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Evaluating the influence of stakeholder participation in the m&e process of green technology projects (A case study of the SANEDI Biogas Digester Projects in South Africa)

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2023
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EVALUATING THE INFLUENCE OF STAKEHOLDER PARTICIPATION IN THE M&E PROCESS OF GREEN TECHNOLOGY PROJECTS

(A case study of the SANEDI Biogas Digester Projects in South Africa)

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Research Report in partial fulfilment of the requirements

Master of Management in Governance

Degree code:	9251
Course code:	PADM7213A
Ethics Clearance Number:	WSG-2021-52

DECLARATION

I, **Linah Ndlovu** (Student No: 462858), declare that this research report is submitted in partial fulfilment of the requirements of the degree of Master of Management in Governance at the University of Witwatersrand Graduate School of Governance, Johannesburg. I declare that this research report is my original work and any material and sources from other researchers that I have used have been referenced and acknowledge. I further declare I have not prior to this submitted this research report for any degree or examination at any other institution or university.



Linah Ndlovu
January 2024

DEDICATION

To my dear husband, Neal, and children, Kundai and Tanaka.
You have always been my pillar of strength.
You encourage me without fail
to always reach for the moon.

To my Lord and Saviour, Jesus Christ –
without whom nothing is possible.

ACKNOWLEDGEMENTS

I would like to thank my supervisor, Dr Caitlin Mapitsa, for all her support. Your knowledge, intellectual guidance, encouragement to always keep going, and patience have had a significant contribution towards this research report.

I greatly appreciate the staff and management of South African National Energy Development Institute (SANEDI), Gauteng Department of Infrastructure Development (GDID), Gauteng Department of Education (GDE) and GDE Schools. The insights and experiences from all participants have provided valuable information and data necessary for the accomplishment of this research report's objectives.

I must sincerely thank my sister, Jane, and entire family for their constant encouragement and unwavering support throughout the ups and downs.

ABSTRACT

Green technology projects have become more recently one of the best alternative strategies for sustainable development against the growing concerns and threats of energy crisis, climate change, population growth and wealth disparity. In the endeavour to fulfil this essence over the past two decades, South Africa has fallen short and demonstrated below average uptake of green technologies compared to other developing countries. Research evidence supports the effective use of participatory M&E of projects and programmes in promoting better project performance, sustenance, and greater adoption of projects.

To explore the influence of stakeholder participation levels on the implementation of green technology projects, a qualitative research approach making use of SANEDI's biogas digester projects as a case study was adopted by this study. Data was collected through semi-structured interviews from eight participants representing internal and external stakeholders. The findings reveal that the level of stakeholder participation in M&E of projects was low to medium amongst external stakeholders during early project stages of inception and planning through to project implementation, monitoring and close out whereas internal stakeholders had high level of participation throughput the project cycle. among internal stakeholders. The low level of participation created downstream challenges in maintaining and operating the biogas digesters, low project acceptance and ownership levels by the community. The study concludes that meaningful stakeholder participation with balanced power dynamics is required throughout the project life cycle. A high level of stakeholder participation amongst internal and external stakeholders in M&E of projects from project inception to closeout allows stakeholders to enjoy decision making benefits that can help create more aligned stakeholder priorities and needs, build better community ownership levels and greater project uptake. The study also concludes that meaningful stakeholder participation supported by the provision and planning of financial resources, training and awareness create an enabling foundation for the sustainable implementation and uptake of green technologies.

Key works: Green Technology Projects, Participatory Monitoring and Evaluation, Stakeholder Participation, Biogas Digesters

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LIST OF ABBREVIATIONS AND ACRONYMS

APP	Annual Performance Plan
ASSAf	Academy of Science of South Africa
BRICS	Brazil, Russia, India, China, and South Africa
CCICED	China Council for International Cooperation on Environment and Development
DMRE	Department of Mineral Resources and Energy
ESTs	Environmentally Sound Technologies
GDE	Gauteng Department of Education
GDID	Gauteng Department of Infrastructure Development
GDP	Gross Domestic Product
IPA	Interpretative Phenomenological Analysis
JET IP	Just Energy Transition Investment Plan
MoA	Memorandum of Agreement
MoU	Memorandum of Understanding
M&E	Monitoring and Evaluation
NGOs	Non-governmental Organisations
PM&E	Participatory Monitoring & Evaluation
R&D	Research & Development
SANEDI	South African National Energy Development Institute
TA	Thematic Analysis
WfE	Working for Energy

CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Introduction and Background

The increasing global social, economic and ecological crises are reshaping the development pathways of the 21st century (Sachs, Kroll, Lafortune, Fuller & Woelm, 2022; Vasenev et al., 2020). Several organisations and research institutions such as the Glasgow Caledonian University ‘s Centre for Climate Justice have expressed concerns regarding the need to address the climate emergency with the similar rapport and urgency as witnessed in the response by world leaders to the novel coronavirus (GCU, 2021).

To mitigate both climate change and environmental damage while at the same time address the global energy and financial crises, governments and stakeholders across the globe have increased their focus and have prioritised green technologies within infrastructure projects (Miranda, Moletta, Pedroso, Pilatti & Picinin, 2021; Gonslaves & Rogerson, 2019; Jang et al., 2018). The technological innovation and implementation of green technologies has globally been recognised as a critical aspect towards supporting a transition towards sustainable development while ensuring economic development (ASSAf, 2014; Shaikh, 2017; Qamar, Ali, Qamar & Noor, 2021).

South Africa has taken several measures to ensure that it is a socially responsible citizen in response to the climate change emergency. Not only does South Africa regularly participate in Earth Summits but since 31 July 2003, South Africa became a signatory of the Kyoto Protocol agreements. The Kyoto Protocol is an international treaty that promotes mitigating climate change and is the United Nation’s 13th sustainable development goal (UN SDG13). Moreover, as a custodian of the adopted Agenda 21 South Africa’s Department of Environmental Affairs and Tourism has committed to minimising negative environmental impacts. This commitment is evident through policies such as the National Strategy for Sustainable Development and Action Plan, the National Environmental Impact Assessment and Management Strategy and the National Climate Change Response policy (Department of Environmental Affairs, 2011). The Government’s commitment also transpires through the current building regulations such

as SANS10400X and SANS 204 which were implemented to promote the shift of South Africa's construction industry towards going green (City of Joburg, 2008; Van Wyk, 2003).

The benefits of increasing the implementation of green technology projects to ensure sustainable infrastructure development are well embraced and valued by the South African Government (UNEP, 2013). Green technology projects are projects which involve the manufacture or utilisation of sustainable technologies that reduce harm to the environment (Bhosale et al., 2020). A wide spectrum of services, systems and products that are sustainable, more environmentally friendly and conserve or efficiently use natural resources across various sectors are recognised as encompassing green technologies by the Academy of Science of South Africa (ASSAf, 2014). Examples of green technology projects within the infrastructure sector include installing biogas digesters and rooftop solar photovoltaic panels as alternative energy sources or installing wastewater recycling and rainwater harvesting tanks in building facilities as water efficiency technologies (Jeffereson et al., 2000; Rathore et al., 2019).

Despite all these abovementioned policies having been implemented over the past two decades, the vision of a sustainable transition through green technologies, innovation and a green economy remains unrealised and sluggish (Gulati, Naude, & Upadhyaya, 2018, Jabeen, Ahmad & Zhang, 2022). A study conducted by ASSAf (2014, p. 21) concluded that generally:

> "the uptake of green technologies in South Africa is below average when compared to other [developing] countries despite South Africa's policy environment being considerably favourable for the adoption of green technologies."

This is also evident through Basabose's (2021) more recent study which looked at energy efficiency in 21 developing countries and found that South Africa was exhibiting a downward trend in renewable energy consumption.

Millstone, Van Zwanenburg and Marshall (2010) and ASSAf (2014) identified that the development and implementation of a monitoring and evaluation (M&E) framework using a consultative process can increase the uptake of green technology projects. Rasila (2018) argues that the implementation of government policies can be improved by

effectively implementing M&E. It is, therefore, evident that the need for and importance of M&E of green technology projects is a recurring theme in literature (CSIR, 2006; Van Wyk, 2015).

Many scholars have, however, highlighted that developing countries face several challenges in implementing M&E (Magagula, 2019). South Africa is one such developing country where challenges across various spheres of government organisations have a wide range. Some scholars argue that the fragmented implementation of M&E renders it ineffective, while other scholars emphasise that M&E is simply an administrative “paper exercise” and yet other scholars reason that M&E implementation challenges stem from the lack of technical capacity, political will, resource allocation and stakeholder participation (Engela & Ajam, 2010; Magagula, 2019; Mthethwa & Jili, 2016; Morkel, 2014; Van Niekerk et al., 2012; Wotela, 2017).

Participation has become the dominant approach for developed and developing countries to ensure that meaningful social changes are also realised with the implementation of development projects and initiatives (Ako, 2017). Sulemana, Musah and Simon (2018) describe how participation is not only a means to enhance the effectiveness of projects, programmes and development initiatives but is also a vital and strategic tool towards long-term sustainability. Evidently, in response to service delivery and M&E challenges, several developing countries have been adopting participatory monitoring and evaluation (PM&E) approaches to monitor and evaluate projects, programmes, or development interventions (Matsiliza, 2012). The value proposition of PM&E approaches is that different stakeholders, especially targeted beneficiaries, are engaged for their participation in the M&E process.

The significance of stakeholder participation in M&E and the need to successfully implement green technology projects, calls for the necessity to determine how the level of stakeholder participation in the M&E process can be improved to positively influence the uptake of green technology projects that are being implemented in South Africa. This study seeks to investigate the level of stakeholder participation in M&E process of green technology projects and its effect on these projects within the South African context.

1.2 Problem statement

Efforts to transition South Africa's economy towards a green economy through the adoption and implement of green technology projects have been underway for the past two decades, however, this vision remains largely unfulfilled (Akinbami, Oke & Bodunrin, 2021; ASSAf, 2014; Basabose 2021; Gulati, Naude, & Upadhyaya, 2018; Miranda et al, 2021).

Several South African studies have focused on the challenges, political interest, drivers and barriers to the adoption, implementation and roll-out of green projects (ASSAf, 2014; Diab, 2015; Montmasson-Clair, Wood., Mudombi & Deonarain, 2018; Montmasson-Clair, 2012; Miranda et al, 2021; Oguntona et al., 2019). Whilst the importance of fostering green economic growth through green technologies and the importance of monitoring and evaluation are recognised through existing South African Government policies such as the Green Technology Implementation Framework and Government-wide monitoring & evaluation (GWM&E) Policy Framework, there is, however, little or no research available on M&E of green technology projects in South Africa especially towards using M&E to inform decision and policy making.

On a global and regional scale, literature has found there is a causal relationship between the incorporation of stakeholder participation and better project performance which subsequently builds consensus among project stakeholders on project goals and promoting sustainability of projects (Estrella & Gaventa, 1997; Kananura et al., 2017; Mthethwa & Jili, 2016; Muli, 2020; Onyango, 2018; Sartorius, 1997). A plethora of literature evaluates many success cases of different PM&E approaches used in projects and programmes that have been used in various countries across the world such as Brazil, Canada, Ghana, Kenya and Uganda (Estrella & Gaventa, 1997; Vernooy, 1999).

Influenced by the literature in recent years which argues for the integration of participation into the GWM&E and the lack of literature on M&E of green technology projects, this research draws inspiration from the studies of Sulemana, Musah and Simon (2018) and Tengan and Aigbavboa (2017) which were performed in the context of Ghana, a country with an existing PM&E approach embedded in current legislation. This study, therefore, investigates the level of stakeholder participation in the M&E process

during the implementation of green technology projects within South Africa. This study seeks to provide valuable insight regarding the levels of participation in the M&E process during the implementation of green technology projects within South Africa with a particular focus on projects by the South African National Energy Development Institute (SANEDI). The value of this study lies in helping South African public agencies, departments and other organisations which implement green technology projects to not only improve their level of stakeholder participation in the M&E process, but to also attain their desired development objectives.

1.3 Purpose Statement

The purpose of this research to explore the level of stakeholder participation in the M&E process during the implementation of green technology projects and its influence on green technology projects in South Africa. This will help contribute towards providing a local context and understanding for public organisations with mandates to implement green technologies on utilising suitable levels of stakeholder participation in M&E process of green technology projects. It will also provide a deepened understanding of how present and future improvements in the levels of stakeholder participation in M&E can affect the implementation and sustainability of green technologies.

1.4 Research Questions

The main research question investigated in this study is:

How, in a South African context, are the levels of stakeholder participation in the M&E process influencing the implementation of green technology projects?

The sub research questions derived from the main research question are:

1. *What levels of stakeholder participation are being employed in the M&E process during the implementation of green technology projects in South Africa?*
2. *What effects have the levels of stakeholder participation in the M&E process had during the implementation of green technology projects in South Africa?*
3. *What recommendations do stakeholders have to deepen and improve their future levels of participation in the M&E process as a means of influencing the future uptake of green technology projects in South Africa?*

1.5 Significance of the Research

Majority of prior studies in relation to studies on stakeholder participation in M&E of projects have been carried out outside of South Africa and have taken a quantitative approach to test several hypotheses (Gaibo & Mbugua, 2019; Kihuha, 2018; Sulemana, Musah & Simon, 2018). These studies have however, not explored and captured the views, experiences, inputs, and knowledge of the stakeholders themselves. This study is therefore unique as it uses a qualitative approach to build onto existing literature on participatory M&E approaches and stakeholder participation. Moreover, this study focuses on the South African narrative.

The importance of this study is to find out how the levels of stakeholder participation in the M&E process during the implementation of green technology projects influences green technology projects in South Africa. This research may form a reference point and fill the knowledge gap on how appropriate levels of stakeholder participation in the M&E process can influence the implementation of green technologies. As this study uses SANEDIs green technology projects as a case study, this research may yield a better understanding of the effect of participatory M&E process on the implementation and sustainability of green technologies. It may also help other institutions which encounter similar challenges or have mandates to implement green technology projects.

1.6 Assumptions Underlying the Study

The study was conducted with the underlying assumption that all the respondents answered all interview questions in a truthful and non-judgemental manner. It has also been assumed that all the respondents had the ability to articulate themselves in answering the presented interview questions.

1.7 Limitations of the Research

Limitations are the shortcomings in the study which may influence how the results and research conclusions are applied and interpreted (Theofanidis & Fountouki, 2018). The responses and information provided by participants may not be completely correct, true, or unbiased because of the research topic nature. The study has however, attempted to overcome this by using code names to maintain anonymity and confidentiality. The study's use of SANEDI's biogas digester projects as a case study, consequently, means that inference is a research limitation because the research finding focused on may not necessarily be applicable or inferable to other government agencies and other provinces in the country.

