

**Barriers and opportunities to incremental innovation in the energy  
sector of Eswatini**



**Student name: Bongumenzi Sukati**

**Student Number: 0614510M**

**[0614510m@students.wits.ac.za](mailto:0614510m@students.wits.ac.za) (00268) 7669 6106**

**Supervisor: Dr Ayanda Magida**

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## **ABSTRACT**

The energy sector plays a crucial role in driving economic growth and enhancing innovation. This sector is constantly evolving, developing programs and services that foster innovation. However, in Africa, the energy sector is still in its infancy, facing challenges that hinder development and innovation.

Given this context, this study investigated barriers and drivers of incremental innovation in Eswatini's energy sector. Two key objectives were set: investigating barriers to incremental innovation in Eswatini's energy sector and identifying factors that could drive it.

This study adopted the Technology-Organisational-Environment (TOE) framework as a guiding theory. A qualitative approach was employed to gather insights from 14 professionals purposively sampled from the sector.

The findings of this research revealed that the barriers were primarily due to policy and governance issues, economic constraints, resource limitations, knowledge gaps, and human capital deficiencies. Furthermore, the absence of adaptive decision-making processes leads to ineffective decision-making and delays in the energy sector.

Conversely, factors driving incremental innovation include sustainable finance, education, and global policy alignment. Good governance is a key factor in driving innovation in Eswatini's energy sector by creating a stable environment for business growth and incremental innovation.

It is recommended that policymakers develop a flexible framework capable of adapting to evolving global policy landscapes, incorporating targeted incentives to stimulate investment and promote sustainable practices within the energy sector. This approach would foster incremental innovation, competition, and environmental sustainability.

## DECLARATION

I, Bongumenzi Sukati, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in The field of Energy Leadership at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other University.

Name: Bongumenzi Sukati

Signature:



Signed at Mbabane...Mbabane.....

On the .....31st..... day of .....March..... 2025.

## **DEDICATION**

I dedicate this research to my late mother, Busisiwe Dube, and my siblings for their unwavering support and inspiration. I extend special recognition to Dr. Velibanti Sukati, who recently earned his PhD in Optometry, exemplifying that with determination, nothing is impossible.

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## **LIST OF ACRONYMS and ABBREVIATIONS**

|       |                                              |
|-------|----------------------------------------------|
| 4IR   | Fourth Industrial Revolution                 |
| AU    | African Union                                |
| BERA  | Botswana Energy Regulatory Authority         |
| BOL   | Botswana Oil Limited                         |
| BRET  | Botswana Renewable Energy Technology Project |
| CSR   | Corporate Social Responsibility              |
| CTCN  | Climate Technology Centre and Network        |
| EEC   | Eswatini Electricity Company                 |
| EFI   | Energy Feed-in Tariff                        |
| ENPC  | Eswatini National Petroleum Company          |
| ERS   | Eswatini Revenue Services                    |
| ESERA | Eswatini Regulatory Authority                |
| IoT   | Internet of Things                           |
| IPP   | Independent Power Producer                   |
| IRP   | Integrated Resource Plan                     |
| LCCR  | Low-Carbon, Climate-Resilient                |

|          |                                                           |
|----------|-----------------------------------------------------------|
| LPG      | Liquefied Petroleum Gas                                   |
| MNRE     | Ministry Of Natural Resources                             |
| MSB      | Modified Single Buyer                                     |
| NamPower | Namibia Power Corporation                                 |
| NEI      | Namibia Energy Institute                                  |
| PPP      | Public-Private Partnership                                |
| R&D      | Research and Development                                  |
| REC      | Renewable Energy Credits                                  |
| REEECAP  | Renewable Energy and Efficiency Capacity Building Program |
| REEEI    | Renewable Energy and Efficiency Institute                 |
| RET      | Renewable Energy Technologies                             |
| RPS      | Renewable Portfolio Standard                              |
| SA       | South Africa                                              |
| SACREEE  | SADC Centre for Renewable Energy and Energy Efficiency    |
| SADC     | Southern African Development Community                    |
| SAPP     | Southern African Power Pool                               |
| SDG      | Sustainable Development Goals                             |

|        |                                                       |
|--------|-------------------------------------------------------|
| SME    | Small and Medium Enterprise                           |
| TOE    | Technology-Organisational-Environment                 |
| UNDP   | United Nation Development Programme                   |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USL    | Ubombo Sugar Limited                                  |

# CHAPTER 1. INTRODUCTION

## 1.1 Purpose of the study

This case study explored incremental innovation constraints/barriers in Eswatini's energy sector.

## 1.2 Context of the study

The African continent still needs access to modern forms of energy for socioeconomic development (Agoundedemba, Kim, & Kim, 2023). Most of the population even now relies on non-environmentally friendly energy sources such as charcoal, wood, etc. Energy is significant in the economic growth of a country (Stern, 2019). Currently, the increased energy demand in Africa is achieved with the use of fossil fuels such as coal, natural gas and oil (Agoundedemba, Kim, & Kim, 2023). However, these forms of energy are detrimental to the environment as they contribute to deforestation, pollute the air, affect human lives and contribute to climate change (Stern, 2019).

Therefore, Africa needs to be innovative and find a solution to the increase in energy consumption resulting in energy shortages by finding alternatives to less polluting energy sources. This aligns with a commitment to global policies such as the Paris Agreement, Sustainable Development Goals (SDGs) and the African Union's Agenda 2063. Focusing on **incremental innovation** in the African energy sector presents a viable pathway to enhance sustainability and efficiency. This approach, characterised by low novelty and risk, is particularly suitable for the region grappling with significant energy challenges. Incremental innovation allows for gradual improvements in existing processes and technologies, requiring fewer financial resources and minimising disruptions to the status quo. By realigning policy frameworks to support such

initiatives, Africa can effectively address its energy deficits while fostering economic growth and sustainability.

Africa stands at a critical juncture in its development, particularly in energy access and sustainability. However, the continent faces significant barriers that hinder its ability to align with global policies aimed at mitigating climate change and transitioning to sustainable energy sources (Agoundedemba, Kim, & Kim, 2023). These barriers include insufficient energy infrastructure, financial limitations, and inadequate regulatory frameworks. These challenges not only impede Africa's energy transition but also exacerbate the effects of climate change, highlighting the urgent need for comprehensive solutions (Agoundedemba, Kim, & Kim, 2023).

