which studies can be replicated, a concept that applies to both procedures and results. If the study is reliable another researcher who uses the same procedure, variables, measurements and conditions should obtain the same results. Reliability is the consistency of the researcher's interactive style, data recording, data analysis and interpretation of participants' meaning from the data (Mahlangu, 2008:92).

According to Thomas, (2013:138), reliability refers to the extent to which a research instrument, such as a test, will give same result on different occasions. Kumar (2011:396) defines reliability as the ability of a research instrument to provide similar results when used repeatedly under similar conditions. Reliability indicates accuracy, stability and predictability of a research instrument: the higher the reliability, the higher the accuracy or the higher the accuracy of an instrument, the higher its reliability.

3.12. Trustworthiness

Trustworthiness of data is linked to authenticity, neutrality, conformability, credibility and dependability, and it is equated to external validity, internal validity, reliability and objectivity in quantitative research design. According to Fawcett and Pockett (2015:33), trustworthiness entails the confidence that another will act with the right motives and in accordance with appropriate moral norms.

The researcher disclosed the purpose of the study to the participants and avoided bias and any falsifying of results during the collection of data.

3.13. Elimination of bias

According to Creswell (2014:162), bias means that if non- respondents had responded, their responses would have substantially changed the overall results. Seale (2012:556) attests that bias is any systematic error that obscures correct conclusions about the subjects being studied. Typically, such bias may be caused by the researcher's own pre-judgments or by procedures adopted for data gathering.

The current researcher distributed questionnaires and interviewed the participants whilst verifying the responses through observation to avoid bias.

.3.14. Ethical considerations

In social research, ethics guide us through a range of concerns, dilemmas and conflicts that arise over the proper way to conduct a study. Ethics guide behaviour and decisions and also tell us what is moral and right. Social researchers have a clear moral and professional obligation to behave in an ethical manner at all times, even if research participants or others in the society are unaware of ethics (Neuman, 2014:69).

The researcher perceives that ethics involve acceptable moral behaviour and action to be followed when conducting a research study in any social setting or public space.

- Ensuring participants give informed consent

Silverman (2014:149) states that informed consent means that research subjects have the right to be informed about the nature of the research and the right to withdraw at any time. He further attests that the right to be informed means that potential subjects should be given a detailed, but non- technical, account of the nature and aims of the research.

According to Seale (2012: 66), informed consent has been viewed as a focal point in any discussion of research ethics, in either natural or social science. He explains that gaining

informed consent is a procedure that aims to support the principle of individual autonomy and is widely agreed to be a safeguard for the rights of people participating knowingly and voluntarily in research.

The principle of informed consent is generally agreed to be the ethical mode of operation when enlisting others in a researcher's design. Informed consent means the knowing consent of individuals to participate, as an exercise of their choice, free from any element of fraud, deceit, duress, or similar unfair inducement or manipulation (David & Sutton, 2011:43).

- Ensuring that no participants are exposed to any harm

Creswell (2014:129) claims that another issue to anticipate regarding confidentiality is that some participants may not want to have their identity remain confidential. By permitting this, the researcher allows the participants to retain ownership of their voices and exert their independence in making decisions. They do, however, need to be well informed about the possible risks of non- confidentiality, such as the inclusion of data in the final report that they may not have expected, however, information that infringes on the rights of others should remain concealed.

Human research, as explained by Babbie (2010:65), should never injure the people being studied, regardless of whether or not they volunteer for the study. In social research practice, this often concerns being careful not to reveal information that would embarrass subjects or endanger their home lives, friendships, jobs and so forth. Because participants can be harmed psychologically in the course of a social research study, the researcher must look for the subtlest dangers and guard against them.

In order to ensure that that no participants are subjected to physical harm, psychological distress or discomfort, the researcher ensured that the participants were informed about their safety during the research study.

- The right to privacy

In order to protect the privacy of individuals, roles, and incidents in the project, the researcher disassociates names from responses during the coding and recording process. In qualitative research, inquirers use aliases or pseudonyms for individuals and places, to protect the identities of participants (Creswell, 2014:139).

Seale (2012:64) attests that the invasion of privacy can be viewed both as harmful in its own right, and also as a condition that subjects people to the possibility of harm by depriving them of the protection that privacy offers.

The researcher views the right to privacy as an ethical norm which places makes it imperative that researchers avoid inflicting any imaginable harm to the persons involved in the research study. In this case, the researcher ensured that she neither caused harm nor violated the rights of participants during the research process.

- Ensuring confidentiality and anonymity

It is also important for the researcher to remind participants that they will use their words in direct quotes in a written report. Although researchers will do all they can to protect their identities, an organisational sleuth might be able to figure out who said what. Sharing this conditional aspect of confidentiality is a more ethical (and accurate) stance than pretending to be omniscient and powerful and able to protect participants' identities, no matter what (Rossman and Rallis, 2012:73).

The researcher understands being confidential as the ability to keep what was shared with the researcher confidential in such a way that a third person may find it hard to know what took place during one-on-one interactions.

The clearest concern in the protection of the participants' interests and well-being is the protection of their identity, especially in survey research. If revealing the survey responses

could injure participants in any way, adherence to anonymity becomes even more important (Babbie, 2010:67).

Van Rensburg et al, (2010:115) claim that if there is a risk of invading someone's privacy, researchers must first ensure that they obtain participant's consent, more especially if findings have to be published in any way.

The researcher managed to assure participants about confidentiality, and made sure that she delivered it. The researcher also made sure that she protected the privacy of participants (their identities, names, and their roles). She ensured that what she shared with one participant was not revealed to others, by not using the participants' real names.