1.8 Delimitations of the Study

The scope of the study has been limited to the implementation phase of green technology projects by SANEDI in Gauteng Province, South Africa within a five-year period 2016-2020 (inclusive) and further by focusing on biogas digester projects under SANEDI's Working for Energy Programme. Also, the sample population used in the study comprised of internal and external stakeholder participants (programme and project managers, school principals and school staff) that were involved in the M&E process of those projects.

1.9 Structure of the Research

Chapter 1 introduces the research background and sets the scene for understanding the social and environmental factors and policies influencing the need for implementation of green technologies in South Africa. The chapter covers the problem statement and research questions and discusses the significance of the research.

Chapter 2 presents a structured literature review with the aim of enabling the researcher to derive a conceptual framework through which to understand, analyse and synthesise ideas on the existing knowledge relevant to the main research topic.

Chapter 3 lays out the research paradigm and approach adopted by this research. This chapter also presents an explanation on the research population and sample size, research instrument and data collection process that were utilised for this study.

Chapter 4 presents the findings from the research interviews and provides an in-depth analysis of these findings based on the identified themes through the lens of the study's conceptual framework. The levels of stakeholder participation followed by the influence of stakeholder participation on projects and recommendations to improve future uptake of green technology projects are presented and discussed.

Chapter 6 draws conclusions emanating from the research data collected and analysed for the current research study. This chapter also reflects on the limitations, recommendations, and suggestions for possible further research avenues.

1.10 Chapter Conclusion

This chapter introduced the research background for understanding the social and environmental factors and policies influencing the need for implementation of green technologies in South Africa. The chapter also defined the problem statement, research questions and outlined the significance of the research. The assumptions underlying the stud and limitations to the study were also presented.

CHAPTER 2: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

This chapter will synthesise the literature on stakeholder participation in the M&E process during the implementation of green technology projects. The chapter begins by explaining the definition of green technologies, describing how green technologies are classified and then bringing into context the adoption of green technologies. The chapter then follows with an overview of the M&E process for green technology projects. Thereafter, a discussion on the study's conceptual framework which is underpinned by the participatory theory and encompasses the concepts of stakeholders, stakeholder participation types and stakeholder participation levels is presented. The chapter ends with a justification for using SANEDI's projects as a case study for this research.

2.2 What are Green Technologies

Green technologies or green technology is a general term used to refer to the use or application of technologies or technology that are created to be sustainable and environmentally friendly throughout the product's life cycle stages (Qamar et al., 2021). Green technologies encompass several forms of climate change mitigation and environmental remediation technologies (WIPO, 2022). They also play a vital role in realising local and global sustainable development goals towards advancing environmental and social well-being (Söderholm, 2020) and combatting the effects of climate change whilst improving living standards and generating economic development (Guo et al., 2020).

Qamar et al. (2021) reports that the earliest concept related to green technology was environmentally sound technologies (ESTs). ESTs were first proposed in 1992 by the Agenda 21 and referred to total systems which focussed on fostering environmental sustainability (Guo et al., 2020). Braun and Wield (1994) indicate that green technologies were conventionally focused on controlling climate change, pollution control and conserving resources. Over the years, the conventional understanding of green

technology has evolved to focus on holistic sustainable solutions that incorporate the consideration of the environment, economy, and society (Guo et al. 2020).

ASSAf (2014) defines green technologies within the South African context as technologies that are used or can be used to achieve two primary goals. The first goal is curbing the negative effects of human activity on the environment and the conservation of energy and natural resources (ASSAf, 2014). The second goal is addressing socio-economic issues through job creation and enabling a green economy (ASSAf, 2014). Where green economy is an economy that "fosters low-carbon, socially inclusive development and investment in green jobs, green technologies and innovation" (ASSAf, 2014, p 31). ASSAf's (2014) definition of green technology is favoured in this study.

2.3 Classification of Green Technologies

Due to the lack of a universally accepted green technology classification system (Guo et al, 2020), several researchers and organisations have developed a number of classification systems to better identify green technologies (Gubanova, Clasen & Theusen, 2015). Guo et al (2020) developed a three-level green technology classification system for with five major categories which they further classified into thirty secondary categories and eighty-seven tertiary categories. The five major green technology categories according to Guo et al (2020) are resource utilization, energy utilization, ecological safety, life health and environmental quality. Gubanova, Clasen and Theusen (2015) established an eight-category classification system for green technologies comprising of green buildings, water and waste management, energy efficiency, environmental quality/safety, renewable energy, forestry/agriculture, transportation, and eco-tourism. Similarly, WIPO (2022) classified green technologies into seven categories namely building and construction, energy, farming, and forestry, pollution and waster, transportation, water, and projects, materials, and processes.

The study conducted by ASSAf (2014) to assess the state of green technologies in South Africa adopted a sector-based classification system. ASSAf (2014) classified green technologies into eight sector categories, namely, manufacturing, mining, agriculture, information and communications technology, health, transport, and building. More

recently, PAGE (2017) published a report on an overview and inventory of South Africa's green technologies and this report derived the categorisation of green technologies based on the National Strategy for Sustainable Development and Action Plan which outlines eight thematic areas. The eight green technology categories comprise of energy, waste and water agriculture, transport, resource conservation and management and built environment. The eight sector-based classification of green technologies by PAGE (2017) has been adopted in this study because it is based on South African context and more recent. *Table 2.1* below details the sector-based categories of green technology and examples of green technologies applied under the category.

Table 2.1 Sector-based Categories of Green Technology

Sector based Categories of Green Technology	**Examples of Application**
1. Energy	Biogas, solar, wind, waste-to-energy hydro, hydrogen and fuel cells, energy efficiency
2. Transport	Alternative propulsion, fuel efficiency and emissions, non-motorised, public transport, electric vehicles
3. Agriculture	Organic farming, cattle feed innovations, fisheries, forestry
4. Built Environment	Buildings, Integrated planning, materials
5. Resource conservation & management	Infrastructure resilience & ecosystems, offset programme, wildlife management, working for programme
6. Sustainable consumption & production	Production processes, green products, manufacturing, materials
7. Waste	Waste separation at source, Collection, energy, recycling
8. Water	Rainwater harvesting, water efficiency, water treatment using nanotechnology, acid mine water treatment

[Source: PAGE (2017)]

2.4 Adoption of Green Technologies

Several developed countries and some developing countries have increasingly adopted green technologies through the influence of initiatives such as the Paris Agreement (Basabose, 2021; Qamar et al., 2021; Shaikh, 2017). According to the United Nations study published in 2018, green technology world trade increased by almost 60% from 2006 to 2016 (UNEP, 2018). Despite all green technologies categories having excellent potential to significantly contribute towards sustainable development, some categories have seen wider adoption and investment than others (PAGE, 2017). Kenton (2022) identified the energy sector notably being at the frontier of green technology adoption in several countries due to increasing global energy demands and awareness about fossil fuels impacts on climate change.

In 2017, the global cumulative investment in renewable forms of green energy technologies exceeded $200 billion (Basabose, 2021; UNEP, 2018). In 2021, the global cumulative in all renewable forms of green energy technologies exceeded $300 billion (Kenton, 2022). The top five most widely used renewable energy forms are hydropower, wind, solar, bioenergy and geothermal energy (Mantaeva et al, 2021). Hydropower energy accounted for 15.3% of the 2021 global electricity generation capacity and is the most widely used renewable energy (EMBER, 2022). The second largest renewable energy source contributing 6.6% of 2021 global electricity generations is wind energy, followed by solar energy at 3.7%, bioenergy at 2.3% and finally geothermal energy with less than 1% (EMBER, 2022).

In developing countries, whilst most countries face several hurdles such as lack of skills, financing to regulatory frameworks to enable and spur growth in the implementation of green technology projects, there are some pockets of excellence of green technologies that have been successfully implemented (Akinbami et al, 2021; Shaikh, 2017). For example, the Bangladesh Solar Home System (SHS) Program is widely hailed as a flagship example of off-grid electrification (Cabraal, Ward, Bogach & Jain; 2021). The SHS program which now holds title as the world's largest national off-grid electrification program began in 2003 and over a 15-year period allowed about 14% of the Bangladesh's population which equates to about 20 million people to obtain electricity services (Cabraal et al, 2021). Of the beneficiaries in Bangladesh, one quarter of the un-

electrified rural population were able to obtain access to electricity through the program (Cabraal et al, 2021). One of the key lessons identified in planning for this successful program in Bangladesh was monitoring performance and evaluating the impacts on key stakeholders (Cabraal, 2021).

Another example is the biogas sector which has traditionally been dominated by European countries is now seeing an increase of successfully implemented projects in developing countries such as Thailand and Nigeria (Montmasson-Clair et al, 2018; Suwanasri, 2015).

Brazil, Russia, India, China, and South Africa (BRICS) currently form the largest consumption power in the world representing 42% of the world population and 45% of the workforce (Alam & Murad, 2020). According to Miranda et al (2021), BRICS countries have over the last decade had an increase in the adoption of green technology practices. China is currently leading as the world's largest investor in the field (Basabose, 2021; UNEP, 2018). Miranda et al's (2021) study which reviewed green technology practices found that since 2013 despite the increase in the uptake of green technologies in BRICS countries, South Africa had the worst environmental performance and uptake compared to the other countries. Within BRICS, China and India have had the highest uptake of green technologies with a strong focus on green technologies related to products, processes and raw materials, agricultural practices, carbon reduction and energy followed by Brazil, Russia then South Africa (Marinda et al, 2021).

In South Africa, there is a vital role for green technology projects because green technologies not only address sustainable development issues, but also address socio-economic goals such as job creation through a green economy (ASSAf, 2014; Montmasson-Clair et al, 2018). Empirical evidence of green technologies addressing sustainable development whilst creating jobs from another country includes Germany which reported that 370 000 jobs were created through the renewable energy sector after implementing green technology projects (Janicke, 2012). South Africa's efforts to implement green technology projects and transition towards a sustainable green economy have been underway for the past two decades, however, this vision remains largely unfulfilled (Akinbami, 2021; ASSAf, 2014; Basabose 2021; Miranda et al, 2021). A study by Jabeen, Ahmad and Zhang (2022) attributes corrupt political systems, public

knowledge and fixed investments and the three main bottlenecks to South Africa's sluggish adoption of green technologies. Jabeen, Ahmad and Zhang (2022) recommend the use of a bottom-up approach in policy formulation to increase the adoption of green technologies.

It is worth noting that the energy crisis in South Africa has progressively deepened over the more recent years where the country has continued to experience severe and widespread national rolling blackouts of electricity (Cele & Burhardt, 2022). South Africa's state-owned power utility, Eskom, provides 90%of the country's electricity and since 2022 has implemented a record 180-day rotational blackout across the country (Bloomberg, 2023; Gbadamosi, 2023). The power outages have been attributed to continually breakdowns of old and properly maintained infrastructure, vandalism, theft, and diesel shortages (Gbadamosi, 2023). In response to the electricity crises, the South African government approved a U$84 billion Just Energy Transition Investment Plan (JET IP) to accelerate the transition away from coal to renewable energy (Farand, 2023; Presidency SA, 2022). However, the JET IP is a five-year plan that will take time to implement. In the interim, the rolling blackouts are set to continue until an additional 4000MW to 6000MW of generating capacity is added onto the grid (Bloomberg, 2023).

It is widely accepted that the stewardship of the environment is imperative for climate resilience and sustainable development in both developed and developing countries alike (Chapin, Weber, Bennet et al, 2022). It is also accepted that the long-term green technologies can provide sizeable benefits to addressing highly relevant sustainable development issues such as the providing adequate food, fuel, and electricity (Berahab, 2022; Tarp, Gonslaves & Rogerson, 2019; Resnick & Thurlow, 2012).

Green technologies are an emerging sector and their implementation in the infrastructure sector has not been without criticism and challenges. Critics such as Tarp, Resnick and Thurlow (2012) and Berahab (2022) argue that green technologies only provide a win-win scenarios for certain micro-oriented and project-level interventions and not large scale because of the considerable investment costs and trade-offs required against a country's scarce resources and "traditional" development strategy and trajectory. Other critics of green technologies argue that it is merely 'a public relations exercise' and that some

technologies are “greenwashed” without a more holistic perspective being adopted (Chitaka, 2021; Gulati, Naude & Upadhyaya, 2018, p. 9).

Apart from greenwashing, another challenge which the Technical Assistance Unit & Western Cape Government (2013) identified is that there is poor M&E of green technology projects. The study by the Technical Assistance Unit & Western Cape Government (2013) found that one of the common barriers experienced by several provincial departments in raising additional financial resources for the implementation of green technology project was due to difficulties in persuading targeted beneficiaries and external stakeholders. The report attributed this challenge to the lack of data, most notably in the following areas: feasibility of the project, achievement of outcomes and policy imperatives or evaluated impact. According to Rasila (2018) this information can be easily generated from implementing M&E of these projects. Rasila (2018) further asserts that information generated by the M&E process can be further used to inform and drive decisions in green technology implementation and policies.

2.5 The Project Case

Improving the welfare of citizens has been a key agenda for the South African government since the country achieved democracy in 1994. However, despite considerable strides which have been made towards this, the country remains with one of the world’s highest inequality and unemployment rates currently sitting at 33.9% (Stats SA, 2022). In addition to complex social issues and post COVID-19 pandemic economic recovery, South Africa faces persistent energy challenges and widespread national rolling power outages (Berahab, 2022; Heinemann, 2019). The inadequacy of the country’s electricity system’s capacity was evident in early 2008 where electric supply could not be met for local and import demands and the country started experiencing national electricity shortages (Tarp, 2012). With the country’s growing population and a high demand for electricity in both and urban areas – the need for sustainable development and energy is critical to propelling growth, job creation and ultimately improving the welfare South African citizens.

One of the public sector entities which make a significant contribution towards the implementation of green energy technology projects in South Africa is SANEDI. SANEDI is an agency of the Department of Mineral Resources and Energy (DMRE). It is nationally mandated and accountable for undertaking applied energy research, innovation and promoting the uptake of green energy throughout the South African economy. In line with National Priorities to enable the country's socio-economic advancement through the energy sector, SANEDI's mandates includes 'directing, monitoring and conducting energy research and development' (SANEDI, 2021, p. 6). Due to nature of research and development work, SANEDI also works through strategic partnerships with various public and private entities such as universities and the Gauteng Department of Infrastructure Development (GDID) whose mandate is the delivery and maintenance of over 6000 facilities and properties in the Gauteng Province (GDID, 2017).