There are also significant barriers to innovation in the energy sector (Ogbu, Eyo-Udo, Adeyinka, Ozowe, & Ikevuje, 2023). Many African nations lack the technological capabilities and regulatory frameworks necessary to foster advancements in Renewable Energy Technologies (RET) (Agoundedemba, Kim, & Kim, 2023). This stagnation prevents the adoption of more efficient and sustainable energy solutions that could alleviate current challenges.

Innovation barriers are defined as challenges that hinder the achievement of innovation targets, which can significantly affect economic growth and organisational development (Simbaña-Taipe, Villamil-Jaramillo, Taimal-Mendez, & Rodeiro-Pazos, 2021). In Africa, addressing these barriers requires collaborative efforts to diversify energy resources, ensuring energy security for sustainable development. This includes decentralising energy systems, enabling competitive pricing for various energy forms, and prioritising effective policy implementation (Agoundedemba, Kim, & Kim, 2023).

Innovation is a critical driver of economic prosperity and organizational growth. It fosters wealth creation, sustains competitiveness in markets, and serves as a learning process that generates knowledge. Additionally, innovation helps

organisations optimize resources by addressing inefficiencies or ‘bleeding points’ (Onukwulu, Agho, & Eyo-Udo, 2023). According to Hanaysha et al. (2022), innovation not only supports sustainability but also fulfils social needs and promotes economic growth while protecting the environment for future generations.

In agreement, Wikhamn (2019) emphasises that innovation acts as a catalyst for sustainability and economic growth, enhancing service delivery and customer retention. Furthermore, it is linked to Corporate Social Responsibility (CSR) efforts, which are increasingly vital for organisations seeking to align with societal expectations (Wikhamn, 2019). Owolabi et al. (2019) argue that innovation can significantly enhance an industry's size and profitability, while Wipulanusat et al. (2019) highlight its role in adding value to competitive markets and improving service delivery. This is testament to the fact that innovation trickles into all aspects of a country's development, such as economic growth, improved service delivery, improved human livelihoods, contributing to sustainability and social equity.

Innovation is essential for achieving economic and sustainable social development without compromising environmental integrity (Agoundedemba, Kim, & Kim, 2023). It serves as a crucial tool for national prosperity and sustainability (Wipulanusat, Panuwatwanich, Stewart, & Sunkpho, 2019). The global landscape has changed dramatically due to SDGs, climate change challenges, technological advancements, and new socio-economic issues. These factors necessitate innovative solutions that can address current developmental needs while safeguarding future generations (Veiga Ávila, et al., 2019). In the energy sector specifically, innovation is vital for economic growth. It enhances productivity through improved access to energy resources, which are foundational for most economic activities (Stern, 2019). Innovations in processes can reduce costs, increase competitiveness,

eliminate barriers to market entry, attract investments by ensuring returns, and promote overall efficiency (Agoundedemba, Kim, & Kim, 2023).

Breaking down barriers to innovation is important for promoting economic growth and sustainable development in Africa and other places. By focusing on teamwork in energy diversity and creating helpful policies, countries can fully use innovation to boost prosperity while tackling important environmental issues. The connection between innovation and sustainability will be key in shaping the economy of the future and ensuring fair distribution of resources for all generations. The sector also lacks innovative financing mechanisms and incentives that could encourage energy conservation and efficient usage. These shortcomings hinder the potential for innovation in the energy sector, ultimately affecting energy security, environmental sustainability, and equitable access to energy resources.

### **1.2.1 Eswatini Energy sector**

The revised Eswatini National Energy Policy (2018) stipulates that the country's energy sector comprises the electricity and petroleum sectors. The legal framework governing the energy sector in Eswatini is as follows: “

1. Electricity Act 2007
2. Eswatini Electricity Company Act 2007
3. Energy Regulator Act 2007
4. Petroleum Act No. 18 of 2020

The policy aimed at supporting the expansion of the energy sector in Eswatini necessitated regulatory oversight, leading to the establishment of the **Eswatini Energy Regulatory Authority (ESERA)** through the Energy Regulation Act. ESERA's primary mandate is to administer the **Electricity Act of 2007**, which governs the country's electricity supply industry value chain. This regulatory body is responsible for approving tariffs, setting quality standards, and

ensuring reliable service delivery, although it does not extend its regulatory powers to the petroleum sector.

The **Electricity Act** outlines statutory requirements for regulating the electricity value chain and mandates that entities must hold licenses. It also includes a procurement guide to enhance generation, transmission, and distribution capacities. Despite these efforts, the **National Energy Policy (2018)** highlights that Eswatini struggles with energy poverty. Reddy, et al., (2000,p.44) define energy poverty as the "*absence of sufficient choice in accessing adequate, affordable, reliable, quality, safe and environmentally friendly energy services to support economic growth and human development.*" The country's energy sector heavily relies on imports from neighbouring countries to meet its electricity demands.

Historically, the **Eswatini Electricity Company (EEC)** has played a pivotal role in ensuring a stable local electricity supply. Fully owned by the government, EEC operates within a liberalized market framework established by the Electricity Act (2007), Energy Regulatory Authority Act (2007), and Public Enterprise Act (1989). As a vertically integrated entity, EEC is tasked with generating, transmitting, distributing, importing, and exporting electricity while also functioning as both system operator and trader in the electricity market.

According to EEC (2024), Eskom serves as the primary provider of baseload electricity for Eswatini, with Electricidade de Mozambique (EDM) stepping in during rare instances of line faults. The electricity supply to Eswatini is primarily facilitated through a 400 kV transmission line that runs from SA to Mozambique, supplying over two-thirds of the country's electricity from the Camden substation (Eswatini Electricity Company, 2024). The central point for this supply within Eswatini is the Edwaleni Substation, while the remaining electricity is sourced from a 132 kV grid connected to the Normandie

Substation in SA, located in the southern region of Eswatini (Eswatini Electricity Company, 2024).

Due to limited domestic power generation capabilities, Eswatini EEC imports approximately **80%** of its electricity, significantly influencing local tariffs (MNRE, 2018). The existing hydroelectric plants generating approximately 60MW in Eswatini are mainly utilised to meet peak demand periods, where prices tend to spike (Eswatini Electricity Company, 2024). However, the costs associated with these peak imports are not fully recovered because local selling prices remain lower than the import prices (MNRE, 2018). As a result, Eswatini's energy sector faces substantial challenges related to energy security and cost recovery, particularly given that Eskom has increasingly struggled to meet its domestic obligations, leading to power rationing that also affects Eswatini (Eswatini Electricity Company, 2024).