- Ensuring professionalism

According to Leedy and Ormrod (2015:137), researchers must ensure that results are not fabricated in order to support a particular conclusion. The goals, behaviours, and attributes that characterise a profession constitute “professionalism” (Mueller, 2009:134).

Professionalism, according to the researcher's understanding, occurs when researchers conduct themselves in a way that shows the valuing of participants and embracing their uniqueness as individual beings and accepting their choices, influenced by their own belief systems.

The ethics of professionalism have been considered by the researcher throughout the research project through her valuing the participants’ values and embracing their thoughts as unique individuals (the researcher refrained from generalising or coercing them into agreeing with what she thought was right, based on her own frame of reference).

- Ensuring honesty and Integrity

According to Leedy and Ormrod (2015:123), researchers must report their findings in a complete and honest fashion, without misrepresenting what they have done or intentionally misleading others about the nature of their findings. Thus, under no circumstances, should a researcher fabricate the information to support a particular conclusion, no matter how seemingly “noble” that conclusion might be, because such an action constitutes scientific fraud.

Furthermore, Van Rensburg et al. (2010:117) state that irrespective of whether researchers undertake social research to obtain a higher qualification or as a full time researcher, the core issue is integrity, meaning that researchers must be honest.

Honesty is described by the current researcher as an act of refraining from twisting the collected data in order to make it fit and make the researcher obtain the desired results. Any type of communication in relation to the research has been undertaken with honesty and transparency. The researcher has not fabricated the collected data to obtain desired outcomes.

- Beneficence

Beneficence suggests a level of altruism that is absent from simply refraining from harm. The ethical principle of having to engage in altruistic or beneficent acts means that we are morally obligated to take positive and direct steps to help others (Summers, 2012:49). Flick (2009:37) asserts that beneficence implies that research on human subjects should produce some positive and identifiable benefit rather than simply be carried out for its own sake.

The researcher is of the opinion that researchers should intend to do good rather than harm, and need to express acts of kindness and courtesy as expected by the society. The researcher was able to show kindness and refrained from doing harm.

- Justice

The justice principle starts with the idea that in the distribution of burdens and benefits, the allocation should be equal. Procedural justice can be defined as “due process" which means that when one gets ones turn, one will receive the same treatment as everyone else (Summers, 2012:51).

According to Flick (2009:37), justice entails that all people should be treated equally. For example, the need to reduce the risk to participants of having any damage or disadvantage is formulated as follows as suggested by Flick (2009:37):

Persons, who are observed, questioned or who are involved in some other way in investigations, for example, in connection with the analysis of personal documents, shall not be subject to any dangers as a result of the research. All risks that exceed what is normal in everyday life must be explained to the parties concerned. The anonymity of interviewees or informants must be protected.

The researcher defines justice as an act of treating people in such a way that no harm is incurred.The researcher ensured fairness and equitable selection of participants. Justice was maintained because the lives of participants were never exposed to any danger or discomfort. An example of this, is the fact that their real names were never used in the research document.

3.15. Conclusion

In this chapter, various research paradigms, approaches, methods and research techniques are described and presented to show their relevance to the study. The choice of the research design and its applicability in the area of the study is discussed in full. The research instruments, validity and reliability are also outlined in this chapter. Furthermore, the elimination of bias, as well as ethical considerations are also presented in this chapter. In the next chapter, data collection, analysis and the discussion of results is presented.

CHAPTER 4

DATA ANALYSIS AND DISCUSSION OF RESULTS

4.1. Introduction

The previous chapter describes the research paradigm, designs and relevant methods used by the researcher to analyse data in this chapter. The purpose of this chapter is to analyse and interpret the data collected. The chapter includes the discussion of results derived from the empirical investigation.

The objectives of the analysis were to identify and appraise factors that impact negatively of the environmental management of sustainable community development. Challenges that hamper the effectiveness of environmental management are also investigated. Data analysis, interpretation and discussion of results enabled the researcher to arrive at suitable conclusions to research questions stated in chapter one, and recommendations for further research.

4.2. Data analysis and discussion of results derived from empirical data

Data analysis in this section was collected by means of questionnaires. Milondzo (2015:5) attests that a questionnaire is a popular method for collecting data because it is cheap and less time-consuming than other data collection methods. Furthermore, questionnaires can be distributed to get information from a very large sample.

Data collected from questionnaires using the Likert scale were analysed using frequencies. The Likert scale uses a rating scale that asks respondents to indicate the extent to which they agree or disagree with a series of statements about beliefs or behaviours around a given subject.

The researcher received responses from fifty respondents and the information obtained through questionnaires was generated by means of statistical inference to reach a valid conclusion regarding characteristics of the population as a whole (Nyathi, 2015:5). The distribution of respondents used in the empirical investigation is summarised in the following section.

Table 4.2.1. Distribution of respondents according to gender

Item	**Frequency (F)**	**Percentage (%)**
Question 1. What is your gender?		
Female	25	50
Male	25	50
Total	Fx= 50	100%

Question 1 indicates that twenty-five (50%) of the respondents were female, while twenty-five of them were male. All participants responded well to achieve the intended objectives of the study.

Participants' gender was distributed equally to avoid bias in the study. This process is in line with the policies of gender equity and equality in South Africa.