Since 2013, SANEDI has been promoting and implementing green technologies projects and awareness through the Working for Energy (WfE) programme. The WfE programme has focussed on developing and implementing clean, efficient and renewable energy solutions that can be utilised to benefit rural and low income urban and peri-urban communities (PMG, 2013; SANEDI, 2021). SANEDI's intent to monitor and evaluate green technology projects is evident through one of the key outcomes identified in the SANEDI Annual Performance Plan (APP) as accelerating a shift towards an energy and resource efficient society implementation of green technology projects (SANEDI, 2022).

PAGE (2017) compiled an inventory of South Africa's green technology initiatives and reported that between 2010 to 2016 there were almost 1000 green technologies initiatives were implemented across the eight sectors. According to the report by PAGE (2017), the energy sector was as one of South Africa's key drivers in transitioning towards a green economy through significant investments and adoption of solar and bioenergy.

Furthermore, SANEDI have also partnered with research institutions such as University of Johannesburg through a Memorandum of Agreement (MoA) with the objective to assess the performance and impact of SANEDI's biogas digester programme (SANEDI, 2019). SANEDI has, therefore, been purposefully selected as the project case for this study.

The below section discusses the M&E of green technology projects.

2.6 Monitoring & Evaluation of Green Technologies

M&E is a combination of collecting and analysing data and assessing programme or intervention performance assessment which equip individual users, governments and organisations with abilities to draw causal connections between choice of policy or project priorities, resource allocations and their ultimate impact on civil society (The Presidency, 2007; World Bank, 2014).

The use and expansion of M&E of green technologies was recommended by PAGE (2021) as a vehicle to improve the deployment and adoption of green technologies. Additionally, China Council for International Cooperation on Environment and Development (CCICED) stresses that the M&E of green technology projects is crucial in promoting transparency and preventing the uncoordinated application and scaling of green technologies (CCICED, 2022). The CCICED (2022) also asserts the need to focus on a life-cycle evaluation of green technologies where M&E is implemented before, during and after the commissioning of green technologies to demonstrate the technology's performance, outcomes, and impact. The significance of M&E lies in that it can be used by implementers and decision makers in creating accountability and improving the project's performance and desired results (Harty,2010; Kusek & Rist, 2004; Markiewicz & Patrick, 2015). Furthermore, a study by Jabeen, Ahmad and Zhang (2022) identified a bottom-up approach that involves politicians at the highest level committing to M&E of projects.

Along with other developing countries in the world, the South African government has recognised M&E as a valuable instrument for the public sector which can support evidence-based policy making, management and accountability whilst improving performance and optimizing impact through service delivery (Engela & Ajam, 2010; Mtshali, 2015; Sanganyi, 2016; The Presidency, 2007). The effective implementation of M&E not only allows Government to evaluate its performance but also to identify the factors which contribute to a more effective state service delivery and realisation of service delivery outcomes (The Presidency SA, 2017).

Due to the complexity, skills intensity, multidisciplinary knowledge required across different sectors and intertwined planning, budget and implementation interactions on a government-wide level, the GWM&E Policy Framework was introduced in 2007 as an overarching framework to help guide and embed M&E processes, practices, principles, and standards across the different spheres in government organisations (Magagula, 2019; The Presidency SA, 2017).

The current South African GWM&E framework has however, been criticised by some scholars for following a conventional approach and excluding local stakeholders' inputs in the M&E framework and process (Matsiliza, 2012). Millstone, Van Zwanenburg and Marshall (2010) and Cabraal (2021) both concluded that whilst M&E process can help generate information – the M&E processes need to be developed and implemented through a consultative process with relevant stakeholders to increase the uptake of successful green technology projects.

Conventionally M&E has been expert-driven involving "outside experts coming in to measure performance against pre-set indicators, using standardised procedures and tool" (Velasco, 2006, p. 98). The 'outsider' M&E experts or experts under the field of study also identify and develop the criteria for data gathering methods and stakeholders, including community and protect staff, are engaged through a top-down approach as respondents in questionnaire surveys or testing procedures (Sartorius, 2018; Velasco, 2006).

However, in the more recent years participatory monitoring and evaluation (PM&E) has been rapidly gaining more interest over conventional approaches to M&E (Sulemana, Musah & Simon, 2018; Hilhorst & Guijt, 2006, Estrella et al., 2000). PM&E is a process that actively involves several stakeholders within the problem definition; collection and analysis of data, interpretation; performance monitoring and improvement; and implementation of corrective actions of a project or programme (Coupal, 2001; Engela &Ajam, 2010, Estrella, 2000; Jobes, 1997).

An important building block of PM&E is that it allows stakeholders from the apex to the base of the pyramid with an organisation structure to be involved from the commencement to the conclusion of the process (Mujuru, 2018, p.35). For this reason, Sartorius (1991) and Mtshali (2000) both recognise PM&E as a mechanism to empower and gain knowledge from local people and communities.

Sulemana, Musah and Simon (2018), Coupal (2001) and Collins (1996) identity the three main objectives of PM&E as being:
(1) generating better quality information;
(2) empowering the affected community and
(3) upholding the affected community's decision-making rights.

Consequently, PM&E can be implemented to achieve either all, some or one of these objectives depending on the desired project objectives. Sulemana, Musah and Simon (2018) argue that in order for the PM&E process to yield the desired project objectives, the different stakeholders' groups involved in projects need to be empowered to have full and active participation.

The conceptual framework for this study is discussed in the following section.

2.7 Conceptual Framework

The conceptual framework used in this study is the participation theory. The participation theory encapsulates the concept and relationship between different stakeholder groups, participation typology and levels. This theory is discussed in the section below followed by a diagrammatic representation of the conceptual framework.

2.7.1 Participation Theory

The participation theory addresses empowering the have-not citizens in society through the redistribution of power to have access to resources and control and influence on decisions that affect them. Ako (2017) and Thomas (1994) both ascertain how participation theory allows local communities to be incorporated into development

initiatives rather than be objects of the process. An early proponent of the participatory paradigm in the field of stakeholder participation was Arnstein (1969). Arnstein (1969) developed a participation ladder that recognises that there are different type and degrees of stakeholder participation.

The different stakeholder groups, types and levels of participation are discussed below.

2.7.1.1 Stakeholder Groups

Whilst the 'entity' of a stakeholder can take different forms such as individuals, organisations, or communities, what is common is that the entity has a stated or plausible interest in a particular concern, intervention, project or programme (Mujuru, 2018). Various definitions for the word 'stakeholder' are explored below.

The simplest definition is that of Zimmermann et al. (2007) who defines a stakeholder as the people and organisations that can affect or be affected by a project. On the other hand, Sanganyi (2016) prefers to define stakeholders as the end-users and the parties responsible of a project. In contrast, Davies, Newcomer and Soydan (2006) identify stakeholders as the interested and affected parties including project organisational staff, funders, decision making institutions and organisations, critics, supporters, community members and NGO's. Watt (2014) juxtaposes the other "passive" definitions by describing stakeholders as the individuals active play a role in the project and therefore reap the benefits or suffer the losses from the project. Lastly, Mtshali (2015) portrays stakeholders as the people who implement a programme or intervention, as well as its funders and the beneficiaries of the programme of intervention.

Depending on the extent of engagement and contractual agreement(s) on a project, project stakeholders can be categorised as external or internal stakeholders (Tengan & Aigbavboa, 2017). Internal stakeholders are those entities who form part of the organization that is managing the day-day project operations while external stakeholders are not necessarily involved in the day-to-day operations but are affected by the project (Watt, 2014).

In this study, internal stakeholders are identified as project funders or implementers such as project managers and stakeholder managers whereas external stakeholders are identified as beneficiaries or end-users such as the facility management and staff members.

2.7.1.2 Types of Participation

Participation is the process whereby stakeholders engage in a development process, project, or programme with the goal of using their involvement, control and influence on interventions, projects or programmes that affect them (Cooke & Kothari, 2001; Tikare et al., 2001). Similarly, Sulemana, Musah and Simon (2018) refer to the term 'participation' as the process of actively involving of all stakeholders so that the affected or targeted communities realise the intended benefits of projects and programmes.

There are two main types of participation in M&E, namely, passive perspective participation and proactive perspective participation (Duraiappah et al., 2005). Passive participation is participation that supports better implementation of a project by sourcing information from different stakeholders (Duraiappah et al., 2005). On the contrary, proactive participation is participation that focuses on the enablement and empowerment of stakeholders with lower powers in society (Bakewell et al., 2003; Duraiappah et al., 2005). The latter aims to address societal imbalances by creating a more equitable society in terms of access to resources for all.

2.7.1.3 Levels of Participation

Within the context of each different type of participation, there are various levels of stakeholder participation (Norad, 2013). According to Sulemana, Musah and Simon (2018) there is a nexus between the level of participation, control, and influence in the M&E process. Mujuru (2018) highlights that depending on who is participating, there are different levels of participation and further identifies and defines nine levels of participation. These nine levels of participation have increasing order of participation. The lower levels of participation include giving information or consultation and the higher levels participation include interactive and self-mobilisation/active participation.

Bakewell et al (2003) has categorised the different levels of participation on a four-stage model spectrum which moves from passive participation, increasing involvement, active participation to ownership/empowerment participation. Arnstein‘s model of participation shows different levels of power through a ladder with eight rungs each representing different levels of power and how a higher level of participation affords those without power to contribute their perspectives and influence on programs and interventions (Sulemana, Musah & Simon, 2018).

Concurringly, scholars such as Bass et al (1995) also pointed out that because of the various power relations between stakeholders, there will inherently be different levels of power in the participation process. Earlier studies in this field also concluded that just because stakeholders participate in a development process, it does not take away the fact that there are many forms and interests that participation can take and serve and this does not mean that when participation is shared, power is shared (White et al,1996). This is still relevant today as El Ansari and Phillips (2001) in their study on improving South African healthcare services found that groups of people with low income and education levels, the youth and elderly were excluded from the decision-making process.

Lauria and Slotterback (2020, p.12) explain that one of the core strengths of Arnstein’s ladder of citizen participation is that

> “it has offered a simple yet elegant characterization of the problems and prospects for achieving more meaningful participation of public decisions that affect them”.

Evidently with over 19 000 citations of Arnstien article as of late 2019, many authors over the past 50 years have drawn inspiration from Arnstein’s ladder to tackle participation issues across various field of study across the globe (Lauria & Slotterback, 2020, Neef & Neubert, 2011).

The Civil Society Support Programme (CSSP, 2014) adapted Arnstein’s “ladder of participation” model and categorised the participation levels into five rungs which move from informing, consulting, involving, collaboration to empowering. Similarly, Neef and Neubert (2011) explain that Ashby (1996) also proposed a five-level participative hierarchy stemming from Arstein’s (1969) “ladder of participation” consisting of nominal,

consultative, action-orientated, decision making and collegial participation. The African Development Bank (2001) as cited by Sulemana, Musah and Simon (2018) identify the six progressive stakeholder participation levels as information-sharing, listening and learning, joint-assessment, shared-decision-making, collaboration and empowerment. Mujuru (2018) suggests that a participation continuum which moves from infirming, consultation, partnership and self-management can be used to evaluate whether a stakeholder's participation level is low or high.

2.7.2 Conceptual Framework Model

The *Figure 2.1* below shows the conceptualised framework that was used for this research which has been adapted from literature and previous similar studies (Mujuru, 2018; Neef & Neubert, 2011; Sulemana, Musah & Simon, 2018).

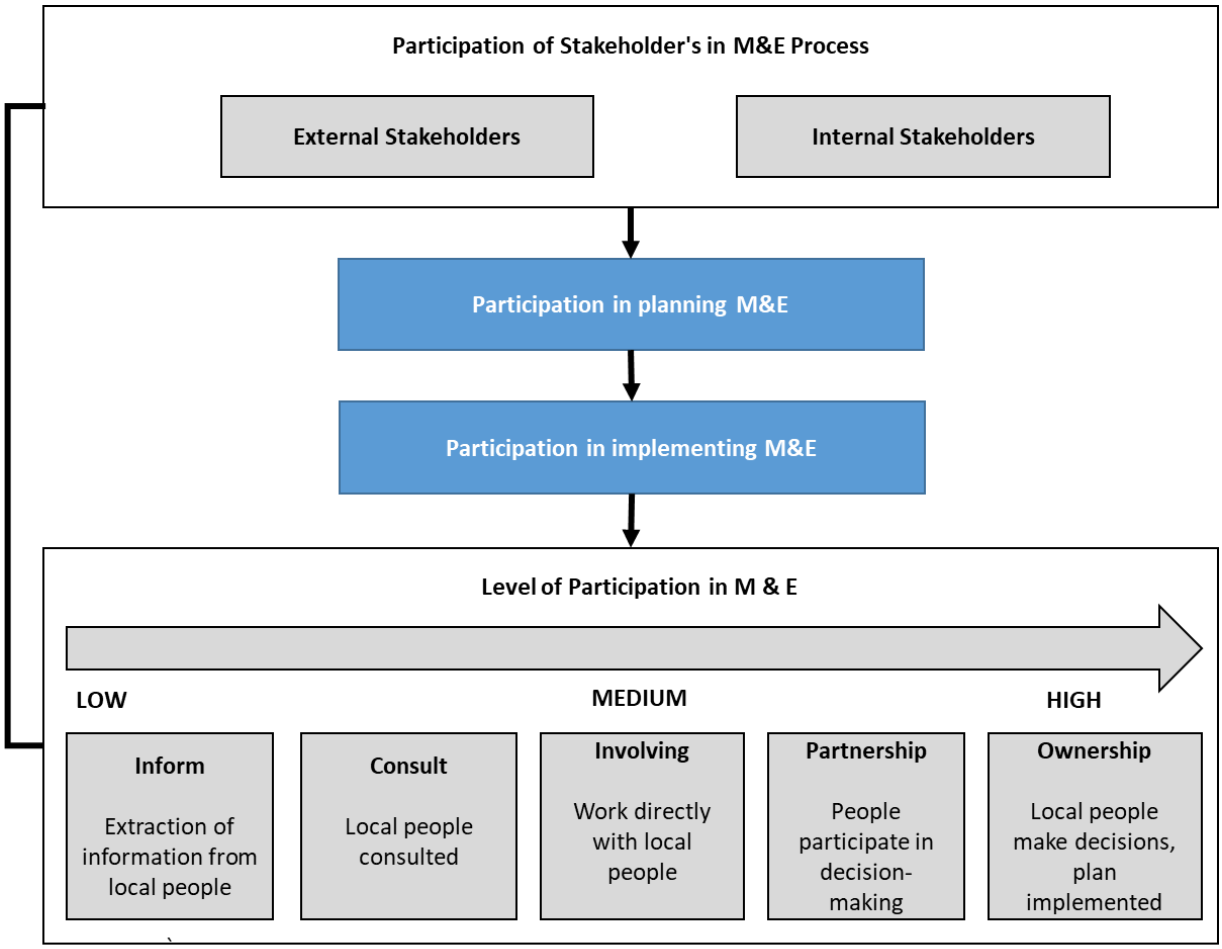


Figure 2.1 The Conceptual Framework of the Study (Source: Researcher's adapted construct, 2023)

This continuum progresses from low to high levels of stakeholder participation. Each participation level contains some form of empowerment and displays the different levels of power sharing between the different stakeholder groups in the project. *Table 2.2* below provides a definition for each level of participation.