The urgent need for energy security has prompted initiatives to enhance local generation capacity. For instance, a recent development includes the commissioning of a **10 MW** solar plant aimed at increasing renewable energy contributions and reducing reliance on imported fossil fuels (Eswatini Electricity Company, 2024). This project is expected to mitigate costs associated with electricity imports and enhance energy security by diversifying the energy mix within Eswatini. The integration of this renewable project aligns with Sustainable Development Goal 7 (SDG 7), which emphasises affordable and clean energy for all (United Nations, 2024).

Moreover, the EEC's strategic plan highlights the importance of pursuing new generation projects to reduce dependence on external sources and improve self-sufficiency in electricity generation (Eswatini Electricity Company, 2024). Eswatini's reliance on imported electricity poses significant challenges for its energy sector (MNRE, 2018). Recent initiatives to enhance local generation capacity and increase renewable energy utilization represent critical steps

toward achieving greater energy security and sustainability. The ongoing efforts to reform the electricity sector through private sector involvement and investment in renewable resources are essential for addressing the pressing energy needs of the country and ensuring a more resilient energy future (Eswatini Energy Regulatory Authority, 2024).

The Eswatini government has initiated programs aimed at ensuring all its citizens have access to modern energy solutions (MNRE, 2018). These initiatives have successfully increased electricity access rates while reducing reliance on candles, thereby improving public health by minimising exposure to harmful fumes (MNRE, 2018).

Private sector development within electricity generation is hindered by the dominance of established players across various segments of the value chain—namely generation, transmission, distribution, importation, and supply—alongside a lack of transparency regarding cost distribution within this supply chain (MNRE, 2018).

Eswatini's oil industry remains underdeveloped due to the absence of an upstream oil sector; it relies entirely on wholesale importers and distributors for petroleum products (MNRE, 2018). The recently enacted **Petroleum Act No.18 of 2020** seeks to modernise and consolidate the legal framework governing various aspects of this sector, including reconnaissance, exploration, production, refining, storage, wholesale distribution, and retail activities.

Currently, Eswatini cannot store petroleum products for a minimum of 90 days as mandated by government policy (MNRE, 2018). The government established the Eswatini National Petroleum Company (ENPC) under the Petroleum Act No. 18 of 2020 to address this shortfall. ENPC's mission is to ensure fuel supply security by managing midstream and downstream operations while overseeing strategic reserves. This initiative aims to

guarantee fuel availability and promote socio-economic development through infrastructure enhancements and job creation.

The transportation sector is the largest consumer of petroleum products in Eswatini, followed closely by agriculture. MNRE manages regulatory oversight for petroleum products, except for LPG pricing (MNRE, 2018). LPG pricing is not regulated, which results in uncontrollable prices and hinders its adoption to some extent. The Petroleum Act No. 18 of 2020 mandated that the technical regulation of petroleum products be taken over by the energy regulatory authority, ESERA.

The demand for LPG in Eswatini remains relatively low due to several factors, including the widespread availability of electricity as an alternative fuel source and free access to firewood from abundant forests. Several barriers impede LPG adoption in Eswatini, including high initial capital costs associated with LPG infrastructure and issues related to accessibility and affordability.

As a member of the United Nations committed to supporting SDGs, Eswatini aims for a renewable energy mix comprising 50% by 2030. To achieve this target effectively while addressing pollution and climate change challenges, Eswatini must implement robust initiatives that promote pollution reduction in transportation and encourage the adopting of fuel-efficient vehicles while phasing out less efficient models (MNRE, 2018).

### **1.3 Research problem**

The energy sector in Eswatini remains underdeveloped compared to its neighbouring countries (Hastie, 2024). There are a few initiatives to foster competition in the energy market, enhance energy efficiency, and promote renewable energy within the electricity sector. Despite the recent introduction of an energy regulator, ESERA, and the energy policy, the petroleum sector

lacks comprehensive regulation, as certain products, such as Liquefied Petroleum Gas (LPG), are not fully covered (MNRE, 2018).

The energy sector also lacks innovative financial models and incentive programs that could motivate stakeholders to conserve energy and use it more efficiently. Without these mechanisms, there is insufficient encouragement for adopting energy-saving practices, which limits progress towards more sustainable energy consumption. This highlights the need for creative financing and policies that promote energy conservation to achieve better resource management and environmental outcomes (UNDP, 2014).

These shortcomings hinder the potential for innovation in the energy sector, ultimately affecting energy security, environmental sustainability, and equitable access to energy resources. In light of this, there is a need to investigate incremental innovation constraints/barriers in the energy sector and determine factors that drive incremental innovation in the energy sector in Eswatini. Especially since the failure to embrace incremental innovation in any sector further worsens the sector's performance as it limits the major players' ability to grow, reduces profits, decreases opportunities, causes them to lose customers, and leaves the sector behind (von Stamm, 2018).

Current research on barriers and opportunities for incremental innovation in Eswatini's energy sector highlights many challenges and possibilities. Recent studies stress the important role of adaptive regulatory frameworks and innovative financing mechanisms, which are currently missing, limiting market participation and renewable energy adoption (UNDP, 2025). An analysis by Hastie (2024) shows that Eswatini's energy infrastructure is relatively underdeveloped and requires policy reforms and market incentives to support growth. Research on solar PV embedded generation markets points to promising opportunities for distributed renewable energy technologies but also

highlights ongoing regulatory and financial challenges (Business Eswatini, October 2024).

## **1.4 Research objectives**

In pursuit of this study, the following objectives shall be addressed:

- To investigate incremental innovation constraints/barriers in Eswatini's energy sector.
- To determine the factors that could drive incremental innovation in the energy sector of Eswatini.

## **1.5 Significance of the study**

The energy sector is pivotal for global development, acting as a catalyst for sustainable progress and economic growth (Stern, 2019). As highlighted by Strielkowski et al. (2021), the international community faces significant challenges in this sector, including risks that can have far-reaching consequences across various domains. Addressing these challenges is essential, necessitating innovative solutions that can mitigate or eliminate the associated risks, as emphasized by (Gibon, Hertwich, Arvesen, Singh, & Verones, 2017).

This study seeks to enhance the existing literature in the energy sector, particularly focusing on Eswatini and addressing global contexts. The research will identify barriers to incremental innovation and factors that promote it by exploring the operational dynamics and innovative practices within the energy sector. Understanding these elements is crucial for fostering a culture of innovation that can enhance the sector's effectiveness and sustainability.