Table 4.2.2. The environmental management and community participation

Item	**F**	**%**
Are members of the community consulted for public participation before commencement of the industry development?		
Agree	5	10
Strongly agree	3	6
Disagree	10	20
Strongly disagree	30	60
Uncertain	2	4
Total	Fx= 50	100%

In question 2, forty (80%) of the respondents disagreed with the statement. Eight (16%) of the respondents agreed with the statement. Only two (4%) of the respondents were uncertain.

From the above analysis, it is clear that the majority of respondents think that the communities are not consulted for public participation before the commencement of industrial developments. Lack of community participation may impact negatively on environmental management. To reinforce this statement, Nyathi (2015:5) attests that lack of community participation always causes polarity amongst stakeholders in environmental management within the industrial area.

Table 4.2.3. Environmental management, community and subsistence farmers.

Item	**F**	**%**
Do subsistence farmers situated next to the industries affected by pollution?		
Agree	21	42
Strongly agree	20	40
Disagree	4	8
Strongly disagree	3	6
Uncertain	2	4
Total	Fx= 50	100%

In question 3, forty-one (82%) of the respondents agreed with the statement. Seven (14%) of the respondents disagreed with the statement. Only two (4%) of the respondents were uncertain.

From the above data, it is clear that majority of the respondents consider that subsistence farmers are affected by pollution. The majority of people practising agriculture are most affected by different types of pollution within the industrial areas (Mavuso, 2015:7). From this statement, it is clear that some of the subsistence farmers are often negatively affected by the industries in Mopani District.

Table 4.2.4. Environmental management and quality of water resources

Item	**F**	**%**
Do government authorities check the quality of water next to the industries before consumption?		
Agree	2	4
Strongly agree	2	4
Disagree	13	26
Strongly disagree	30	60
Uncertain	3	6
Total	Fx= 50	100%

In question 4, forty-three (86%) of the respondents disagreed with the statement. Only four (8%) of the respondents agreed with the statement, while three (6%) of the respondents were uncertain.

From the above information, it is evident that the majority of the respondents were of the opinion that government authorities do not check the quality of water next to the industries. According to Mawila (2015:9), most people who drink water next to the industrial areas are affected by pollution. Government authorities are expected to check the quality of water before it is consumed.

Table 4.2.5. Environmental management, experience and pollution.

Item	**F**	**%**
Have you ever experience any form of pollution hazard from your nearest industries?		
Agree	14	28
Strongly agree	30	60
Disagree	2	4
Strongly disagree	3	6
Uncertain	1	2
Total	Fx= 50	100%

In question 5, forty-four (88%) of the respondents agreed with the statement. Only five (10%) of them disagreed with the statement, while only one (2%) of the respondents was uncertain.

From the above analysis, it is clear that most of the respondents believed that they had experienced pollution hazards from their nearest industries. People who live next to industrial areas are always the victims of pollution in various ways (Nyathi, 2015:9). From the above statement, it is clear that poor environmental management always leads to pollution hazards which may eventually affect the communities living near the industries.

Table 4.2.6. Environmental management, community, experience and odour.

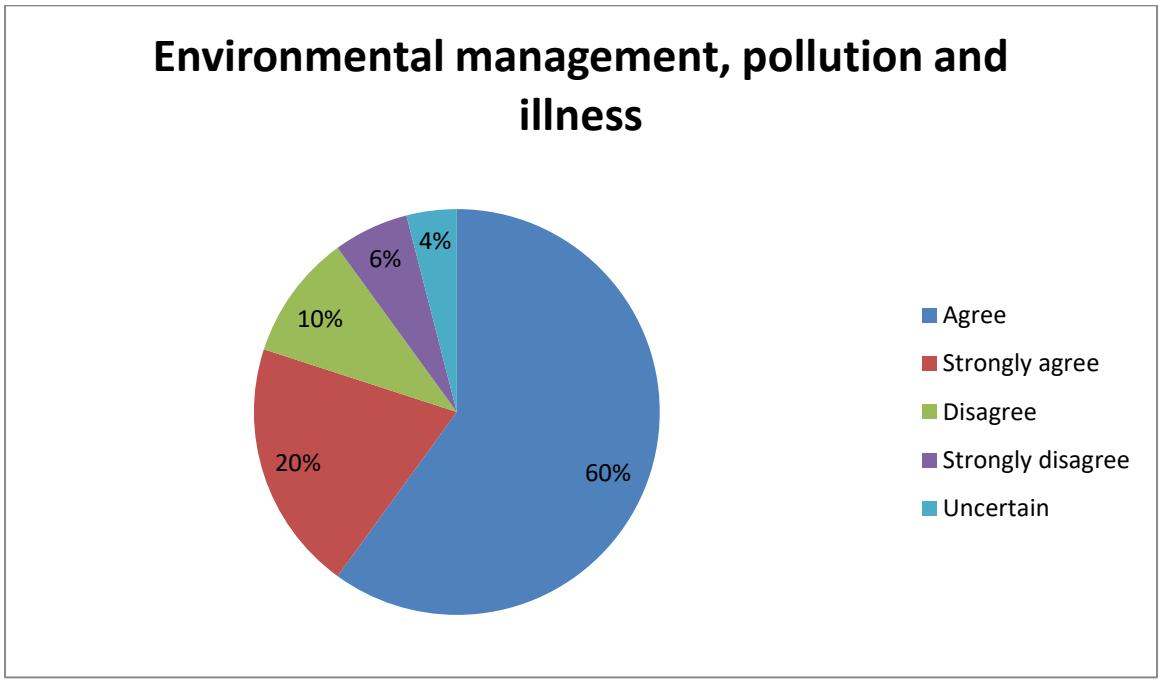
Item	**F**	**%**
Did the community experience bad odour emanating from the nearest industries?		
Agree	26	52
Strongly agree	10	20
Disagree	5	10
Strongly disagree	2	4
Uncertain	7	14
Total	Fx= 50	100%

In question 6, thirty-six (72%) of the respondents agreed with the statement. Only seven (14%) of the respondents disagreed with the statement, while three (6%) of the respondents were uncertain.