Table 2.2 Defining Levels of Participation

Participation Typology	**Description**	**Participation Level**
1. Inform	• Information sharing • Extracting information from external stakeholders • External stakeholders informed about project plans, goals, and outcomes	Low
2. Consult	• Listening and learning • External stakeholders communicate their opinions • External stakeholder needs may be included in the project plan • Project feedback is provided	Low
3. Involve	• Involved in implementing parts of the project • Internal stakeholder work with external stakeholders • External stakeholder expertise/local knowledge recognised	Medium
4. Partnership	• Shared decision-making • Joint assessment and collaboration • External stakeholders take part in decision-making processes in the project	High
5. Ownership	• Empowerment • Internal and external stakeholders have delegated power in the project • External stakeholders are able to make decisions about the project	High

2.8 Chapter Conclusion

This chapter commences with an appraisal of the contextual background by discussing the definition classification of green technologies. Following this, literature reviews the adoption and M&E of green technology projects are presented. Lastly, a systematic analysis and synthesis of literature in the field of participatory paradigm and the related theoretical concepts of stakeholders, participation types and levels that will enable the derivation a conceptual theoretical research framework and answering the research question are also presented.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology that has been utilised in undertaking this research study. The chapter first presents the research paradigm, approach and research instruments followed by a description of the population and sampling approach, data collection and analysis process. In concluding the chapter, a discussion of the research limitations and how reliability, validity and ethical research principles were met and upheld in the current study are presented.

3.2 Research Paradigm, Approach, and Instrument

3.2.1 Research Paradigm

A research paradigm in simple terms is the basic set of beliefs or world view that guides a researcher conducting a research study (Guba & Lincoln, 1982). A paradigm is equivalent to a lens or frame employed by a researcher to reliably process, understand, develop, and obtain further knowledge about a research study (Davies & Fisher, 2018).

This research is instituted on a constructivist paradigm which is centred around the belief that understanding the complex and dynamic world requires one to interpret it by integrating social constructs and human experiences into a study (Braun & Clarke, 2013; Schwant, 1994). This research study adopted a constructivist paradigm because the exploration of the levels of stakeholder participation in the M&E of green technology projects in South Africa requires research participants to share and describe their stakeholder participation experiences within a particular contextual setting. Braun and Clarke (2013) state that research participants each come with their own prior experiences and biases through which they interpret and perceive events, objects, or concepts. Collecting data about the research participants experiences and biases allows for research questions to be answered by the researcher.

3.2.2 Research Approach

Research approaches for collecting, analysing, and interpreting data can be separated into three main categories, namely qualitative, quantitative, and mixed method research (Braun & Clarke, 2013; Neuman, 2014). A quantitative research approach involves numerical data which is collected and analysed to study a particular phenomenon of interest (Punch, 2013). A qualitative research approach involves non-numerical narrative and visual data to study a particular phenomenon of interest (Punch, 2013).

This study collected non-numerical empirical data by way by way of interviews where project stakeholders explained and narrated their experiences and perceptions of the project. The research, therefore, adopted a qualitative approach. A qualitative research approach has the advantage of inherently seeking patterns while still accommodating and exploring the divergence within the data (Braun & Clarke, 2013; Denzin & Lincoln, 2011). This approach was beneficial as it assisted the researcher in being able to create a richer exploration and investigation of the levels of participation of internal and external stakeholders in specific M&E of green technology projects, which is the aim of this study.

Invoking personal experiences, social reality constructs, cultural meanings and contextualisation of the data gathered helps render a high degree of justice to the research study (Mohajan, 2018) and is believed to be best achieved through a qualitative research approach (Braun & Clarke, 2013; Mugenda & Mugenda, 2003; Neuman, 2014). Neuman (2014) contends that a qualitative research approach can be seen as a “data enhancer” which allows for a clearer observation and detection of key aspects of cases under study.

A case study design seeks to comprehend the complex social phenomena of stakeholder participation (Braun & Clarke, 2013; Miles, 2015). This study used a case study because the results from this study could form the foundation for further possible research that expands on the context of stakeholder participation in green technology projects. SANEDI was used as a case study to focus on green technology projects that entailed the installation of biogas digesters under SANEDI’s Working for Energy (WfE)

programme over five years from 2016 to 2020 (inclusive). Under the WfE programme, SANEDI installed over 100 biogas digesters at community centres, early childhood centre schools, schools, university and individual households in Gauteng, Limpopo, Eastern Cape, North-West and KwaZulu-Natal Province (SANEDI, 2021). The five-year timeframe has been selected because it ties in with the period over which SANEDI implemented these projects as part of the WfE programme.

3.2.3 Research Instrument

There are several research instruments in qualitative research which can be utilised for data collection such as interviews, observations, focus groups and document analyses (Mohajan, 2018; Wagner, Kawulich, & Garner, 2012). This study collected data through semi-structured interviews and document analysis. The reason for using both semi-structured interviews and document analysis was to allow for triangulation of the collected data and confirming the convergence of information from research findings and other sources (Carter, 1969; Denzin & Lincoln, 2011).

3.3 Population and Sampling

This study's research population is all the biogas digester installation projects carried out by SANEDI from 2016 to 2020. SANEDI has over this duration installed 350 biogas digesters across the four South African provinces, namely Gauteng, Eastern Cape, North-West and Limpopo (SANEDI, 2022; UJ-PEETS, 2022a). As a result of time, cost and related research constraints, it was not feasible for the researcher to interview all internal and external stakeholders in all 350 biogas digester projects. The researcher, therefore, made use of sampling.

3.3.1 Research Sample

Sampling refers to the selection of a subset of participants or items from a population who are relevant to the research question (Mouton & Marias,1996). In social research, the objective of sampling is to systematically produce a representative selection of

participants or items from “a pre-defined population which can be observed, interviewed or undergo experimentation” directed by the objectives of the research study (Sharma, 2018, p 749).

Purposive sampling involves the logical and non-random selection of participants based on their knowledge on the phenomenon being studied (Bhattacherjee, 2012). Purposive sampling was employed in selecting the research participants. The rationale of purposive sampling for this research study was twofold. Firstly, to allow the researcher to identify specific groups of stakeholders who either possessed the knowledge or first-hand experiences of the circumstances relevant to the phenomenon being studied. Secondly, purposive sampling is a recommended research methodology for studies which employ a case study approach (Leedy & Ormod, 2019; Mays & Pope, 1995).

There are numerous local, provincial, and national government agencies, municipalities, non-governmental organisations (NGOs), research institutions and private organisations which contribute directly and indirectly towards the implementation of green technologies in South Africa (PAGE, 2017). SANEDI was elected by the researcher because of its strategic objective to research and develop suitable models for the South African energy system and its role in supporting and advising on government initiatives regarding energy sector based on the M&E of implemented pilot project and projects (SANEDI, 2015). The purpose of this research study was achieving an in-depth and multi-perspective exploration (Neuman,2014) of the phenomenon stakeholder participation in the M&E process during the implementation of green technology projects. This required focusing in-depth interviews with research respondents to capture and understand their opinions, experiences and thoughts whilst achieving saturation (Sim et al, 2018) as opposed to focusing on the coverage and quantification of data which is important for quantitative research (Punch, 2013).

South Africa currently has approximately 700 anaerobic digesters of various sizes installed across the country and in 2022, SANEDI reported that they had installed about 350 micro-biogas digesters (UJ-PEETS, 2022a; SANEDI, 2022). Out of the 350 micro-

biogas projects, 12 micro-biogas digesters were installed in public institutions in urban settings (UJ-PEETS, 2022a). The qualifying met criteria for this research project was three-fold. Firstly, the project had to have gone through project implementation and project close out phase. Secondly, internal and external stakeholders needed to have participated in the project M&E processes. Thirdly, the project location was limited to Gauteng province because it is South Africa's economic hub, the most populous province in containing 22.4% of the country's population and generates close to 34% of South Africa's gross domestic product (GDP) and 10% of Africa's GDP (Mthombeni, Antwi & Oduniyi, 2022). Since the purpose of this research was to look at the influence of stakeholder participation levels in the M&E process on the uptake of biogas digester green technology, the researcher purposively sampled the optimum number of research participants from the qualifying projects to reach saturation.

Although qualitative research is not prescriptive in nature, there is a plethora of views and discussions on the best possible sample size for qualitative research. The sample size that was used in this research study was guided by a considering (1) methodological consideration rules of thumb from previous studies and (2) numerical guidelines to achieve saturation derived from empirical investigations (Sim et al, 2018):

(1) Research methodology rule of thumb

This study follows a thematic data analysis process and the nature of green technology projects in this research study were small scale. Braun and Clauke (2016) derive that for thematic analysis research for small scale projects, 6-10 interviews with knowledgeable participants are a sufficient sample size to understand the fundamental themes in study of lived experiences.

(2) Numerical guidelines for saturation

Hennink, Kaise and Marconi (2017) conducted a study that examined sample size in relation to saturation, where saturation meant that no additional issues or further

insights are reached. They concluded that 53% of codes are usually identified within the first interview, 91% of codes by the sixth interview and code saturation is normally achieved by the nineth interview. Concurringly Ando, Counsins and Young (2014) found 90% of codes were achieved by the sixth interview and recommended six interviewees as a sufficient sample size when conducting thematic analysis.

Based on the above considerations, the researcher purposively sampled and interviewed eight participants as a sufficient sample size to uncover and understand the fundamental themes of lived experiences for this research study.

3.3.2 Research Participant Profiles

The research participants comprised of a total of eight stakeholders who were involved during M&E process of the biogas digester projects under SANEDI's Working for Energy (WfE) programme. Four participants were internal stakeholders, and the remaining four participants were external stakeholders. An equal number of respondents of external and internal stakeholders was selected to allow for fair representation and for the opinions of one stakeholder type not to outweigh the other. The sample size used in this research study, as discussed in *section 3.3.1* above, has been guided by the methodological consideration that 6-10 interviews with knowledgeable participants constitute a sufficient sample size to understand the fundamental themes in study of lived experiences (Braun & Clarke, 2016) and that saturation would be achieved by the 6th interview (Ando et al, 2014; Sim et al, 2018). *Table 3.1* below provides a breakdown of the participants who were interviewed:

Table 3.1 Breakdown of Research Participants

Stakeholder Type	**Stakeholder Description**	**Number**
Internal Stakeholder	Programme Manager	1
	Stakeholder Manager	1
	Project Manager	2

External Stakeholder	School Principal	1
	Science Teacher	1
	School Caretaker	1
	Kitchen Staff	1
Total		**8**

A project consists of several internal and external stakeholders. The nature of research topic and research question required views, experiences and knowledge from participants who had participated as stakeholders in the project's M&E process. Further details about the above tabled stakeholders are provided below:

3.3.2.1 *Internal Stakeholders*

Internal stakeholders represent participants who were employed by the organisation funding or implementing the project:

(i) **Programme manager**: A programme manager's primary task involves overseeing and managing several projects within a programme (Rowe & Sikes, 2006). Due to the nature of their role and experience, they have knowledge on the programme goals and objectives, M&E targets, project budgets, constraints, and risks.

(ii) **Stakeholder manager**: A stakeholder manager responsibility involves managing any issues between stakeholder parties, meeting with and communicating with stakeholders regarding project goals, progress, and project issues. They are involved in knowing all the relevant stakeholders are and understanding the influences and expectations of different stakeholders (Rowe & Sikes, 2006).

(iii) **Project manager**: A project manager's role involves planning, executing monitoring and closing out projects. Project managers oversee the project implementation, report on project progress, and provide technical support for the project (Rowe & Sikes, 2006).

The contractors who were responsible for constructing the project are also internal stakeholders. They were not included as research participants because their role in the biogas digester projects was limited to the construction activities, and they were not involved in the project's M&E process (SANEDI, 2021).

3.3.2.2 *External Stakeholders*

External stakeholders represent participants who are beneficiaries or end-users of the project.

(i) **School Principal** – The school principal's responsibility includes managing the school and overseeing the high level day-to-day (Department of Education, n.d). The principal has knowledge of the school's expenditure on electricity and gas, budget constraints, internal politics, number of children the feeding scheme provided for etc. They also have the authority to implement projects at the school following approval from the Gauteng Department of Education (GDE) district office.

(ii) **Science Teacher** – A science teacher educates students on scientific phenomena and concepts such as chemical reactions, gasses, energy production, etc as per the school curriculum (Department of Education, n.d). Due to schedule and commitment, the principals of some schools would assign science teachers to be their representative and to champion and run with the biogas project.

(iii) **Caretaker** – School caretakers are responsible for managing and maintaining the school premise, aiding school staff, and locking and unlocking the buildings as and when required (der Westhuizen & Gerhardus, 2022). The caretaker is responsible for using the fertilizer (the solids) from the biobags as compost for the school garden and grass areas and to help support kitchen staff and put feedstock into the digester bag.

(iv) **Kitchen Staff** – The kitchen staff's role was to prepare the meals for learners in the kitchen. They would use either electricity, LPG gas or the biogas in the kitchen for cooking them meals. The kitchen staff was also responsible for chopping the kitchen waste (i.e., potato or cabbage peels) into smaller sizes and feeding it into the biobag (SANDEI-GDID, 2020).

The GDE District office was also an external stakeholder of this project, however they have not been included as participants in this study because they were not involved in the project's M&E process (SANEDI-GDID, 2020).

3.4 Data Collection Process

3.4.1 Primary Data – Online and Face-to-face Interviews

Semi-structured interviews provide a valuable source of information and allow the researcher to retain a more open-minded approach while obtaining rich descriptive data from the research respondents so that new knowledge and concepts can be discovered as opposed to the confirmation of a hypothesis (Bryman, 2012; Mohajan, 2018; Wagner et al., 2012). As a result of this qualitative research approach, the use of semi-structured interviews for the eight participants allowed for open, in-depth discussions with each participant on their understanding and constructs of social reality in relation to stakeholder participation in M&E of green technology projects. The semi-structured interviews allowed for explanations and social realities from the participants to be utilised in exploring the study phenomena as opposed to structured closed-ended interviews with fixed options (Wagner et al., 2012).