The significance of this study extends to its potential influence on the legal and regulatory frameworks governing the energy sector. The findings will enable policymakers and regulators to continuously refine these frameworks by providing empirical evidence, ensuring they remain relevant and conducive to sustainability. This is particularly crucial as the energy landscape evolves, necessitating adaptive policies that address emerging challenges and opportunities.

State-Owned Enterprises (SOEs) in the energy sector stand to gain significantly from this research. The information derived from the study will empower these entities to develop innovative business models that promote sustainable practices. In an era where environmental concerns are paramount, SOEs' can leverage this knowledge to align their operations with sustainability goals, enhancing their competitiveness and long-term viability.

Additionally, academia will benefit from this study by understanding the interplay between innovation and energy policy. The findings will contribute to the body of knowledge in energy studies, laying a foundation for further research and discourse on sustainable energy practices. This academic engagement is crucial for nurturing a new generation of scholars and practitioners equipped to tackle the complex challenges facing the energy sector today.

## **1.6 Delimitations of the study**

- The study will only focus on incremental innovation in Eswatini's energy sector.
- Due to time constraints and the nature of the study, as it is an applied research project, the focus will be on the players in the energy sector of Eswatini such as energy regulators, SOE in the energy sector, Independent Power Producers (IPPs') and petroleum companies.

## **1.7 Definition of terms**

Energy security refers to the uninterrupted availability of energy sources needed to sustain livelihoods and socio-economic development (Axon & Darton, 2021). However, the electricity sector has faced significant challenges, including frequent load-shedding, which arises from limited energy resources and the need to prevent nationwide blackouts amid high demand (Eswatini Electricity Company, 2024).

Energy equity refers to the ability of a country to provide affordable, reliable energy for socio-economic development (Kang, 2022). The capital-intensive nature of the energy sector means that its expansion heavily depends on ongoing financial support from multilateral development banks and government initiatives aimed at improving electricity access (Eswatini Electricity Company, 2024). Unfortunately, many residents of Eswatini live below the poverty line, making it difficult for them to afford access to electricity (Dhemba & Nhapi, 2020).

Environmental sustainability refers to measures of the country to reduce pollution from greenhouse gases or transition towards net zero pollution (Kang, 2022). In Eswatini, the reliance on fossil fuel power generation from neighbouring countries, such as South Africa (SA) and Mozambique, has arisen from a lack of energy resources in the electricity sector. This dependence has resulted in base load power being largely controlled by these external suppliers (Eswatini Electricity Company, 2024).

## **1.8 Assumptions**

The assumptions of this research are as follows:

1. The responses from the participants will yield the insights sought by this research.
2. The respondents will be able to answer all the questions and be honest with their responses.

## **1.9 Structure of the report**

The report comprises of the following six chapters:

1. Chapter 1: This chapter provides an overview of the study's purpose and serves as a guide for readers, covering key aspects such as the study's purpose, context of the study, research problem, research objectives, significance of the study delimitations and assumptions.
2. Chapter 2: This chapter provides an in-depth analysis of the existing literature relevant to the study, with a focus on explaining key terms and concepts. Specifically, it explores the critical concepts of barriers and drivers to incremental innovation. Following the comprehensive review of the literature, propositions are formulated as potential responses to the research objectives outlined in Chapter 1.
3. Chapter 3: This chapter outlines the methodological framework employed in this study, detailing the approach used to address the research objectives and analyse the data. The key areas covered include research approach, research design, data collection methods, population and sample selection, research instruments utilised, procedures for data collection, data analysis and interpretation techniques, limitations of the study, and ethical considerations.
4. Chapter 4: This chapter outlines the research findings obtained from data gathered via semi-structured interviews conducted with experts chosen through a purposive sampling strategy. The analytical process commenced with extracting initial codes from interview transcripts, which were subsequently categorized into subthemes and themes.

Ultimately, the relationships between these themes were examined to establish their definitions and classifications.

5. Chapter 5: This chapter discusses the findings of the qualitative study within the context of the literature review conducted in Chapter 2 and further integrates these insights with the results presented in Chapter 4.
6. Chapter 6: This chapter synthesizes the findings from the propositions and aligns them with the original research objectives outlined in Chapter 1.

## CHAPTER 2. LITERATURE REVIEW

### 2.1 Introduction

This section reviews scholarly literature on innovation research and how it has contributed to human prosperity. It is critical because it provides a framework for relating new findings in the discussion section of a research paper (Randolph, 2019). Assessing prior relevant literature is important in creating a firm foundation to improve knowledge in areas where there is a research gap or generation of new and additional knowledge.

### 2.2 Innovation

Innovation is a multifaceted concept that lacks a singular definition, as highlighted by various scholars. According to Veiga Ávila et al. (2019), innovation can be understood as a process that transforms an idea into a service or marketable product, or as an enhancement of existing methodologies aimed at improving services or products. This process is characterized by the necessity for these changes to add value to the system, process, or product involved. In contrast, Chen, Walker, and Sawhney (2020) define innovation more succinctly as the generation and realisation of novel ideas, emphasising the importance of both creativity and implementation in the innovation process. Aslam et al. (2020) expand this notion by describing innovation not only as an outcome but also as an ongoing process and a mindset, indicating that it requires a continuous commitment to change and improvement.

According to Thompson (1965) (as cited in Duan, Cao, & Edwards, 2020, p.676) innovation is defined as *“the generation, acceptance and implementation of new ideas, processes, products or services”*. Innovation can

be classified into four distinct types, namely, incremental innovation, radical innovation, disruptive innovation and architectural innovation (Snihur & Wiklund, 2019). Other types of innovation emanate from a combination or subtypes of the aforementioned types (Ahmadu, 2021).

### **2.2.1 Incremental Innovation**

Incremental innovation is a form of innovation with a low degree of novelty, low risk, and less expensive, it has a minimum possibility for a radical change in firm/organisational performance (Souto, 2015). It is an innovation aimed at improving solutions within a given framework. This type of innovation focuses on the improvement of the organisation's existing concepts, previous processes, products, prevailing production or delivery process, and methods, bringing about a pleasant experience for customers (Zhang, 2022), because of the low degree of novelty.

Furthermore, it focuses on eliminating inefficiencies and enhancing performance through characteristics such as life extension of products, productivity, competitiveness, and cost reduction (Staniškis & Katiliūtė, 2019). Incremental innovation has its downside, and affordability is critical to this approach. An organisation must have the required capital and other necessary resources to resume with incremental innovation. In addition, other limitation factors are ineffective communication, inadequate marketing, and improper planning, which are also of concern (Zhang, 2022).