From the above information, it is evident that most of the community members were exposed to bad odours derived from the industries. According to Motaung (2015:6), the majority of people living next to industries are exposed to bad smells from the local industries. From the responses to question six, it is clear that people living next to industries are often affected by the bad odours in the environment.

Figure 4.2.1. Environmental management, pollution and illness.

Q7. Was there any reported form of illness emanating as a result of pollution?



In question 7, forty (80%) of the respondents agreed with the statement. Only eight (16%) of the respondents disagreed with the statement, while two (4%) of them were uncertain.

From the above analysis, it is clear that majority of the respondents believe that there were symptoms of illness caused by the local industrial pollution. Lack of commitment to, and poor, environmental management result in unknown symptoms of diseases caused by local industrial pollution (Mawila 2015:12). Lack of environmental compliance calls for the government to protect its citizens from diseases that are caused by emissions from the local industries.

Table 4.2.8. Environmental management, pollution and farming

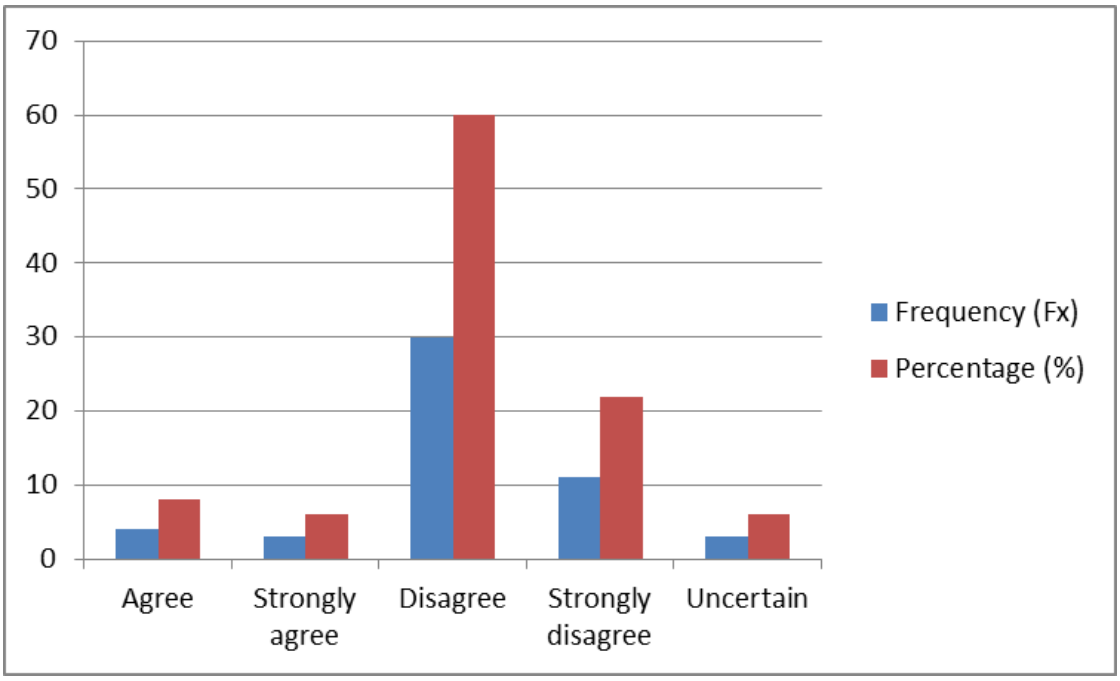
Item	**F**	**%**
Does the industrial pollution have a negative impact on commercial farming?		
Agree	30	60
Strongly agree	9	18
Disagree	5	10
Strongly disagree	4	8
Uncertain	2	4
Total	Fx= 50	100%

In question 8, thirty-nine (78%) of the respondents agreed with the statement. Nine (18%) of the respondents disagreed with the statement and only two (4%) of the respondents were uncertain.

From the above responses, it is evident that majority of the respondents believe that industrial pollution has a negative impact on commercial farming. From this finding, it is clear that lack of environmental management reduces the quality of production in commercial farming. To support this statement, Nkuna (2016:8) attests that industrial pollution normally affects the quality of agricultural production within the market environment.

Figure 4.2.2. Environmental management, waste and sustainable community development.

Q9. Industries that produce more waste have a positive impact on sustainable community development.



In question 9, forty-one (82%) of the respondents disagreed with the statement. Seven (14%) of the respondents agreed with the statement, while three (6%) of the respondents were uncertain.

The above analysis indicates that the majority of the respondents reacted negatively to the statement. Lack of environmental management allows many industries to produce more waste that will in turn impact negatively on sustainable community development. Most of the community projects near the industries are not sustainable because of the volume of waste that is produced (Motaung, 2015:11). This environmental hazard calls the owners of the industries to manage the environment according to the legal requirements.

Table 4.2.10. Environmental management, waste and local economic development.

Item	F	%
Poor environmental management has a negative impact on local economic development.		
Agree	10	20
Strongly agree	30	60
Disagree	4	8
Strongly disagree	2	4
Uncertain	4	8
Total	Fx= 50	100%

In question 10, forty (80%) of the respondents agreed with the statement. Six (12%) of the respondents disagreed with the statement. Only four (8%) of the respondents were uncertain.