The list of interview questions (*see Annexure B*) was developed based on the conceptual framework in *Figure 1* Chapter 2. Six of the interviews were conducted online using Microsoft (MS) Teams and two of the interviews were conducted face-to-face. The choice to utilise online interviews for this study was based on benefits of scheduling flexibility and transport efficiency (Keen, Lomeli-Rodriguez & Joffe, 2022). The face-to-face interviews were used because of participants' data connectivity and Wi-Fi access issues.

The use of the two interview mediums in this research was not an issue as research supports that remote interviewing also offers comparable visual cues and rapport with face-to-face interviews (Deakin & Wakefield, 2013; Keen, Lomeli-Rodriguez & Joffe, 2022; Lathen and Laestadius, 2021; Sullivan, 2012). The searcher also followed the same procedure and research style when conducting both online and face-to-face

interviews. Traditionally, widely cited textbooks and qualitative methodologists have recommended the “gold-standard” face-to-face interviews for qualitative research (Creswell & Poth, 2016; Gillham, 2005; Self, 2021). The corona virus (COVID-19) pandemic required researchers globally to adapt and find innovative methodologies to collect data remotely and this subsequently catalysed a growing and wider use of remote data collection methods such as video-calling in qualitative research (Keen, Lomeli-Rodriguez & Joffe, 2022; Lobe et al, 2020). A recent study by Keen, Lomeli-Rodriguez and Joffe (2022, p. 1) found that virtual data collection methods employed during or because of COVID-19

> “yielded access to underrepresented and marginalised populations and elicited notable rapport and rich data, uniting people in synchronous conversation across many environments”.

They further concluded that COVID-19 pandemic merely accelerated the digitization of qualitative interview processes as our personal and professional are already increasingly digital.

3.4.1.1 Piloting Interview Instruments

Prior to conducting the actual research interviews, two pilot interviews were conducted by the researcher to test the suitability of the interview questions and make improvements on the interview instrument and gain some practice in interviewing (Majid, Othman, Mohamad & Yusof, 2017). The pilot interviews were also intended to strengthen the interview protocol (Castillo-Montoya, 2016), assess any potential practical issues (Van Teijengen & Hundley, 2002) with conducting online interviews and to get familiar with testing and downloading recorded online transcriptions. The two pilot interviews were carried out with one external stakeholder and one internal stakeholder. During the pilot interviews, the respondents were open and conversational and asked further questions on the five descriptor levels of participation which the researcher clarified. Adjustments and improvements were then made to the interview instrument.

3.4.1.2 Conducting interviews

The researcher contacted participants via email and cellular phone to briefly explain the background of the research study and obtain consent from participant to be interviewed for the study. For the online interviews, the researcher the emailed participants the MS Teams link for the online interview and consent form. The interview was recorded using MS Teams and the transcriptions were downloaded once the interview was complete. The researcher provided the participants with hard copy consent forms for the face-to-face interviews. These interviews were recorded on a recorder and transcribed the data afterwards.

Once participants had agreed to be interviewed, an appointment was scheduled at a mutually convenient date and time by the researcher with each participant. All the interviews were conducted in English and there was no need to translate any of the transcriptions. During the commencement of the interviews, the researcher explained the ethical considerations relating to participation and gave a brief background of the research. The researcher also highlighted that the participants responses would be kept confidential and anonymous, and this helped put the participants and ease and helped with the disclosure of information (Mouton & Marais, 1996). The researcher also requested consent from the participants to record interview sessions and recorded the sessions upon consent. Next, the researcher explained the pre-formulated levels of stakeholder participation based on literature as discussed in Chapter 2, *Table 2.2*. The participants were then allowed to answer the questions and speak about their experiences in question (Mouton & Marais, 1996).

3.4.2 Secondary Data – Document Analysis

In order to clarify and substantiate the statements made by participants in the interviews (Glaser & Strauss, 1967), and to build a thorough description of the study documents relating to the implementation of the relevant projects were also reviewed (Esterberg, 2002; Merriam, 2002). *Table 3.2* below provides a list of documents and website links that were reviewed. The documents and website links were reviewed to check and

substantiate whether the information they provided corresponded to the answers and information provided by interview respondents. A project close-out report for the WfE projects was made accessible to the researcher from the respondents upon receiving permission and approval from the organisation.

Table 3.2 List of Documents Analysed

Documents
Sector development plan for the micro-digester sector in South Africa (UJ-PEETS, 2022)
Unlocking the Energy of Micro-digesters in South Africa: Online Expert Dialogue Outcome Report (UJ-PEETS; 2022)
GDID Green Technology Implementation Framework (GDID,2017)
Final Report Assessment of Viability and Implementation Options for Renewable Energy in Rural and Low-Income Urban Areas in South Africa. Working for Energy Programme – SANEDI (2021)
Business Case for SANEDI-GDID Greening Projects (SANEDI-GDID, 2020)
SANEDI Annual Performance Plans 2015-2022
Biogas technology in South Africa, problems, challenges, and solutions (Mukumba, Makaka & Mamphweli, 2016).
An investigation into the optimisation of small-scale anaerobic digestion process systems for rural South Africa (Ogwang, 2020)

3.5 Process of analysis

Data gathered from qualitative research can be analysed through several approaches such as interpretative phenomenological analysis (IPA), grounded theory analysis, thematic analysis (TA) or document analysis (Kawulich & Holland, 2012). TA is the reiterative procedure or process of analysing data by developing thematic patterns (Kawulich & Holland, 2012)

Once the data was transcribed, TA was employed to code specific key concepts, identify, and define the emergent themes from the collected data. TA was applied in this study because it relates well to the study's purpose to explore and understand both the stakeholder's participation level in the M&E of green technology projects and the effect of the stakeholder participation has on projects. TA is also suitable for this study as it assists in bringing across the emergent themes and creating new insightful and rich understandings of stakeholder participation in M&E of projects within the South African society. The TA was influenced by the participatory paradigm and literature review to guide and collate the exploration and rationalisation of the data presentation and interpretation.

3.6 Reliability and Viability

Reliability refers to the degree to which the research method produces dependable and consistent results (Bhattacherjee, 2012). Reliability ensures that an independent researcher who repeats the test or interview is able to yield the same results. Biggam (2011) advises that reliability in a research project can be enhanced by not only undertaking several operational steps but also performing the research as if a third party were observing the researcher over the researcher's shoulder.

Pilot interviews were conducted with two participants to ensure interview questions could be eastly understood to improve interview questions, to test their suitability and to also ensure reliability (Majid et al., 2017). The researcher also maintained consistency by using the interview guide whilst conducting interviews and referring to the theoretical framework whilst analysing and interpreting the research data. Interview recordings from participants who gave permission to record, interview notes and transcripts were be stored on a password encrypted laptop by the researcher.

3.7 Limitations, Feasibility and Positionality

This research focused on stakeholder participation levels in the M&E process during the implementation of green technology projects of the SANEDI within the five-year period 2016-2020 (inclusive) and consequently the findings of this study may not necessarily be applicable or inferable to other government agencies in the Gauteng provinces and other provinces of the country. Inference is therefore a limitation for this research. Inference is therefore a limitation for this research. Furthermore, the small sample size of eight participants means that making generalisation is a limitation of this research. Another limitation is that participants may be biased based on individual perceptions, work experiences or other factors which results in the gathered data having an inherent level of subjectivity (Guest, 2017).

The use of the online platform MS Teams for six of the eight participants allowed the researcher to reduce transportation costs and travel times to interview the participants. However, access to the internal stakeholders was a challenge. Firstly, the schooling calendar cycle affected the availability of external stakeholders and meant that the researcher had to secure interview dates when schools were open and classes where not in progress. Secondly, some of the research participants had no emails and were limited by having no access to mobile data / Wi-Fi connection. Thirdly, the kitchen staff were employed on a limited 6–12-month contract and the kitchen staff who were employed during the time of the biogas digestor project M&E process were no longer working at the school. The researcher overcame these research obstacles by using assistance from the school principal and teachers to locate and access the kitchen staff. These factors significantly increased the data collection period and imposed travel costs on the researcher (Mohajan, 2018).

SANEDI was chosen as a case study for this research because it is an agency of government responsible for supporting and promoting green technology adoption through incubation and research & development (R&D) throughout the country. It also partners with other government institutions with similar mandates in the green agenda or green technology space (SANEDI, 2022). One such institution is GDID. Although, the

researcher was a former employee of GDID which has some projects done in partnership with SANEDI, at no point did the researcher work or was directly involved in the WfE projects or biogas digester projects. Also, the researcher during their tenure at GDID did not hold any position that was senior to the respondents from SANEDI or project managers and stakeholders from GDID. Furthermore, the Memorandum of Understanding (MoU) between SANEDI and GDID is one to bring together funding and resources and mutually foster and promote the incubation and uptake of green technology projects, so there are no power dynamics where one organisation holds a position of power over the other (Ako, 2017). The purpose of this research was also done in the same spirit to be objective, honest and make recommendations that can be used by organisations with similar mandates.

3.8 Ethical Considerations

It is imperative that the conduct of social research upholds the highest standards of ethical conduct to protect the dignity, wellbeing and rights of research participants. Leedy and Ormod (2019) further highlight the importance of research findings to be reported and presented in a complete and truthful manner without misrepresentation or human bias.

Prior to the collection of data, an ethical clearance certificate was obtained by the researcher from the University of Witwatersrand's Ethics Committee of the School of Governance. As explained previously, prior to all interviews, each participant was either emailed or provided with a hard copy of a consent form. The consent forms provided participants with confidence and made them fully aware that they each at any time of the process had the right to withdraw from the study without loss or costs. Participants were also given assurance that the information they provided in the study would only be for academic purposes and would not be exposed or shared with other participants. The researcher ensured anonymity and confidentially of each participant by referring to participants in code names in the research (Roulson & Choi, 2018). Each participant's information has been stored in a password encrypted laptop to ensure the information is safeguarded and privacy is maintained. Furthermore, to maintain their anonymity and

confidentiality all the research participants were given code names. The research data will be kept in a password encrypted laptop until the research report is submitted and approved.

3.9 Chapter Conclusion

This chapter outlined the qualitative research paradigm and approach adopted in carrying out the research study. The choice of using SANEDI's green technology projects implemented over a period of five years between 2016 – 2020 as a case study for this research was also discussed. This chapter also covered the research imperatives such as research instrument, research sample, collection and analysis of data which are in alignment with the overarching research paradigm.

CHAPTER 4: PRESENTATION OF FINDINGS AND DATA ANALYSIS

4.1 Introduction

This chapter presents the collation of data collected from the research respondents followed by a logical and structured analysis and discussion of the themes that were derived from the findings in the preceding chapter, Chapter 3. The collected qualitative data relates to participants' level of participation and how this influenced projects within the context of the M&E process. A total of eight participants were selected through purposive sampling and semi-structured interviews were conducted with these participants. Their confidentiality and anonymity have been preserved by using code names. The analysis is based on the interviews conducted, triangulation of other data sources, literature review and theoretical framework. An analytical thematic approach was adopted as an element of qualitative research. The goal is to gain a thorough understanding of influence of the level of stakeholder participation in the M&E process of SANEDI's biogas digester projects. The chapter then ends with recommendations and conclusions.

4.1.1 List of Respondents

The list of participants who were interviewed and their code names are presented in *Table 4.1* below. During the interviews with the respondents, it was found that saturation was achieved the 6th interview.

Table 4.1 Participants' Code Names

Code Name	**Stakeholder Description**
Respondent 1	Programme Manager
Respondent 2	Stakeholder Manager
Respondent 3	Project Manager
Respondent 4	Project Manager

Respondent 5	School Principal
Respondent 6	Science Teacher
Respondent 7	School Caretaker
Respondent 8	Kitchen Staff

4.2 Discussion and Analysis of Results

The following section discusses the results of the study. Firstly, the levels of stakeholder participation from low, medium to high are analysed. Next the influence of stakeholder participation on projects is discussed and then the recommendations to improve future uptake of green technology projects are presented and analysed.

4.2.1 Levels of Stakeholder Participation

The first sub-research question sought to investigate what levels of stakeholder participation are being employed in the M&E process on green technology projects in SA. The participants' responses are presented below. Respondents provided descriptions and explanations of what and how participation between the different stakeholders occurred throughout the different stages. The participation descriptions were centred around the 5 predefined levels presented in Chapter 2, *Table 2.2* of this study, namely informing, consulting, involvement, partnership, and ownership.

4.2.1.1 Low Stakeholder Participation Levels

Participation through informing and consulting stakeholders is a low level of participation. This form of participation primarily involves sharing information and feedback with external stakeholders and listening, learning, or extracting information from external stakeholders. It is a low level of participation because it is one directional and does not have a pathway for external stakeholders to impact decisions in the project (Yates,

2018). The participants responses when asked about participation through (a) informing and (b) consulting are presented below:

(a) Participation through informing

When asked about their participation through informing *Respondent 1 and 2* explained that during project inception and planning stage, the GDE district offices [external stakeholders] were informed about the biogas digesters. The benefits of using the green technology were explained to the GDE officials and approval was requested from GDE to implement the project at suitable schools.

Respondent 5 and 6 described how they were contacted by a project manager from SANEDI. The manager informed the respondents that the GDE district office had identified their school for a potential biogas digester technology project. Furthermore, there was a meeting request with the school to further explain the project.

Respondent 5 detailed how they remembered "early on there was a meeting [and] the SANEDI officials told [me, the schoolteachers, and the school governing body members] about this biogas technology, they explained how it worked and how it was going to benefit our school by saving us money …. we would use less electricity and LP gas…. During the meeting I asked questions along with some of the teachers and the School Governing Body (SGB) which they answered or said they had noted. It sounded like a win-win situation because they explained [the technology] had worked successfully in other provinces and the school could benefit in using the money saved towards other resources the school needed".

A similar experience was experienced by Respondent 3 who said "I think in the beginning because it's a collaborative programme, we informed the head office Department of Education. Then we informed the school principal in a meeting with his governing body. We also informed the community about the project. As part of the project programme, we needed the local people to form part of the team that builds the biogas – this was low skilled labour, like digging and so forth." Likewise, Respondent 4 mentioned how "the Black Business council was also informed about the project before construction so that there would be no disruptions when the program started, even though it was a small-scale program".