### **2.2.2 Radical Innovation**

Radical innovation is best defined as significant shifts in technology, processes, products, and services, leading to substantial transformations in current markets and industries, or even the emergence of entirely new ones (Sandberg & Aarikka-Stenroos, 2014). This innovation type allows for the

integration of significantly different core technology and offers considerably greater customer benefits compared to earlier products in the industry (Thijssen, et al., 2023).

Radical innovation presents significant challenges and often necessitates specialized resources. It represents a significant level of uncertainty, instability, and unpredictability and entails considerable risks, typically greater than those associated with incremental innovation. The failure rate of Radical Innovation is enormous due to numerous challenges in their development and commercialization (Thijssen, et al., 2023). Despite these challenges, embracing radical innovations can offer companies enduring competitive advantages (Williams, 2021). By navigating the complexities associated with radical innovation, organizations can position themselves at the forefront of their industries.

### ***2.2.3 Disruptive Innovation***

According to Si and Chen (2020), disruptive innovation is defined as follows: It is an innovation process where technologies, products, or services start off being less advanced than those offered by established companies in areas that mainstream consumers prioritise. However, these innovations can appeal to and meet the needs of consumers in lower-end or emerging markets by providing performance benefits—such as affordability, simplicity, or convenience—that are valued by these consumers but often overlooked by the mainstream market (Nagy, Schuessler, & Dubinsky, 2016).

The theory of disruptive innovation suggests that innovation itself is not disruptive; rather, it disrupts market dynamics through its process (Kumaraswamy, Garud, & Ansari, 2018). According to Si and Chen (2020), this theory can be broken down into two main phases:

1. **Entry Phase:** In this initial stage, disruptive innovations focus on low-end or overlooked markets, targeting consumers who are underserved by existing products. By offering simpler and more affordable solutions, these innovations can capture a portion of the market that established companies often neglect.
2. **Transformation Phase:** After establishing a presence in niche markets, disruptive innovations improve their performance through ongoing technological advancements. This phase involves effective commercialisation and business models that enable these innovations to attract mainstream consumers, ultimately allowing them to compete with incumbents.

This two-phase approach illustrates how disruptive innovations can evolve from niche markets to challenge dominant competitors, significantly altering the competitive landscape over time. Disruption happens when a product's performance in key mainstream attributes reaches an acceptable standard for mainstream customers, while these customers simultaneously start to appreciate new attributes (Si & Chen, 2020). Emphasising that disruptive innovation should be viewed as a process rather than merely an outcome.

#### **2.2.4 Architectural Innovation**

Architectural innovation can be defined as a type of innovation that transforms the overall structure of a product or system while maintaining many of its existing components in a relatively unchanged state (Henderson, 2021), and it refers to the process of redefining how these existing components interact with one another (Albert & Siggelkow, 2022). Architectural innovation occurs when interactions among components change. This type of innovation does not involve creating entirely new components; instead, it focuses on reconfiguring the relationships and arrangements among established elements to enhance functionality or performance (Park, Ro, & Kim, 2018). By altering the

architecture of a product or system, organizations can unlock new possibilities and efficiencies without the need for radical technological advancements (Henderson, 2021).

In essence, architectural innovation is about leveraging existing technologies in novel ways to create improved products or services. This approach can lead to significant market advantages by enabling companies to respond more effectively to consumer demands and shifting market trends while minimising risks associated with developing new technologies from scratch (Albert & Siggelkow, 2022). This method not only fosters efficiency and cost savings but also enables businesses to remain competitive in rapidly evolving markets (Henderson, 2021).

### **2.2.5 Incremental Innovation Choice**

When looking at how radical and incremental innovation work, many people find that incremental innovation is usually better for developing products. This is because big changes, or radical innovations, don't always bring good results. For example, if a product is already popular and has little competition, it might not need major changes. Also, the new technology needed for radical innovations might not be ready yet, making it hard to launch in the market. When a product is doing well and making good money, companies often hesitate to make big changes.

On the other hand, disruptive innovation involves ongoing changes that can shake up existing markets and create new opportunities. This shows that innovation is always evolving, and businesses need to keep adapting. Incremental innovation is often seen as better because it allows companies to improve their current products and services step by step. This approach lowers risks and makes customers happier as they appreciate steady improvements that meet their needs. It also helps build brand loyalty, making it easier for

established companies to manage changes without causing too much disruption.

Incremental innovation is often preferred over architectural innovation because it focuses on continuous improvement with less risk. This type of innovation means making small updates to existing products or services, which helps companies respond better to what customers want. For instance, tech companies often update their software to improve user experience, keeping current customers happy while attracting new ones. The incremental approach reduces the risks that come with big changes by building on what already works instead of trying out something completely new that might not be a success. While architectural innovations can create new business models, they usually need a lot of investment and come with high risks due to their complexity.

In this context, focusing on incremental innovation is a smart choice since it has a lower chance of failure compared to radical approaches. Small changes not only help businesses grow but also address social and environmental issues we face today. By using incremental innovations, organisations can support sustainable development while effectively handling the challenges of modern markets.

This method allows businesses to remain relevant and competitive by continuously refining their offerings in response to evolving consumer needs and market trends. Ultimately, incremental innovation serves as a powerful tool for companies aiming to thrive in an ever-changing landscape while fostering positive societal impact.

## 2.3 Innovation in the Energy Sector

The energy sector plays a crucial role in promoting sustainable development, functioning as a socio-economic system aimed at enhancing livelihoods and fulfilling present needs without jeopardising future generations' well-being (Marti & Puertas, 2022). Central to this concept are the three pillars of the World Energy Trilemma Index: **Energy Security**, **Energy Equity**, and **Environmental Sustainability** (Marti & Puertas, 2022).

Energy security encompasses the availability of primary energy sources, including electricity as a secondary source derived from various primary inputs. The electricity sector is increasingly scrutinised due to its significant contribution to pollution and greenhouse gas emissions, particularly as energy-intensive activities shift towards greater reliance on electricity (Chalvatzis & Rubel, 2015). To address this challenge, initiatives aimed at reducing carbon intensity are being implemented. These include substituting or eliminating certain fuel types, introducing carbon capture and storage technologies, improving efficiency, and promoting renewable energy policies (Chalvatzis & Rubel, 2015). Such measures not only aim to decrease primary energy demand but also enhance energy security by making energy costs more attractive through lower tariffs (Rhodes, Skea, & Hannon, 2014). The tariff structure in the energy sector reflects production costs and other value chain activities; thus, reductions in specific components can lead to overall price decrease, enhancing affordability (Freier & von Loessl, 2022).