The above information shows that majority of the respondents believe that the poor environmental has a negative impact on the local economic development. According to Mavuso (2015:14), poor harvests and low agricultural production is often the result of a polluted environment and therefore contributes less to the Gross Domestic Product (GDP).

4.3. Data obtained through semi- structured interviews

In this section, the researcher used semi- structured interviews to collect data from ten (10) industry owners. The data collected from participants gave the researcher a clear picture of the situation and factors that hamper environmental management of the industrial sector in sustainable community development of the Mopani District.

In this study, from the interviews, the following challenges were identified by the respondents as the main factors that hamper positive impact of environmental management on sustainable community development in Mopani District:

4.3.1. Environmental Management and legislation

Of the ten (10) industry owners interviewed, eight (8) claimed that they were conversant with the legislation impacting on answering environmental management in their industry.

Question:
(Are your managers conversant with the legislation that impacts on the environmental management in your industry? If yes/no, how?.....)

Of the ten (10) industry owners interviewed, eight (8) claimed that they did not understand the legislation related to environmental management.

Some of their comments are as follows:

“How can you expect me to understand legislative laws if there is no one who has trained me about their impact on environmental management”.
“Lack of clarity on implementation of the environmental law is the main cause of environmental management disaster”?

From the above responses it can be deduced that lack of empowerment on issues related to environmental laws and management, impact negatively on sustainable community development.

4.3.2. Environmental management and measures

Question:
Do you have measures to curb environmental management anomalies in your industry? If yes/no, how?.....
Out of ten (10) industry owners, eight (8) indicated that most of their industries did not have effective measures to curb environmental management anomalies.

Some respondents commented that:

“Our industries do not have measures that are meant to prevent the environmental anomalies, hence a lot of challenges related to pollution”.
“Lack of relevant measures to combat environmental disaster has a negative impact on the climate change and sustainable community development”.

The above responses indicate that lack of relevant measures may impact negatively on the environmental management for sustainable community development in the area of the study.

4.3.3. Environmental management and technology

Question:
Do you think technology can assist your managers to combat environmental management disasters in your industry? If yes/no, How?.....
…….
Of the ten (10) industry owners interviewed, nine (9) confirmed that technology could assist to combat environmental management disasters in their spheres of operation.
Some of them remarked that:

“The technological device that we have assists us to combat environmental management disaster in our industry”.
“The technological system that is used within our industries has a positive impact on the reduction of environmental management disasters”.

From the above responses, it is clear that technology has a role to play in the reduction of the environmental management disasters.

4.3.4. Environmental management and industrial waste.

Question:
Does the generation of waste in your industry have a negative impact on the environment? If yes/no, how?……..
Out of ten (10) industry owners interviewed, nine (9) of them indicated that the generation of waste has a negative impact on the environment.

Most of the industrial owners remarked that:

“‘The generation of industrial waste has a negative impact on the environment; hence a lot of money has been paid by our management for compliance”.
“How can you expect the management within industries to prevent the generation of waste if they do not have proper systems and mechanisms in place?”

From the above responses, it has been realized that most of the respondents did not have proper systems and mechanisms to prevent the generation of waste. Hence, a negative impact on the environment and sustainable community development.

4.3.5. Environmental Management and strategies.

Question:
Do you have strategies that are used by your industry to enhance the environmental management for sustainable community development? If yes/no, how? …….
Out of ten (10) industry owners interviewed, seven (7) confirmed that they did not have strategies that are developed to enhance the environmental management for sustainable community development in Mopani District.

Some of their comments are as follows:

“How can you expect me to work effectively, if there are no strategies that are meant to enhance the environmental management for sustainable community development”?
“Lack of relevant strategies impact negatively on environmental management for sustainable community development”.

From the above information, it can be concluded that lack of relevant strategies impacts negatively on environmental management for sustainable community development.

4.4. Conclusion

The purpose of data analysis and the responses from the semi-structured interviews was to explore the impact of environmental management of the industrial sector on sustainable community development in Mopani District. Responses from the interviewees were analysed and interpreted in this chapter. This study reveals that the lack of mechanisms and systems has a negative impact on environmental management and sustainable community development. The study discovered that there are factors that impact negatively on environmental management and sustainable development in Mopani District.

The above analysis assisted the researcher to suggest appropriate strategies and recommendations that can be used by industrial owners to enhance the environmental management for sustainable community development in the area of the study. In the next chapter, the researcher presents an overview of the study, findings, recommendations and the general conclusion of the study.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

The purpose of the study was to investigate the impact of environmental management of industrial sector on sustainable community development. The objectives addressed in this study were as follows:

- To determine the impact of environmental management of the industrial sector on sustainable community development in Mopani District;
- To identify factors that hamper the impact of environmental management for sustainable community development in the area of study;
- To determine the measures used by the owners of industries to enhance the impact of environmental management for sustainable community development in area of study.
- To suggest strategies that may be used by policy makers to enhance the impact of environmental management for sustainable community development in Mopani District.

In this chapter, the researcher draws conclusions of the study and makes recommendations to combat factors that hinder the impact of environmental management of industrial sector on sustainable community development. The chapter commences with an overview of the study. This is followed by findings derived from the primary study, deliberation of issues that need further research, limitations and general conclusions of the study.

5.2. Overview of the study

Current environmental challenges caused by industry have been left unattended by the other researchers. In Mopani District, challenges such as land, air and water pollution are mostly caused by local industries. To understand nature of the problem, the researcher has discussed how these anomalies impact on the environmental management for sustainable community development.