Respondents 7 and 8 said that they were informed about the project by the school principal before the contractor started construction work. They further described that the project implementers [internal stakeholders] came to educate the school

staff about the biogas project. *Respondent 8* said that “they had a workshop where they showed us what to feed the biobag and how to use the biogas”

(b) Participation through consultation

When asked about participation through consultation Respondent 2 explained that the project team from SANEDI and GDID consulted the GDE officials to assist in identifying and preselecting suitable schools where the biogas digester projects could be implemented, however, this occurred following a positive response from the GDE district office officials after they were told about the project.

Respondent 2 further explained that suitable schools were considered as “schools that had a feeding scheme…basically the school had a kitchen where they cooked breakfast and lunch for the school learners”. *Respondent 1* also mentioned how once the GDE district office had granted approval they then engaged with the school staff directly. *Respondent 1* further stated “after the GDE approval we didn’t really engage much with them – we invited them to the meetings, but our focus was the school principal and staff”.

Respondent 3 and 4 responded that the school was consulted about the project and that this was done prior to the project being put out on tender. *Respondent 5* said “I would say we were consulted about the project…not in the very beginning, they engaged us before the project went into construction”.

Respondent 6 also indicated that “they [external stakeholders] collected information from us like how much gas or electricity we were using monthly, what times we cook meals for the learners, what meals we cooked and how many learners we cooked for, and they also asked us what we thought about the biogas”.

It can be gathered from the above responses that both external and internal stakeholders participated in the project through being informed or informing other stakeholders at different stages of the project. It is interesting to note that not only did the internal stakeholders inform external stakeholder [project beneficiaries] about the project, but the school principal also cascaded the project information to the school caretakers and kitchen staff. Consultative participation to a limited extent occurred during the planning stages of the project between internal and external stakeholders to get input and feedback relating to certain aspect of the project.

Since external stakeholders as explained by respondents 4, 5 and 6 were only informed and consulted about the project and did not make any decisions during the project

inception planning stages, this indicates a low level of participation. Most respondents attested that participation through informing and consultation assisted external stakeholders to be aware of the project and understand the benefits and opportunities of using biogas digesters. However, it was evident from the respondents that the participation process had little to no incorporation of input and information from external stakeholders during the project inception and planning phase. Literature indicates that informing and consultation are predominantly top-down participation approaches (Collie et al., 2013).

These findings are consistent with studies by Murdock, Wiessner and Sexton (2005) which found that although most project planning processes involve participation of various stakeholder groups, community stakeholders [external stakeholders] participate predominantly through consultation and often do not have power to make or influence decisions during the project planning processes.

Given that the level of stakeholder participation for external stakeholders at inception and planning stage was low, the effect of this was that there were several failures and challenges in the project. For example, after project was handed over to the schools the biogas digesters would breakdown and not be operational over several periods because of lack of maintenance budget and dedicated labour to operate the technology. The project beneficiaries [external stakeholders] did not take ownership or responsibility for the maintenance and maintenance costs of the project. The lack of ownership and accountability can be attributed to the external stakeholders' level of participation which did not go beyond informing and consultation during the project planning stages. The low level of participation did not enable the opinions and inputs from externals stakeholders on issues such as operational costs and resources to be elicited, discussed, negotiated, or incorporated (Kihua, 2018). Consequently, when project issues occurred, external stakeholders took the back seat with the expectation that internal stakeholders would take responsibility in addressing the problems.

A study conducted by Anderson (2013) found that the exclusion of stakeholders from the inception of a project, leads to downstream challenges experienced on the project. For example, projects fail to achieve their desired objectives; additional project costs are incurred resulting in budget overruns and the implementation of the project experiences

several postponements and interruptions (Anderson, 2013; Khan, 2013). Anderson (2013) also provides an example of a windfarm development project in South Australia that failed and was abandoned because the local community was excluded from participating in project planning stages. Yates (2018) further explains that stakeholder involvement from the project planning stage is crucial because it creates a benchmark proactively identifying many potential problems between the different stakeholders before they can significantly affect the project cost and schedule. This explains why the maintenance costs required for the biogas digesters were not identified or planned for during the planning stages and why the biogas was not kept operational after it was handed over to the schools. These project challenges can be attributed to the low level of external stakeholder participation during the project inception and planning stages.

4.2.1.2 Medium Stakeholder Participation Levels

Participation through involvement represents a medium level of participation. This form of participation includes both external and internal stakeholders being involved in implementing parts of the project. It also entails internal stakeholder working with external stakeholders and the expertise/local knowledge of external stakeholders being recognised. The participants responses when asked about participation through involvement are presented below:

Participation through Involvement

When asked about their participation through involvement *Respondent 6* said they felt “involved in the project because they [stakeholder manager and project manager] worked with us to monitor how the project was doing. They would come and check if the biogas was still working and when the biogas was not working, they would come check what the problem was and help us fix it…we worked together”.

Respondents 5, 6, 7 and 8 all agreed that as local stakeholders they considered themselves involved or “part of the project” because they assisted in collecting data about how the technology was working or not working during the project monitoring phase of the project. *Respondent 6* further emphasised that during the quarterly project meetings, “we would also tell the SANEDI and GDID officials some of the challenges we were facing with the biogas digester.” *Respondent 7* expressed his sense on involvement in the project saying, they were “very very

> involved in the biogas…I would help the kitchen staff to put the feedstock into the digester bag and also use the fertilizer from the biobags for our garden" and lawns".

Overall, most respondents agreed that external stakeholders had an increased level of participation because they were involved and worked together with the internal stakeholders during the project implementation and closeout stages. *Respondent 4* and *5* explained that as external stakeholders they assisted in gathering M&E data and sharing their experiences on the benefits and challenges that arose from using the biogas digesters at the schools. The external stakeholders also said that there was regular communication between stakeholders during monthly progress meetings. This reflects a medium level of participation based on literature.

The influence of stakeholders participating at an involvement level during the project execution, monitoring and close out stages contributed to generating lessons learnt from both internal and external stakeholders involved in the project. The significance of this is that lessons learnt can be used as a tool to improve performance and decision making in the organisation's future in similar projects by other organisations or individuals (Project Management Institute, 2004; Rowe & Sikes, 2006). The consultation and involvement of external stakeholders in the project also improved communication channels between stakeholders. benefited participants by allowing them to gain additional knowledge and skills. The M&E process was evidently well received and embraced by external stakeholders through their active role in the collection of data, sharing of lessons learnt and contribution to the coproduction of knowledge on the use and performance of biogas digesters. There was external stakeholder buy-in for the M&E process, and this can be attributed to the medium level of participation of external stakeholders during the project implementation stages.

A study by Yates (2018) which looked at the dynamics of stakeholder participation in marina spatial planning projects had similar findings. Yates (2018) found that external stakeholders want to see their input used or integrated in the projects to achieve stakeholder buy-in, gain improved understanding and develop a great appreciation of project processes and objectives. Similarly, authors such as Ako (2017), Anderson (2013) and Nutters and Pinto da Silva (2012) also concluded that involving external

stakeholders in the project stages contributes to capacity building and increasing their commitments to the project.

4.2.1.3 High Stakeholder Participation Levels

Participation through partnership and ownership of stakeholders constitutes a high level of participation. This form of participation involves shared decision-making, joint assessment, and collaboration between stakeholders. External stakeholders are empowered to make decisions about the project. Participation through partnership and ownership results in meaningful participation because the beneficiaries actively participate in decisions that affect their lives and how they become subjects of their own development (Ako, 2017). The participants responses when asked about participation through (a) partnership and (b) ownership are presented below:

(a) Participation through Partnership

When asked about participation through partnership *Respondent 3* responded that GDID through its MoA partnered with SANEDI to implement the biogas digester project. SANEDI provided the project funding and GDID had the project managers which had the technical knowledge and experience on delivering and managing green technology projects.

Respondents 1 and 2 said that SANEDI and GDID had a partnership on the project. When both respondents were further asked to describe the participation between the school and SANEDI/GDID, both respondents highlighted that the schools had a dependency on SANEDI and GDID to make the technology work. *Respondent 1* said “in the rural areas where we installed the biogas digesters – they would make it work but with the schools they were dependent on us to make it work”.

There were very few comments from the respondents who were external stakeholders regarding being involved in the project at a partnership level with the internal stakeholders. *Respondents 5* when asked about participating in the project as a partner said, “mmm…the biogas project was a partnership between SANEDI and GDID officials – the school was a beneficiary of the project, it was donated to us”. *Respondent 6* appeared to share the same view as *Respondent 5* as they could not describe the school as a partner but recipient of the project.

(b) Participation through Ownership

When asked about participation through ownership *Respondent 1* believed that the local stakeholders did not own the project because the schools would always call them to come troubleshoot problems and when they came to monitor the project after handover, they would find that the biogas digesters was not working. *Respondent 3* reiterated *Respondent 1's* view that by alluding to the fact that the schools did not take responsibility for the maintenance of the project once it was handed over to them.

Respondent 4 confidently expressed that he felt that the project was owned by SANEDI and GDID because they would go out to troubleshoot issues and get the biobag to be working. According to *Respondent 4*, "the schools saw the biobag as a donation from us - they never really took ownership of it".

Respondent 2 alluded to the project's intention of ownership by the project beneficiary. She remarked that "we intended for the schools to "own the technology after handing it over to them – but it became such a maintenance headache, the schools would keep calling us back."

Respondent 5 said that "well the project was owned by SANEDI because they paid for it…they donated it to the school. They also provided the technical know-how and skills on the technology". Similar responses were also obtained from *Respondents 6 and 7* related project ownership to SANEDI and/or GDID based on their perception of who funded the project.

There was a strong view from the participants relating to partnership between SANEDI and GDID in the project. Both external and internal stakeholders were able to perceive it in one form or the other. The general response from respondents about project ownership was that SANEDI and GDID [internal stakeholders] "owned" the project. According to respondents, internal stakeholders were able to influence and make decisions on the project and they linked this to project ownership which represents a high level of participation. This shows that whilst internal stakeholders had decision making powers from project inception to close out, external stakeholders did not have decision making powers. When the researcher further asked respondents to explain further on reasons why external stakeholders did not have or exercise decision making powers throughout the project cycle, most respondents struggled to identify reasons why whilst

some respondents related decision making to project funding and financing. The researcher believes this could be because of the power dynamics between different stakeholders and because external stakeholders wanted to obtain access to a project that they perceived was beneficial and at no cost to them. Additionally, the project process of participation and power to make and influence decisions was also not mapped out for the project. This explanation is drawn from findings by Inagaki's (2007) study which analysed the power dynamics amongst stakeholders of several projects and concluded that power imbalance exists because of technical backgrounds, social and economic positions. Inagaki (2007) substantiates this with an example of a study on a community-based healthcare service improvement project that was done in South Africa where the elderly, youth and low-income community members were not involved decision making process whilst the academics and elites were involved.

4.2.2 Stakeholder participation influence on projects

The second sub-research question sought to investigate what effects the levels of stakeholder participation in the M&E process have had on green technology projects in South Africa. The respondents described several influences they believed stakeholder participation had on the projects.

4.2.2.1 Lessons Learnt

Respondents provided a wide range of experiences on lessons learnt and knowledge gained from the project. All the respondents said that their participation in monitoring the project contributed to the lessons learnt that were realised and documented about the project. Most of the respondents indicated that they had gained some additional knowledge or skill(s) as a result of their participation in the project monitoring.

> *Respondent 3* made the following remark by saying "we would monitor the project quarterly and also as and when trouble came, because that is where we got the lessons learnt – a lot of the lessons learnt came from that".
>
> *Respondent 7* said "there were mistakes that were made, there were some good solutions we managed to come up with – but all of this builds knowledge about the biogas so that others who want to implement the same technology learn the

mistakes we made". Respondent 8 attested to having gained knowledge by participating in the project.

Respondent 1 commented that one of the lessons learnt on the project was having gas meters installed so that the savings could be quantified as LPG gas or electricity consumption. *Respondent 3* said that "so the reason why the meters were not installed but it was something that was raised after implementation to say we should have put meters to measure and track how much gas is produced and used on a daily basis. So that you are able then to calculate your return on investment when you compare methane gas." *Respondent 6* commented in another way saying that "we did not have gas meters, so we were not able to measure gas produced and consumed. If the targets were set including all stakeholders – maybe this could have been picked up and added then".

4.2.2.2 Communication and Transparency

There was unanimity in the responses that participation of stakeholders was important and had a positive influence on the implementation of the project. All the respondents pointed out that by having both internal and external stakeholders involved in monitoring the project improved communication channels and transparency between stakeholders and this led to better project implementation.

Respondent 6 commented that "the project had challenges yes, but because we communicated with each other and worked together, we managed to get things fixed and the technology working…it was clear to all of us what we were trying to achieve and where we were".

4.2.2.3 Responsibility

The issue of responsibility was consistently mentioned by all the respondents especially after the technology was handed over to the schools. There was unanimity in the responses that when end users have a sense of ownership in the project, they take responsibility of the project and there is improved project performance and better adoption of the technology. Most of the respondents described that once the project was handed over external stakeholders felt that the project and project maintenance was dumped on them to deal with. The respondents attributed this to project beneficiaries not

being consulted early in the project about to influence decisions or give input on project issues such as maintenance and resource allocation.

> *Respondent 3* commented that “it does make a difference whether the school or institution own the technology. If they own the technology, it means they are taking the technology installed as their own and they're taking good care of it and that will ultimately have a positive influence on the project. Other than that, we don't see any changes and project will stall with the smallest challenges. For example, there was a wastewater recycling technology that was installed in primary schools – in one of the schools, we saw the school take ownership of the technology and they are still using that technology until today since 2016. When there are any problems or any challenges the school is experiencing, the principal will contact us and then we'll go there to troubleshoot and then they fix it and continue with the technology. But it depends, there needs to be commitment from the management of the school”.
>
> *Respondent 5* pointed out that the district office was informed and consulted as far as identifying schools for the project. However, beyond that they didn’t make decisions or influence the project. *Respondent 4* further said “I'm not sure if the schools were not motivating the kitchen stuff enough to assist them or because the kitchen staff kept changing because it seemed as if it was an added extra duty to them to prepare the feedstock and use the biogas”.
>
> *Respondent 6* said “the technology was donated to the school; the school did not have to pay for the project – so when the maintenance issues came and needs funds, the school was not prepared for it and the expectation was that SANEDI, GDID or GDE head office had planned for that since they were involved from the very beginning…these issues need to be discussed and agreed upon at the beginning of the project. but I guess during the engagements at the bringing of the project that was not discussed or agreed on.”