Environmental sustainability is paramount, and there are laws enacted to protect against environmental degradation and for climate purposes (Fleming, 2021). The release of pollutants into the atmosphere has dire global health implications, contributing to numerous deaths (Fuller, et al., 2022). Transitioning to renewable energy sources is a critical strategy for mitigating these effects (Oduro, Uzougbo, & Ugwu, 2024) while simultaneously

supporting other objectives of the energy trilemma, such as energy security (Fleming, 2021).

Sustainable development aims to confront pressing global threats like climate change and water scarcity (Elder & Olsen, 2019). The SDGs, particularly SDG 7, focus on ensuring affordable and clean energy for all (Marti & Puertas, 2022). This goal is integral to achieving broader objectives such as eradicating poverty (SDG 1), promoting health (SDG 3), ensuring clean water access (SDG 6), taking climate action (SDG 13), and protecting life on land and below water (SDGs 14 and 15) (United Nations, 2024).

Many countries are actively pursuing innovative solutions to combat global warming as part of their commitment to climate change mitigation policies (Fawzy, Osman, Doran, & Rooney, 2020). These solutions often integrate with climate adaptation programs designed to enhance food security and improve infrastructure resilience against 'harsh' weather conditions (Carlson, et al., 2024). The overarching goal remains, achieving net-zero greenhouse gas emissions while improving living standards worldwide (Stern & Valero, 2021).

Investment in innovation is essential for transitioning towards environmentally sustainable growth across various sectors (Stern & Valero, 2021). This includes moving from traditional fossil fuels to renewable sources while meeting current energy demands. As renewable technologies expand through increased investments and incentives, electricity becomes more affordable due to reduced tariffs. The interconnectedness of the three pillars of the energy trilemma means that advancements in one area can positively influence others.

The energy sector is undergoing significant transformations to meet contemporary challenges by developing tailored programs and services that foster innovation (Kang, et al., 2020). This shift involves introducing new ideas

and enhancements to existing processes, which are essential for achieving optimal performance. The sector's objectives extend beyond mere efficiency improvements to encompass a commitment to sustained energy security and environmental sustainability, aligning with global climate policies (Oduro, Uzougbo, & Ugwu, 2024).

As developed nations implement strategies prioritising energy efficiency in response to rising populations, there is an urgent need for comprehensive approaches that balance economic viability with environmental responsibility. Such measures are crucial in the pursuit of sustainable development (Moorthy, Patwa, & Gupta, 2019). This urgency is further underscored by the recognition that immediate actions can lead to significant cost savings while simultaneously reducing greenhouse gas emissions and mitigating the impact of escalating oil prices (Song & Oh, 2015).

Research by Jiemen and Chen (2022) highlights that innovation is pivotal in reducing carbon emissions within the energy sector. The integration of advanced technologies, such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain, has become central to this transformation. These technologies not only enhance operational efficiency but also facilitate the transition towards renewable energy sources by optimising production and distribution processes.

The energy sector is changing because of new technologies and the need for more sustainable practices. This transformation happens as different groups, like governments, businesses, and consumers, work together. By embracing new ideas and teamwork, the energy sector can handle the challenges of this change while ensuring that energy needs are met now and in the future.

## 2.4 Innovation Barriers

A comprehensive examination of innovation barriers reveals that research in this field extends beyond the energy sector, encompassing various industries. Hen, Zhang, and Fu (2019) emphasize the diversity of innovation research, highlighting that scholars explore a wide array of topics, necessitating different methodologies and analytical approaches to address the unique challenges associated with each area of innovation.

An innovation barrier is defined as any obstacle that impedes a firm's capacity to innovate (Sandberg & Aarikka-Stenroos, 2014). These barriers are often context-dependent; their significance and definition can vary based on the specific characteristics of the firm involved. This variability suggests that understanding barriers requires a nuanced approach tailored to individual organisational contexts (Sandberg & Aarikka-Stenroos, 2014).

In a study conducted by Veiga Avil et al. (2019) on barriers to innovation and sustainability in universities, it was discovered that the main barriers to innovation for sustainable development among higher educational institutes are due to management lack of support, lack of committees for specific initiatives, (e.g. environment), lack of appropriate technology, lack of commitment by organisations, lack of systematic infrastructure (i.e. guidelines, policies, incentives in research), negative attitudes towards environmental issues and lack of government support.

A study on Small and Medium Enterprises (SMEs) in Ecuador revealed that lack of knowledge and funding are the main innovation barriers resulting from the unavailability of competent human resources to pursue innovation projects/tasks and economic limitations, respectively (Simbaña-Taipe, Villamil-Jaramillo, Taimal-Mendez, & Rodeiro-Pazos, 2021). Therefore, the SMEs' competitiveness and organisational growth are inhibited.

According to Wipulanusat, Panuwatwahnich, Stewart, and Sunkpho (2019), the barriers to innovation in the Australian public sector emanate from insufficient resources, regulatory requirements, risk-averse culture, and failure of leadership. The study highlights limitations due to the qualitative study which, only the senior executives participated. It is their perceptions of the broader Australian public sector. The study findings provide the foundation for conducting future research to assess the impact of drivers and barriers to innovation in depth.

The barriers to innovation in the construction industry are associated with financial systems, regulations, organisational culture and organisational structure (Owolabi, Faleye, Eshofonie, Tunji-Olayeni, & Afolabi, 2019). The financial system hindrances arise when the investment return is not guaranteed; shareholders want to see an immediate return on investment, and the solution should not be to limit the profits (Owolabi, Faleye, Eshofonie, Tunji-Olayeni, & Afolabi, 2019). Regulations limit businesses from penetrating other market spaces (Reis, Gonçalves, Lopes, & Antunes, 2021). Innovation, in its nature, is risky. Therefore, an organisational culture that avoids risk will not be motivated to encourage innovation, limiting itself to possibilities (Owolabi, Faleye, Eshofonie, Tunji-Olayeni, & Afolabi, 2019).

#### **2.4.1 *Innovation barriers in the energy sector***

The energy sector across various nations is increasingly embracing renewable energy sources as part of a transition towards a sustainable energy future (Moorthy, Patwa, & Gupta, 2019). This shift not only offers significant environmental benefits but also has the potential to provide electricity to underserved populations in remote areas lacking access to traditional power grids. However, the expansion and integration of renewable technologies face considerable challenges due to regulatory barriers and obstacles to market entry (Moorthy, Patwa, & Gupta, 2019).