The researcher began by presenting the purpose of the study, statement of the problem, research questions and significance of the study in chapter 1. A review of relevant literature on the impact of environmental management on sustainable community development was also discussed in chapter 2. The research design and methodology used to collect and analyse data in chapter 4, is discussed in chapter 3. The analysis and interpretation of data are presented in chapter 4. The findings and recommendations outlined in these chapters, are discussed with reference to the objectives and research questions stated in chapter 1.

5.3. Summary and conclusions from the findings

The following conclusions derive from both the empirical investigations and semi-structured interviews. The findings are deliberated referring to the objectives, recommendations, questionnaires and structured interviews. In the next section, the researcher discusses how the objectives were achieved in the study.

Objective 1: To determine the impact of environmental management of the industrial sector on sustainable community development in Mopani District.

5.3.1. Members of the community are consulted for public participation before commencement of industrial development.

The findings show that participants were not consulted before the commencement of industrial developments. Most of the participants (80%) disagreed with the statement showing that they were not involved before commencement of the developments. Only a few participants supported the statement, because of ignorance and lack of understanding about issues related to environmental management. To reinforce the statement, Nyathi (2015:11) attests that most people in rural communities suffer from environmental hazards because of lack of participation, ignorance and understanding.

5.3.2. To check whether industries that produce more waste have a negative impact on sustainable community development.

According to the findings, majority of the participants believe that industries that produce more waste impact negatively on sustainable community development. These findings were supported by majority of the respondents (82%) who responded negatively to the statement. Nkuna (2016:8) attests that industries that produce more waste have a multi-layered effect that impacts negatively on the environment and community sustainable development. From this statement, it is clear that the volume of waste generated by industries impacts negatively on both the environment and sustainable community development.

Objective 2: To identify factors that hamper the impact of environmental management for sustainable community development in area of the study.

5.3.3. To check whether pollution had a negative impact on farming.

The above objective was achieved by the analysis of responses from the respondents. According to the findings from the respondents, factors such as land, air and water pollution impact negatively on sustainable, commercial and community development. The majority of the respondents (80%) believe that industrial pollution and environmental disasters have a negative impact on the quality of agricultural production.

Bad odours emanating from the industries also result in lack of sustainability as well as symptoms of illness amongst community members. The study further finds that poor environmental management impacts negatively on local economic development. For example, poor environmental management such as emissions, hazardous waste and other toxins are likely to cause climate change which may result in drought or floods. These natural disasters are a great threat both subsistence and commercial farming which may result in poor local economic development.

Objective 3: To determine measures used by the owners of industries to enhance the impact of environmental management for sustainable community development in area of the study.

5.3.4. To check types of measures used by the owners of the industries to enhance the impact of environmental management for sustainable community development.

To achieve this objective, the researcher asked both the industry owners and members of the community about the measures used to prevent the occurrence of pollution. The findings show that majority of the industry owners were not using effective measures to curb pollution. It was also found that they did not have strategies to enhance the impact of environmental management for sustainable community development. Furthermore, the study also discovered that authorities did not always check the quality of water or enforce relevant legislation enacted to enhance the environmental management. According to Mawila (2015:10), water used by people living next to industries is seldom checked by relevant authorities.

5.4. Recommendations

Based on the findings, the following recommendations are made to assist stakeholders with environmental management and sustainable community development:

5.4.1. The community should be encouraged to participate during the establishment of new industrial developments. This process may assist owners of industries to develop future policies to enhance environmental management in area of the study.

5.4.2. Owners of the industries should be encouraged to avoid issues that may have negative impact on matters related to natural and human disaster, so as to achieve sustainable community development. They should be encouraged to adhere to environmental laws, so as to curb the generation on toxic waste that is likely to impact negatively on sustainable community development.

5.4.3. The industry owners should be encouraged to establish systems that will produce less waste. This can be achieved through the use of technology and other mechanisms that are geared towards minimisation of toxic waste.

5.4.4. Policy makers should be encouraged to develop interventions and environmental strategies to compel owners of industries to adhere to all legislations related to environmental management. This process could assist local municipalities to achieve sustainable development in Mopani District.

5.5. Recommendations for further research study

Every research is intended to suggest further studies because no research can claim to be complete on its own. The following topics are suggested for further research:

- Exploring the role of Traditional Leaders in environmental management.
- The effect of lack of environmental management on commercial farming.
- The impact of environmental disasters on sustainable community development.

- The impact of environmental legislation on sustainable development.
- The perception of community members of environmental management.

5.6. Limitations of the study

Every study has limitations that affect collection and findings of data. In the current study, the attitude of some of the owners of the industries slightly affected collection of data. However, the researcher managed to collect all the required data from other industry owners who were cooperative and understood the research. Time and financial constraints further limited the researcher in her quest to cover all the industries in Mopani District. For this reason, the researcher used purposive sampling to achieve the intended objective of the study.

5.7. Conclusion

The purpose of this study was to investigate the impact of environmental management of the industrial sector on sustainable community development in selected municipalities in Mopani District. From the findings, it is evident that the environmental disasters resulting from local industries is caused by non- compliance and lack of knowledge of legislation related to environmental management.

For industry owners to minimise pollution, they need to comply with environmental legislation. They should also develop correct measures to assist them to curb environmental disasters. To reinforce the above measures, policy makers are also expected to appoint more environmental specialists to monitor and enforce the laws related to environmental management for sustainable community development.