4.2.2.4 Stakeholder Needs and Priorities

The project M&E process uncovered the differences in stakeholder priorities and needs on the project. The respondents explained that although there were pre-set targets that were being monitored on the project, it became apparent during the project monitoring that internal and external stakeholders had different priorities and needs. This affected not only the project’s performance but also the way the technology was adopted by the external stakeholders. The most common example highlighted by respondents was the competing needs for maintaining the biogas project against the schools’ need to maintain already existing infrastructure with a limited budget.

Respondent 4 said “the project could have done better in making sure the end users were part of setting some of the project targets. When we started monitoring the project and the technology was not working due to challenges, some of the schools started expressing they had other needs. For example, one school said purified water from the boreholes was a challenge, another said efficient lighting as that didn’t need dedicated labour but still reduced their electricity costs”.

Respondent 3 highlighted that although the M&E targets for the project were set by SANEDI as the project funders, we [GDID] were able to adopt and incorporated them into our green agenda targets. Our targets are not the same as SANEDI but there is a common ground because both organizations have a mandate with towards sustainable development through research and implementation of green technologies. *Respondent 1* also explained that “when project monitoring targets were set – it was decided that the biogas digester had to achieve at least 60% design capacity to be successful”.

4.2.3 Recommendations to improve future uptake of green technology projects

The third sub-research question sought to investigate what recommendations stakeholders have to deepen and improve their future levels of stakeholder participation in the M&E process as a means of influencing the future uptake of green technology projects in South Africa. There were three key recommendations highlighted by respondents to improve the uptake of green technologies. The responses from the respondents are presented and analysed below.

4.2.3.2 Participation and Commitment at Early Stages

Most of the respondents expressed participation and commitment from external stakeholders is needed from the early project stages. The respondents indicated that although the communities and schools were involved and consulted to some extent, this only happened after project planning, so their ability bring in local knowledge and influence changes in the project structured was limited.

Respondent 4 explained said that “the schools and communities were brought into the program at an advanced stage. They didn’t feel fully part of the program. At some schools, they really felt like the technology was just dumped onto them and left like that because also even the women that work in the kitchen, they leave

when their contracts end, and you find that new people now need to manage the system. So, you find that some people like not even interested in feeding the system. They feel like it's extra work and so forth."

Respondent 5 commented that allowing external stakeholders to be involved and provide input early on in the project will make sure that important considerations are taken into account when deciding on how and when to implement projects. Many schools need these technologies and interventions because they solve energy and waste challenges, but the same schools also don't want to end up with maintenance burdens that are unbudgeted for.

Respondent 3 further commented that the GDE district office should have been involved or had a partnership with SANEDI on the project. A partnership between SANEDI and GDE District offices would have created a situation where both parties have a shared interest in the success of the project. In this case GDE district office and the schools were welcoming to the project, however, when the need for financial resources and taking ownership and responsibility came up – they had not prepared for it.

The recommendations from the interviews reveal that meaningful levels of stakeholder participation need to take place throughout the project cycle and not just at a particular project stage. This recommendation is consistent with Rowe and Sikes (2006) which found that the decisions made by stakeholders throughout the project life cycle influences and affects the prioritisation and realisation of project goals and outcomes. Based on the interview responses, the internal stakeholders were not able to identify and incorporate the maintenance budget costs and labour resources into the project planning and this consequently resulted in operational disruptions to the biogas digesters. Other authors such as Reed (2008) have also highlighted that allowing stakeholders to provide their inputs during the project cycle creates a conducive environment for gaining insights of wider social and political views that can impact on the project implementation and adoption.

4.2.3.2 Training and Support

The need to train stakeholders and create awareness amongst project beneficiaries was highlighted as an important factor to facilitate a higher level of stakeholder participation and improve the uptake of green technologies.. Although some respondents gave detailed responses about the training gaps because of the kitchen staff turnover when

labour contracts ended, all respondents commented that structured training and support promotes the effectiveness of the project.

> *Respondent 3* explained that “just before the service provider [contractor] left, there was a training session with the kitchen staff and general workers in the school on how to maintain the program, on how to maintain the technology rather and how to run it on a day-to-day basis and how to troubleshoot. However, those were early days so as much as they went through the training, I would say that they were not fully sure how the systems works until they started using it.
>
> *Respondent 2* recounted that “we did several training sessions throughout the project. Other times we did training after schools experienced problems. For example, the biogas needs water so the kitchen staff would put the kitchen wastewater into the digester as well. This led to problems because the wastewater from the kitchen had detergents which affected the pH and killed good bacteria in the biobag. The staff then showed concern about cooking with bacteria, and we then had to educate them about good and bad bacteria.
>
> *Respondent 8* commented that structured and continuous training would help fill the gaps when people left instead of reactive training after old staff leaves. *Respondent 8* described this by saying that “although people were trained how to feed the biogas, you would find that there were large potato and cabbage chunks being feed and this would block the pipes. People need to be trained and its not a once off. When people leave if you already have structured training, the impact is less”.

Studies conducted by Jabeen, Ahmad and Zhang (2022) and Mukumba, Makaka and Mamphweli (2016) had similar recommendations. Jabeen, Ahmad and Zhang’s (2022) study looked at green energy technologies in South Africa and recommended the need for a bottom-up approach and creation of public awareness through training and upskilling people about green technologies as a means to increase the uptake of green technologies in South Africa. Similarly, Mukumba, Makaka and Mamphweli (2016) also observed that the lack of adequate awareness on biogas resulted in biogas users had strong perceptions that the biogas digesters as research-based projects instead of community-based projects to improve their livelihoods. According to Mukumba, Makaka and Mamphweli (2016) the community also did not feel that the projects were theirs.

4.2.3.3 Dedicated Resources and Maintenance Budget

Most of the respondents recommended the need for assigning dedicated resources in terms of labour and maintenance for operating the technology. According to most of the respondents, the project was dependant on training and utilising the existing kitchen staff and general labour to operate the biogas. Once the project was implemented, the lack of dedicated resources to take responsibility for operating and managing the biogas became a problem. The kitchen staff and general labour would change after their 6-12 month contracts lapsed.

> *Respondent 6* commented "that there was no dedicated person to be responsible for the biogas – it kept shifting between the caretaker and the kitchen staff, and when new kitchen staff was employed the process of informing and training had to start again".
>
> *Respondent 2* commented in another way saying "most of the school principals would come back to us and ask whether we could look at providing incentives for the kitchen staff or employing someone to be responsible for operating the biogas. The principal indicated that it was a headache because the staff saw it as extra work. With dedicate labour and budget to fix things, the schools would be empowered to make the technology work for them, but without these basic things it was a burden".

It is widely accepted that effective asset maintenance is critical for prolonging the useful life and enhancing the performance and reliability of infrastructure and equipment (Davis, 2016; Hastings, 2015). All the respondents acknowledged that maintenance of the biogas digesters had a significant impact on the project's performance. The respondents commented that when maintenance problems came up in the projects, it was not clear who was responsible for them, and this consequently led to lengthy delays in getting the technology working and affected the projects' performance. Internal stakeholders had the assumption or expectation the school was responsible for maintenance. External stakeholders had the assumption or expectation that the project implementers/funders to provide for maintenance, whilst internal stakeholders expected external stakeholders to maintain the technology after handover. The matter of insufficient maintenance budget for schooling infrastructure is reported in various studies (DBE, 2018; Nhlapho, 2020).

Respondent 3 said “we would get calls from the school that there is no gas, one example we found after troubleshooting was that there was a leak in the piping – the issue now came up who must buy the piping? So, if the school was not willing to buy the piping and fix the leak then the biogas digester was just sitting there and not working. After project handover, these problems were quite common amongst the four schools until we got to point where the University of Johannesburg had come in to do a review of the biogas digesters and they got the projects working again”.

Respondent 2 said that “when we were monitoring the biogas projects in the schools, the maintenance became a headache for us. I am not sure you know, but SANEDI has discontinued the biogas projects under the WfE programme”.

Respondent 5 commented “the schools had not budgeted for maintenance of the biogas and neither had the GDE headoffice – so this became a serious challenge because there was no maintenance budget that had been allocated from either side when the project was approved and commission.”

Since most respondents experienced the effect that the lack of funds to address maintenance cost and dedicated labour had on the project, the need for projects to incorporate and negotiate for the provision of financial and labour resources was recommended by both internal and external stakeholders. The need to provision of financial and labour resources to maintain and operate the technology is a recurring theme across several studies (Yates, 2018, Anderson, 2013). An example is the study by Mukumba, Makaka and Mamphweli (2016) which concluded that the determining factor on whether the digester will be fully operational or not relies on the “availability of labour to carry out the daily operation, maintenance, supervision, feeding, storage and disposal of slurry of the biogas digester”. Additionally, Cooke and Kothari (2001) describe how meaningful stakeholder participation and the desired project outcomes and results cannot be achieved without supporting factors such as provision of financial resources, training and external stakeholder buy-in.

4.3 Chapter Conclusion

The findings of the research investigation have been presented, discussed, and analysed in this chapter. The research has been able to establish that external and internal stakeholders had different levels of participation in the M&E process throughout the project life cycle of the SANEDI WfE biogas projects, with internal stakeholders having a

higher and more empowered level of participation. It was also discovered that the lack of dedicated labour resources to operate and take responsibility produces negative stakeholders' perceptions where the technology is viewed as a burden or additional responsibility. Financial resources and maintenance budgets need to be agreed and allocated at project inception stage by all key stakeholders is also crucial in avoiding unintended project challenges during project implementation and handover. Training and support to all stakeholders involved in the M&E process will furthermore bolster the realisation of the project outcomes and impact.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This concluding chapter summarizes the research report. It also presents the conclusions drawn on the main research question based on a combination of literature review, document analysis and the findings from the interviews conducted in this study. The aim of this study was to explore the influence of the level of stakeholder participation in M&E process of SANEDI's biogas digester projects. Based on the study's findings, this chapter additionally presents recommendations on how to improve the uptake of green technology projects and related areas to be considered for future research.

5.2 Summary of the Study

This study explored the influence of the level of stakeholder participation in M&E process of green technology projects through a case study of SANEDI's biogas digester projects. To conduct the study, Chapter 1 introduced the study outlining the background and importance of green technologies in mitigating climate change and environmental damage against the backdrop of increasing global social, economic, energy and ecological crises. South Africa's endeavours over the past two decades to transition towards a green economy through implementing green technologies remains largely unrealised with the country's uptake of green technologies being below average compared to other developing countries. Furthermore, whilst several South African studies have focused on what drives, impedes, and enables the adoption of green technology, there is little or no research available on the influence of the M&E and stakeholder participation in green technology projects to inform decision, policy making and project implementation. To address this knowledge gap, this study therefore, investigated the influence of the level of stakeholder participation in the M&E process on the uptake of green technologies.

Chapter 2 reviewed existing literature on green technology definitions, classification systems and the adoption of green technology in developed countries, developing countries and South African local context. The importance of using the M&E processes

towards supporting evidence-based policy making, management and accountability whilst improving project performance was explained in Chapter 2. In addition, arguments on how the participation of the main stakeholders in the M&E process can increase uptake of green technologies were presented.

Chapter 2 also presented the theoretical framework based on the participation theory and an adaptation of Ashby (1996) and Arstein's (1969) ladder of participation guiding this study. The participation theory in development surmises from the recognition that there is a need for the involvement of all stakeholders in project decision-making and implementation processes so that they can meaningfully benefit from projects. The ladder of participation explains and represents the different levels of participation and power that stakeholders have in the M&E process of projects. Critical to this is the recognition that although stakeholders may participate in the M&E process, they may not share powers on the project. As reflected in Chapter 2 Figure 2.1 and Table 2.2, a low level of participation entails stakeholders being informed and consulted about the project whereas a medium level of participation entails stakeholders being involved in implementing parts of the project and contributing their local knowledge. A high level of participation entails stakeholders collaborating and being empowered to making decisions in the project with delegated powers.

Chapter 3 subsequently outlined the study's adoption of a qualitative research approach making use of SANEDI's biogas digester projects as a case study. The choice of using SANEDI's biogas digester projects as opposed to other implementing agents and category of green technology is also motivated in Chapter 3. Semi-structured interviews were employed to the collection of data from eight research participants representing internal and external stakeholders in the projects through purposive sampling.

Chapter 4 presented the study findings and discusses the related to the levels of stakeholder participation employed during the different project stages based on the participants' interview responses and triangulating secondary data from literature review and documents analysed in Table 3.2, Chapter 3. Chapter 4 also presented the influence of the levels of stakeholder participation on the project, and the recommendations to improve the uptake of green technology projects. A discussion on the emergent themes

of low, medium, and high level of participation influences on the adoption of green projects is also presented in Chapter 4.

5.3 Conclusion of the Study

Several studies conducted in other African countries such as Ghana and Kenya have demonstrated that the effectively employing participatory M&E in projects and programmes promotes better performance, sustainability, and greater adoption of projects (Gaibo & Mbugua, 2019; Kihuha, 2018; Tengan & Aigbavboa, 2017). This study has established that during the inception and planning stages of the project, external stakeholders participated at a low level of participation whereas internal stakeholders had a high level of participation. The internal stakeholders' high level of participation allowed them to make decisions on the project scope, cost, schedule and M&E targets and outcomes. The external stakeholder's low level of participation allowed them to be informed and consulted about the project goals and objectives but excluded them from the project's decision-making process. External stakeholders did not have any decision-making powers. Although the interview respondents were not able to readily identify reasons why the external stakeholders did not make decisions, it can be drawn from other similar studies in other development fields that decision making is linked to power dynamics which are influenced by the various stakeholders financial and social resources and technical backgrounds. The exclusion of external stakeholders from the decision-making process negatively impacted the sustenance of the project because when the project was handed over to the external stakeholders upon project close out, there was poor acceptance of the project by external stakeholders and intermittent provision of trained workers to operate the technology. Evidently, responses from participants indicated that most of the external stakeholders perceived the project as a burden or additional responsibility. This is consistent with studies that also found that the exclusion of stakeholders from the project planning phase leads to misaligned priories, lack of ownership and responsibility amongst stakeholders (Anderson, 2013)

As described by respondents in Chapter 4, external stakeholders were more involved and participated at a medium level whilst internal stakeholders directed the project and

participated at a high level as the projects progressed into implementation, monitoring and close out project stages. A medium level of stakeholder participation during the implementation, monitoring and close out stages of the project enabled external stakeholders to be involved and more active in gathering of the M&E data, providing input on the reporting of project progress and issues, and operating the technology on a day-to-day basis. This level of participation resulted in improved communication channels and transparency between stakeholders, enhanced co-generation of knowledge and lessons learnt between project implementers and beneficiaries that could be used for other projects. As most respondents attested, it also resulted in the training and upskilling of external stakeholders and subsequently creating awareness about the technology.