These regulatory hurdles often stem from outdated policies, cumbersome permitting processes, and misaligned or conflicting regulations at different levels of government (Oduro, Uzougbo, & Ugwu, 2024). Consequently, the time required to obtain necessary permits for renewable energy projects is prolonged and costly due to the many approvals needed. Additionally, legal uncertainties regarding land use, property rights, and interconnection requirements pose significant challenges for potential investors in renewable energy (Oduro, Uzougbo, & Ugwu, 2024). The installation of renewable energy infrastructure, such as solar panels and wind turbines, necessitates extensive land use, which can be problematic in environmentally sensitive regions or densely populated areas where zoning regulations apply (Gross, 2020). These issues not only delay project development but also lead to legal disputes and diminish community support for renewable initiatives (Gross, 2020).

In the electricity sector, regulations dictate how new generators interconnect with the grid. Compliance with specific technical standards is essential to ensure grid reliability and minimise outages caused by non-compliant generators (Robles, Haro-Larrode, Santos-Mugica, Etxegarai, & Tedeschi, 2019). This necessitates adequate transmission infrastructure and effective coordination among energy regulators and grid operators (Oduro, Uzougbo, & Ugwu, 2024). Unfortunately, outdated interconnection rules and insufficient grid capacity hinder the integration of renewable energy sources, while incumbent energy providers often resist these changes (Medina, 2022). Furthermore, integrating renewable technologies with energy storage solutions could enhance stability and flexibility; however, the absence of clear guidelines for deploying energy storage systems impedes their adoption (Oduro, Uzougbo, & Ugwu, 2024).

Current electricity market designs predominantly favour centralised fossil-fuel-based generation systems that do not accommodate the unique characteristics of renewable energy sources, such as their low marginal costs and

environmental advantages (Oduro, Uzougbo, & Ugwu, 2024). This market structure disadvantages renewable energy providers by perpetuating a system that favours conventional energy sources (Oduro, Uzougbo, & Ugwu, 2024).

Moreover, the lack of long-term policy certainty poses a significant barrier since the energy sector is heavily capital-intensive (Oduro, Uzougbo, & Ugwu, 2024). A stable and predictable policy framework is crucial for attracting investments (Dogar, 2024); any shifts in government policies that compromise investment returns or alter subsidies create an unpredictable environment for investors (Gatzert & Kosub, 2017).

Liubkina, Murovana, Magamedova, Siskos, and Akimova (2019) indicate that innovation within the energy sector remains stifled without a robust financial incentive system and adequate support mechanisms. Conversely, Costa, Garcia-Quevedo, and Dutch Brown (2014) found that while financial resources and knowledge gaps are not major barriers to innovation in the sector, the dominance of established firms can inhibit new entrants.

#### **2.4.2 Proposition 1**

Barriers to incremental innovation in the energy sector include financial constraints, outdated policies and inadequate regulatory frameworks, and knowledge gaps.

### **2.5 Innovation drivers**

Among the key drivers of innovation is a robust Research and Development (R&D) foundation, supported by financial resources that facilitate the creation of innovations (Kuś & Grego-Planer, 2021). Establishing an effective policy framework is essential to foster this environment, including implementing legal regulations offering various tax incentives, attractive interest rates, and

adequate support infrastructure. Such mechanisms are vital for financing innovations, particularly from small organisations, thereby enhancing entrepreneurship and bolstering the economic credibility of the state (Kuś & Grego-Planer, 2021).

Furthermore, a well-structured innovation system is crucial for overcoming the barriers to implementing innovations. The effectiveness of this system hinges on extensive collaboration among key stakeholders, including the public sector, scientific community, and industry. These entities must operate within an environment that promotes the creation, implementation, adoption, and commercialisation of innovative solutions, as exemplified by the triple helix model (Kuś & Grego-Planer, 2021). Thus, the degree of innovation development within a country is contingent upon the coordinated activities and synchronised growth of these critical players (Liubkina, Murovana, Magomedova, Siskos, & Akimova, 2019).

State regulation emerges as a fundamental pillar in stimulating innovation (Costa & Matias, 2020). By establishing clear guidelines and support mechanisms, governments can create an ecosystem conducive to innovation (Liubkina, Murovana, Magomedova, Siskos, & Akimova, 2019). This regulatory framework not only facilitates collaboration but also ensures that resources are allocated efficiently to maximise the potential for innovative outcomes.

Building a place where new ideas can thrive needs a well-rounded approach. This means combining financial help, strong policies, and teamwork between tertiary schools, businesses, and the government. These groups work together to promote lasting economic growth through innovation.

### ***2.5.1 Innovation drivers in the energy sector***

A critical factor in accelerating innovation within the energy sector is the collaboration among key stakeholders, including policymakers, industry

leaders, environmental advocates, and legal experts. This collective effort is essential for identifying bottlenecks and developing tailored solutions to enhance renewable energy deployment (Oduro, Uzougbo, & Ugwu, 2024). Such collaboration fosters an enabling environment conducive to advancing energy transition initiatives.

Robust legal frameworks are necessary to effectively overcome existing regulatory barriers that hinder renewable energy integration. These frameworks should address current legal challenges while promoting innovation and sustainable growth (Akpuokwe, 2024). Such legal structures must evolve in tandem with the dynamic landscape of renewable energy implementation to effectively mitigate climate change and facilitate a transition towards a sustainable energy future (Akpuokwe, 2024). A harmonised regulatory approach can streamline permitting processes, clarify legal frameworks, and ensure compliance with environmental regulations (Oduro, Uzougbo, & Ugwu, 2024).

Policies that incentivise innovation in the energy sector are crucial (Sonjaya & Noch, 2024). Such policies may include feed-in tariffs, tax incentives, grants, and accelerated depreciation schemes aimed at facilitating renewable energy deployment (Matos, Viardot, Sovacool, Geels, & Xiong, 2022). To unlock the full potential of renewables and mitigate climate change risks, regulatory reform and legal innovation must be prioritised (Oduro, Uzougbo, & Ugwu, 2024).