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APPENDIX 1

STRUCTURED QUESTIONNAIRES

Kindly respond to the following statements and indicate your opinion by inserting a tick in the box next to your preferred answer.

1	What is your gender?			Female	Male
		1.Agree	**2. Strongly Agree**	**3.Disagree**	**4. Strongly Disagree**
2	Are members of the community consulted for public participation before commencement of the industry development?				
3	Do subsistence farmers situated next to the industries affected by pollution?				
4	Do government authorities check the quality of water next to the industries before consumption?				

5	Have you ever experienced any form of pollution hazard from your nearest industries?				
6	Did the community experience bad odour emanating from the nearest industries?				
7	Was there any reported form of illness emanating as a result of pollution?				
8	Does the industrial pollution have a negative impact on commercial farming?				
9	Industries that produce more waste have a positive impact on sustainable community development.				
10	Poor environmental management has a negative impact on local economic development.				

APPENDIX 2

SEMI-STRUCTURED INTERVIEWS

4.3.1. Environmental Management and legislations

Are your managers conversant with the legislation that impacts on the environmental management in your industry? If yes/no, how?.....

……..

……..

4.3.2. Environmental management and measures

Do you have measures to curb environmental management anomalies in your industry? If yes, how?.....

……

……

4.3.3. Environmental management and technology

Do you think technology can assist your managers to combat environmental management disasters in your industry? If yes/no, How?.....

……

……

4.3.4. Environmental management and industrial waste.

Does the generation of waste in your industry have a negative impact on the environment? If yes/no, how?……

……

……

4.3.5. Environmental management and strategies.

Do you have strategies that are used by your industry to enhance the environmental management for sustainable community development? If yes/no, how?

…….

……..

……..

APPENDIX 3

LETTER OF PERMISSION TO CONDUCT THE RESEARCH STUDY IN THE MOPANI DISTRICT

Enq: Mamabolo T.M.M.
Tel: 015 290 7159
Cell: 079 527 8329
E-mail: MamaboloTM82@gmail.com
MamaboloTM@ledet.gov.za

The Municipal Manager
Mopani District Municipality
Private Bag X 9677
GIYANI
0826

Dear Sir/Madam

REQUEST LETTER FOR APPROVAL TO CONDUCT A STUDY ON THE IMPACT OF THE ENVIRONMENTAL MANAGEMENT OF INDUSTRIAL SECTOR ON SUSTAINABLE COMMUNITY DEVELOPMENT IN SELECTED MUNICIPALITIES IN THE MOPANI DISTRICT OF THE LIMPOPO PROVINCE

My name is Tebogo Mamabolo and I'm a student at the University of Limpopo, studying for Master of Development. Following the adoption of the Constitution of South Africa, National Environmental Management Act, enacted to give effect to the environmental rights contained in Section 24 of the Constitution, NEMA has introduced a number of additional guiding principles into South African environmental legislations, polluter pays principle/duty of care on any person who may cause significant pollution to institute measures to prevent pollution from occurring or minimise and rectify the pollution where it cannot be avoided.

This letter serves as a communiqué to request approval to conduct a study entitled "The impact of the environmental management of the industrial sector on sustainable community development in selected municipalities in the Mopani District of the Limpopo Province". The study will empower the members of the surrounding community to understand the effects of industrial pollution in the Mopani District, and it will assist the management to develop relevant measures to combat pollution.

It is constitutional to not infringe other people's rights, therefore I will take the following ethics into account:-

- **Ensuring participants have informed consent -** full consent will be obtained from the participants before the study. The researcher will only conduct the research with participants who agree to take part in the study.
- **Ensuring that no participants are exposed to any harm -** I will ensure that no participants are subjected to harm in any way. They will be informed about their safety during the research study.

- **Ensuring confidentiality and anonymity-** the protection of the privacy of participants, adequate level of confidentiality and anonymity must be ensured. Participants will be given a guarantee that their identities will not be revealed when the data is reported in the study.
- **Ensuring honesty and Integrity-** any type of communication in relation the research should be done with honesty and transparency.

I humbly request that you to consider my request as the knowledge gained through the studies will benefit the Province.

Hope you find the above in order

Ms Mamabolo TMM

Date: 08/12/2016

APPENDIX 4

APPROVAL LETTER TO CONDUCT A RESEARCH STUDY IN MOPANI DISTRICT

Office of the Director
Community Services

MOPANI DISTRICT MUNICIPALITY

Government Buildings
Main Road
Private Bag X9687
Giyani
0826

Tel: +27 15 811-6300
Fax: +27 15 812-4301
E-mail: mudaun@mopani.gov.za

Ref : 10/3/2
Enq : Mudau NR

To : Mamabolo TMM
From : Director: Community Services
Date : 09 January 2017

SUBJECT: REQUEST FOR APPROVAL TO CONDUCT A STUDY ON THE IMPACT OF ENVIRONMENTAL MANAGEMENT OF THE INDUSTRIAL SECTOR TOWARDS SUSTAINABLE COMMUNITY DEVELOPMENT IN MOPANI DISTRICT.