A medium level of participation conversely resulted in shortcomings on the project sustenance and uptake. Although the external stakeholders' level of participation increased during project implementation from being informed to involvement, external stakeholders still did not enjoy the benefits of making or influencing decisions on the project. Respondents indicated that during the project monitoring stage there would be periods where the biogas digesters would not be in use due to a lack of funds to fix or maintain the technology or continuous availability of dedicated and trained workers to operate the technology. The responses from the participants additionally revealed that there was no provision of maintenance in the project. Consequently, when the biogas digester projects were handed over, there was a lack of willingness by external stakeholders to accept responsibility for the project maintenance and a misalignment of priorities between the internal and external stakeholders. Internal stakeholders regarded maintenance as an integral aspect of using the biogas digesters.

The research findings reveal that by not empowering external stakeholders to participate beyond being informed and consulted about the project creates gaps in identification of project considerations in the planning stage. For example, the schools and district offices investigated as part of this study had not budgeted for project maintenance because it was not identified, discussed and negotiated between internal and external stakeholders at the project inception stage. Some of the participants highlighted that although internal stakeholders had assumed that the schools would maintain their infrastructure, the schools could not absorb additional maintenance costs due to already insufficient maintenance budgets and competing priorities. Consequently, there was a lack of

willingness by external stakeholders to take responsibility for maintaining and providing resources to operate the biogas digesters after the project was handed over. This finding suggests that higher levels of external stakeholder participation at the onset of the project are important because they allow for the consideration of more comprehensive inputs from stakeholders and enable better negotiation and alignment of stakeholder needs, priorities and commitment that benefit the project's performance and sustenance.

The study therefore concludes that when external stakeholders participate at low and tokenistic levels, it creates downstream challenges in developing a sense of responsibility and ownership amongst external stakeholders once projects are handed over. Moreover, passive levels of participation where stakeholders are informed or consulted about projects without being able to influence project plans or decisions can foster misaligned stakeholder needs and priorities. The importance of having meaningful participation of key stakeholders from the onset of the project can be equated to the importance of how the setting of the project targets, goals and objectives at the project inception and planning stages of a project is instrumental in establishing the right foundation towards a successful and sustainable project (Rowe & Sikes, 2006). Similarly, Reed (2008) and Cabraal's (2021) studies concluded that stablishing meaningful stakeholder participation in M&E process from the project onset is crucial towards the attainment of project success and sustainability.

Additionally, the study concludes that stakeholder participation process needs to happen within an enabling environment. The need for maintenance budgets, provision of labour, training and awareness are crucial to ensuring the stakeholder participations yields the desired outcomes and results.

5.4 Recommendations

Upon reviewing the findings and conclusions reached in this study, there is a clear need for external and internal stakeholders to have meaning and empowered participation throughout the entire project life cycle. Rowe and Sikes (2006) highlight that in any project, the decisions made by stakeholders throughout the project life cycle influences and affects the prioritisation and realisation of project goals and outcomes. It is therefore

a recommendation for external and internal stakeholders to participate from the onset of the project at high levels where they are empowered to provide input into the decision-making process of project goals, targets, etc. Furthermore, external and internal stakeholder should both take collaborative ownership or responsibility of the project.

Considering some the project implementation and sustenance challenges highlighted by respondents in Chapter 4, dedicated labour resources which are assigned responsibility for operating and managing the technology should be provided. It is equally important to ensure that the provision of dedicated labour is complimented by a succession plan to ensure continuity of project even after people leave or their contract ends. There is also a need to provide structured training and support programmes for local stakeholders using and operating the green technology. This is reiterated in Ahmad and Wu's (2022) study which investigated the uptake of biogas technology in almost 600 Bangladesh households and concluded that lack of knowledge about biogas, training and access to technical assistance inhibited the uptake of biogas projects. Furthermore, against the backdrop of competing prioritise and limited organisational budgets, it is imperative for a maintenance budget to be negotiated and agreed between stakeholders during the project planning stage and made available for the maintenance of the project.

5.5 Areas of Future Research

The growing global concerns and threats of climate change, population growth, social and energy crises are a few reasons for the increasing efforts by countries to adopt green technologies as an alternative strategy for sustainable development (Basabose, 2021; Qamar et al., 2021; Shaikh, 2017). Understanding the influence of stakeholder participation on the uptake of green technologies is important. The present study only focused on biogas digester projects in schools located in Gauteng, this study could however be replicated in the other provinces in South Africa or across South Africa. WIPO (2022) classifies green technologies in categories of maturity as proven, frontier or horizon green technologies This research can also be expanded by exploring the effects of the availability and maturity of green technologies on the implementation and uptake of green technology projects. Since this study focused on stakeholder participation, a

further study could explore the influence of South Africa's loadshedding crisis on the uptake of green technologies. There is generally little or no research available on M&E of green technology projects in South Africa, therefore future studies could help address this research gap by investigating strategies for implementing effective participatory M&E of green technology projects. Lastly, the awareness of external (local) stakeholders on green technologies and project M&E.

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ANNEXURE A: Participant Consent Form



TITLE OF PROJECT: Evaluating the influence of stakeholder participation in M&E process of green technology projects. (*A case study of the SANEDI Biogas Digester Projects in Gauteng South Africa*)

Name of Researcher: Linah Ndlovu

I …….. agree to participate in this research project. The research has been explained to me and I understand what my participation will involve.

Please tick the relevant option below:

I agree that my participation will remain anonymous	**YES**	**NO**
I agree that the researcher may use anonymous quotes in her research report	**YES**	**NO**
I agree that where I respond in my official capacity my title could be revealed	**YES**	**NO**
I agree that the interview may be audio recorded	**YES**	**NO**
I agree that the information I provide may be used in an anonymized format after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained	**YES**	**NO**

Participant's Name ……

Signature …… **Date** ……..……

ANNEXURE B: Interview Guide/Schedule



INTRODUCTION

- Introduce myself as the researcher
- Explain the purpose of the research and interview
- Explain, as per the consent form, that the interview is voluntary and can be stopped at any point
- Explain that the interview will take no longer than 1 hour and that the responses will be treated with confidentiality and used solely for research purposes

RESEARCH TOPIC

- **Evaluating the influence of stakeholder participation in the M&E process during the implementation of green technology projects** ***(A case study of the SANEDI Biogas Digester Projects in South Africa)***

DATE	
INTERVIEWER	
RESPONDENT NAME	
PERIOD OF INVOLVEMENT IN PROJECTS	
STAKEHOLDER TYPE	Internal ☐ External ☐

RESEARCH QUESTIONS

- Theory stakes that's the levels of stakeholder participation can be described by a five-level hierarchy namely: inform, consult, involve, collaborate, ownership
- Using these five levels of stakeholder participation, I will ask about the level of participation of yourself and other stakeholders that you observed in the beginning, during the project and at the end of the project
- I will also ask, how in hindsight, would have liked to improve any of this

	LEVEL OF PARTICIPATION	
1	INFORM	• How and when were you and other stakeholders informed about the project? How did that affect the project?
2	CONSULT	• How were you and other stakeholders consulted about the project goals, targets and objectives in the beginning, during implementation and/or the end of the project? ○ How did that affect the project?
3	INVOLVEMENT	• How were you and other key stakeholders involved at the beginning, during and end of the project?
4	PARTNERSHIP/ COLLBORATION	• What partnerships or collaborations were in the project? • Who made decisions on the project, and do you feel like your input into the decision-making was considered?
5	OWNERSHIP / EMPOWERMENT	• Who do you feel owned the project in terms of monitoring and evaluating the project?
6	RECOMMENDATIONS TO IMPROVE THE UPTAKE OFGREEN TECHNOLOGY PROJECTS	• What do recommend can be done to increase the uptake of green technology projects, in terms of informing, consulting, involving, collaborating or people owning the project?
7	GENERAL & CLOSING	• Is there anything that you would like to add or questions that you would like to ask at this point? • Thank you for your time to do the interview and thank you for your valuable insights

THE END

ANNEXURE C: Letters of Approval to Conduct Research

ENERGY INNOVATION FOR LIFE
SANEDI, PO Box 9935, Sandton, 2146
A: CEF HOUSE, Block C, Upper Grayston Office Park, 152 Ann Crescent, Strathavon, Sandton, 2146
T: +27 [11] 038 4300 E: information@sanedi.org.za W: www.sanedi.org.za

sanedi
South African National Energy Development Institute

01 February 2022

Ms. Linah Ndlovu
[redacted]

Dear Ms. Ndlovu

RE: Permission Letter to conduct research at SANEDI

Ethical Clearance Number: WSG-2021-52 (University of Witwatersrand)
Institution: South African National Energy Development Institute (SANEDI)

A permission letter is hereby granted for the study *Evaluating the influence of stakeholder participation in M&E process of green technology projects* with A case study of the SANEDI Biogas Digester Projects in South Africa.

All data pertaining to SANEDI will be treated confidentially and you are required to abide by ethical principles at all times. It is your responsibility to seek consent from participants. It is also your responsibility to obtain any relevant authorisation(s) to engage stakeholders outside of the SANEDI organisation who were involved in the project.

Kind regards,

DocuSigned by:
[redacted]
539192F4C1134A6...

Dr. Karen Surridge
Renewables Programme Manager, SANEDI

SANEDI is a state-owned entity, established under the National Energy Act (Act 34 of 2008)
Board Members: Mr Sizalo Xulu (Chairperson), Ms Lungile Mtiya (Deputy Chairperson), Ms Abagail Bolkhuto, Ms Tumelo Mashabela, Ms Ilze Baron, Mr Jongikhaya Witi, Mr Mthokozisi Mpofu. Alternate members: Ms Noma Qase, Mr Gerard Fourie, Ms Olga Chauke
Interim CEO: Ms Lethabo Manamela Company Secretary: Mr. Sihle Mhlangu

GAUTENG PROVINCE
INFRASTRUCTURE DEVELOPMENT
REPUBLIC OF SOUTH AFRICA

01 December 2021

Ms. Linah Ndlovu
[redacted]

Dear Ms. Ndlovu

RE: Permission Letter to conduct research at GDID

Ethical Clearance Number: WSG-2021-52 (University of Witwatersrand)
Institution: Gauteng Department of Infrastructure Development (GDID)

A permission letter is hereby granted for the study *Evaluating the influence of stakeholder participation in M&E process of green technology projects* with A case study of the SANEDI Biogas Digester Projects in South Africa.

All data pertaining to GDID will be treated confidentially and you are required to abide by ethical principles at all times. It is your responsibility to seek consent from participants. It is also your responsibility to obtain any relevant authorisation(s) to engage stakeholders outside of the GDID organisation who were involved in the project.

Kind regards,

Director: Research and Green Technology

Ms. Emmah Mkhatshwa

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	**07 April 2022**
Validity of Research Approval:	**08 February 2022– 30 September 2022** **2022/114**
Name of Researcher:	**Ndovu L.**
Address of Researcher:	[redacted]
	[redacted]
	[redacted]
Telephone Number:	**072 965 4709**
Email address:	**Indlovu91gmail.com**
Research Topic:	**Evaluating the influence of stakeholder participation in M&E process of green technology projects (A case study of the SANEDIs Biogas Digester Projects in South Africa).**
Type of qualification	**Master of Management in Governance (Public Sector Monitoring & Evaluation)**
Number and type of schools:	**3 Primary Schools**
District/s/HO	**Gauteng North, Johannesburg West and Sedibeng West**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

07/04/2022

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below are met. Approval may be withdrawn should any of the conditions listed below be flouted:

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

1. *The letter would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. ***Because of the relaxation of COVID 19 regulations researchers can collect data online, telephonically, physically access schools, or may make arrangements for Zoom with the school Principal. Requests for such arrangements should be submitted to the GDE Education Research and Knowledge Management directorate.***
4. ***The Researchers are advised to wear a mask at all times, Social distance at all times, Provide a vaccination certificate or negative COVID-19 test, not older than 72 hours, and Sanitise frequently.***
5. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s has been granted permission from the Gauteng Department of Education to conduct the research study.*
6. *A letter/document that outlines the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs, and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
7. *The Researcher will make every effort to obtain the goodwill and cooperation of all the GDE officials, principals, and chairpersons of the SGBs, teachers, and learners involved. Persons who offer their cooperation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
8. *Research may only be conducted after school hours so that the normal school program is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
9. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
10. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
11. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
12. *The researcher is responsible for supplying and utilising his/her research resources, such as stationery, photocopies, transport, faxes, and telephones, and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
13. *The names of the GDE officials, schools, principals, parents, teachers, and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
14. *On completion of the study, the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
15. *The researcher may be expected to provide short presentations on the purpose, findings, and recommendations of his/her research to both GDE officials and the schools concerned.*
16. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a summary of the purpose, findings, and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

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Mr. Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 07/04/2022

Making education a societal priority

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ANNEXURE D: Ethics Approval



Research Office:
Ayanda Molefe
Tel: 011 717 3968
Email: ayanda.molefe@wits.ac.za

Research Ethics Chair:
Rekgotsofetse Chikane
Tel: 0117173869
Email: rekgotsofetse.chikane@wits.ac.za

10 November 2021

Dear Linah Ndlovu,

Title: Evaluating the influence of stakeholder participation in the M&E process of green technology projects
Student Number: 462858
Degree: Master in Management in the field of Governance
Ethics Clearance Number: *WSG-2021-52*

All candidates must satisfy the University's ethical standards for research. Your ethics application has been received and reviewed by the Wits School of Governance Human Research Ethics Committee.

Your ethical clearance has been approved subject to you getting permission to conduct research from all sites where research is conducted. The letter(s) of permission to undertake research must be submitted to the WSG Research Office and kept on file with your final proposal and other ethics documents.

You may commence your data collection under the guidance of your supervisor. In the event that the scope, methodology or nature of the research changes, you are required to submit another ethics application reflecting the changes.

The onus is on you as the candidate, with support from your supervisor, to ensure your research complies with university human research ethics policies and protocols at all stages of the research process.

It is recommended that you keep this letter in a safe place as you are responsible for ensuring you have proof of ethics clearance and have lodged the ethics clearance / protocol number with Faculty before final submission of your research report. If you do not have an ethics clearance number, you are not permitted to graduate.

Please do not hesitate to contact me if you have any queries.

Yours sincerely,

Rekgotsofetse Chikane

Rekgotsofetse Chikane
Research Ethics Chair