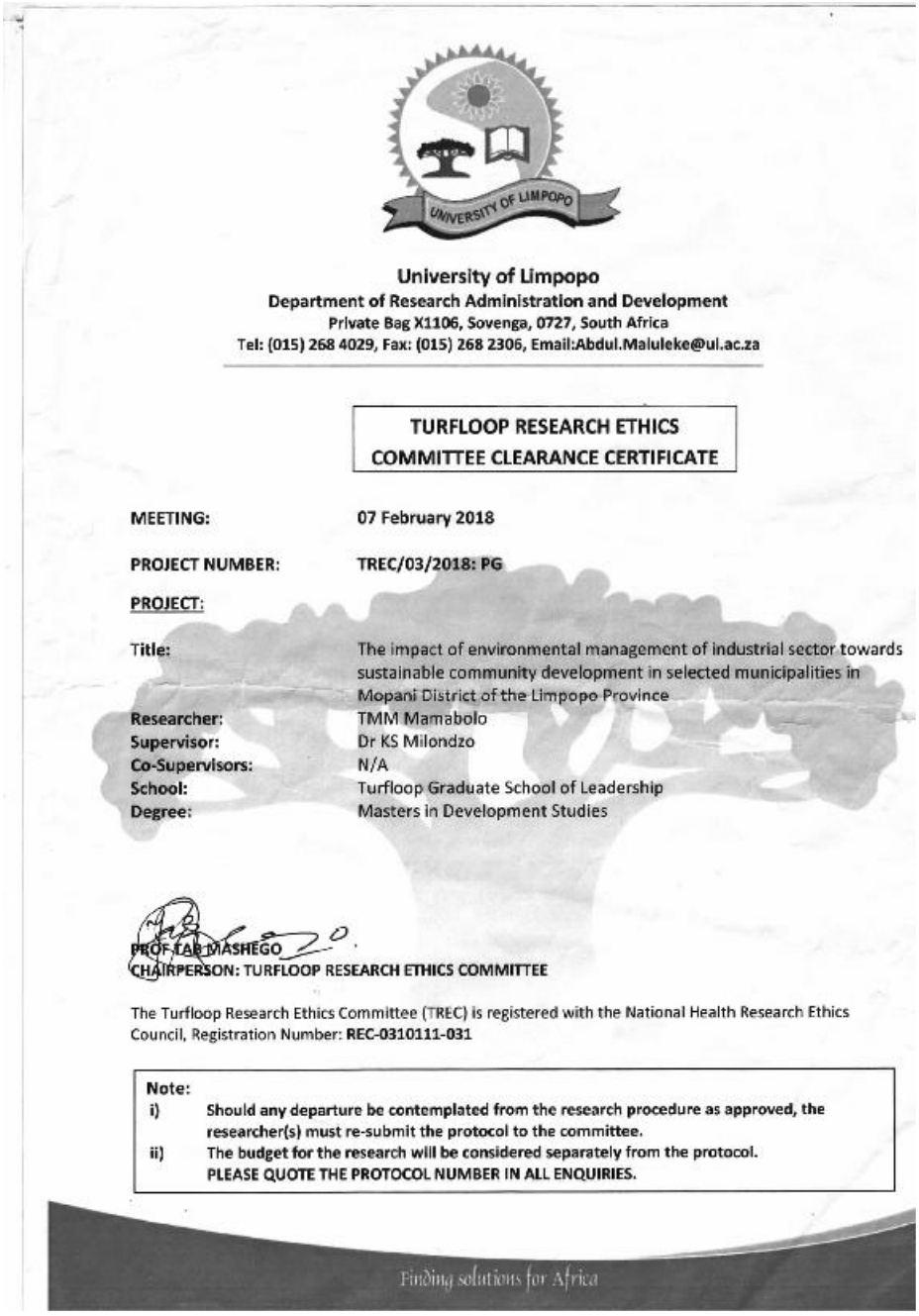
1. The above matter refers,
2. Conducting this kind of study empowers the community in Mopani to have more understanding of Environmental Pollution Impact in relations to Environmental Management and Community Sustainable Development.
3. Therefore, approval is being granted for you to conduct the study as explained in your letter.
4. Hoping that the end results of your study will also be presented to the District Municipality for further use and references.

Regards

Shitlhangu DD
Acting Municipal Manager

APPENDIX 5

TURFLOOP RESEARCH ETHICS COMMITTEE CLEARENCE CERTIFICATE



University of Limpopo
Department of Research Administration and Development
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Tel: (015) 268 4029, Fax: (015) 268 2306, Email:Abdul.Maluleke@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE CLEARANCE CERTIFICATE

MEETING:	07 February 2018
PROJECT NUMBER:	TREC/03/2018: PG
PROJECT:	
Title:	The impact of environmental management of industrial sector towards sustainable community development in selected municipalities in Mopani District of the Limpopo Province
Researcher:	TMM Mamabolo
Supervisor:	Dr KS Milondzo
Co-Supervisors:	N/A
School:	Turfloop Graduate School of Leadership
Degree:	Masters in Development Studies

PROF TAB MASHEGO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: **REC-0310111-031**

Note:
i) **Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.**
ii) **The budget for the research will be considered separately from the protocol.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding solutions for Africa

APPENDIX 6

LETTER FROM THE EDITOR

Sue Matthis B A (Hons) 1 Oden Place Douglasdale, 2191	Cell: 0837817646 e-mail:suematthis@gmail.com

TO WHOM IT MAY CONCERN

This serves as confirmation that I have proofread and language edited the following dissertation:

THE IMPACT OF ENVIRONMENTAL MANAGEMENT OF THE INDUSTRIAL SECTOR ON SUSTAINABLE COMMUNITY DEVELOPMENT IN SELECTED MUNICIPALITIES IN THE MOPANI DISTRICT OF THE LIMPOPO PROVINCE

submitted to me by TEBOGO MARTHA MANNGWADI MAMABOLO

S E Matthis

31 May 2018