Innovation is a critical driver of energy transitions, enabling the adoption of new technologies and practices that promote sustainability, improve efficiency, and minimise costs (Sambodo, 2024). The advancements in RETs are a testament to the transformative role of innovation across all sectors. Technological improvements in the energy sector have been observed in wind energy production, where larger turbines installed offshore, facilitated by supportive

policies and regulatory frameworks, have significantly reduced the cost of electricity compared to conventional fossil fuel generation (Strielkowski, Civiń, Tarkhanova, Tvaronavičienė, & Petrenko, 2021).

Furthermore, technological advancements in solar Photovoltaic (PV) have led to substantial cost reductions over the past decade (Sambodo, 2024). This has resulted from declining module prices and improved efficiencies, allowing Solar PV to compete with conventional energy sources without financial subsidies (Gerarden, 2023).

Moreover, advancements in energy storage, grid infrastructure, and system integration have enabled the integration of variable renewable energy sources into power systems (Stephanie & Karl, 2020). Innovative technologies for smart grids, such as real-time monitoring, demand response systems, and sophisticated grid management software, i.e. Supervisory Control and Data Acquisition (SCADA), improve the grid's capacity to adjust to fluctuations in renewable energy production (Sayed, 2017). Such integration promotes decarbonisation, decentralisation, and helps minimize system losses (Sambodo, 2024).

Public-Private Partnerships (PPP) play a crucial role in advancing renewable projects by capitalising on the expertise of private entities alongside government resources (Mathu, 2023). Globally, PPPs are increasingly utilized to implement climate mitigation and adaptation strategies, including the development of Low-Carbon, Climate-Resilient (LCCR) infrastructure (Casady, Cepparulo, & Giuriato, 2024). Public authorities favour PPPs for LCCR projects due to budget constraints and the need for innovative solutions (Vassileva, 2022). The private sector is drawn to these partnerships by factors such as profitability, effective risk management, and supportive policy frameworks (Mathu, 2023). This collaborative approach enhances the energy sector's capacity for innovation.

This collaborative model not only shares project risks and costs but also simplifies the project approval process due to governmental influence over regulatory procedures (Oduro, Uzougbo, & Ugwu, 2024). Such partnerships have the potential to attract substantial investment into renewable projects.

Regulatory sandboxes have emerged as an innovative solution to promote experimentation with new renewable technologies and business models, free from the constraints of full regulatory compliance. This approach has proven to be a promising strategy for fostering innovation, accelerating technological advancements, and overcoming regulatory barriers in the energy sector (Gangale, Mengolini, Covrig, Chondrogiannis, & Shortall, 2023). Numerous regulatory authorities globally are implementing legislation that includes the concept of a "sandbox," establishing a regulatory framework and experimental environment (Aydın & Yardımçı, 2024). This setup fosters participation by integrating infrastructure with new technologies and business processes, thereby facilitating and speeding up the energy transition (Schneiders, 2021). Sandbox applications provide designated test or pilot projects with protected spaces, enabling regulatory trials and the development of essential regulations (Schneiders, 2021). Regulatory sandboxes offer a unique opportunity to identify regulatory barriers while fostering the development of effective solutions (Oduro, Uzougbo, & Ugwu, 2024). This aligns with the concept of incremental innovation, as it continually improves performance in the energy sector and minimises hindrances. By allowing for iterative testing and refinement, regulatory sandboxes play a crucial role in enhancing the sector's overall efficiency and adaptability.

Furthermore, capacity-building initiatives are essential for stakeholders affected by regulatory barriers to develop strategies for overcoming these challenges. Identifying and engaging all relevant stakeholders is vital in addressing regulatory barriers. Collaborative efforts should focus on understanding stakeholder needs and developing innovative regulatory

frameworks that support renewable energy growth while addressing their concerns (Oduro, Uzougbo, & Ugwu, 2024).

Training programs and workshops serve as a valuable platform for knowledge-sharing and collaborative problem-solving (Oduro, Uzougbo, & Ugwu, 2024). Global initiatives such as the Green Climate Fund and Climate Technology Centre and Network (CTCN) provide funding and capacity-building support to propel the countries' sustainable energy programmes (Falcone, 2023). Participating in regional and international forums promotes information sharing, fosters replication of best practices, and the adoption of successful, sustainable energy models.

The above examples of stakeholder engagement and capacity building demonstrate emphasis on their critical role in overcoming barriers in the energy sector in renewable energy deployment. Furthermore, it contributes to the development of innovative regulatory frameworks, improving energy sector performance by either replication of successful models or incrementally improving current models. Collectively, these measures represent an inclusive approach for sustainable energy sector reformations, promoting innovation in the sector for its sustainability.

Incentives for R&D in new technologies can significantly expedite renewable energy expansion. Government-funded research programs aimed at supporting R&D activities—including scholarships and grants for educational institutions—have shown positive impacts on innovation within the sector (Matos, Viardot, Sovacool, Geels, & Xiong, 2022). Renewable deployment incentives such as feed-in tariffs and Renewable Energy Credits (REC) are instrumental in promoting innovation. RECs serve as proof of renewable energy generation and can facilitate market participation by ensuring stable payments for electricity fed into the grid (Oduro, Uzougbo, & Ugwu, 2024). A REC is a non-tangible commodity that is tradable and proof

that 1 MWh of electricity was produced from a renewable source and fed into a transmission system (Nguyen & Felder, 2020). The growing emphasis on global policies like the European Green Deal necessitates mechanisms that ensure compliance with renewable energy standards to maintain competitiveness in international markets (Cameron, et al., 2021).

Furthermore, organisations can purchase Renewable Energy Certificates to support renewable energy markets, particularly those facing challenges in implementing energy efficiency projects (Holt & Bird, 2005). This approach also benefits organisations aiming to reduce carbon emissions by leveraging the efforts of others to meet their environmental goals. Once a REC is purchased, it cannot be resold; each REC is assigned a unique identification number and contains information about the type of renewable source, its generation location, and the date of issuance (Nguyen & Felder, 2020). These RECs are meticulously tracked and recorded. In the United States, the REC market significantly contributed to the surge in solar installations, increasing from approximately 10 MW in 2005 to about 950 MW in 2012 (Nguyen & Felder, 2020). This demonstrates innovation at its best, increasing the utilisation of alternative energy supplies to meet the demand and decarbonise the energy sector.

Renewable Portfolio Standards (RPS) require utilities to procure a specified percentage of their electricity from renewable sources to further stimulate innovation in renewable energy sources. This regulatory framework not only enhances market demand but also provides certainty to investors and manufacturers regarding future market conditions (Oduro, Uzougbo, & Ugwu, 2024). Encouraging entrepreneurship within the renewable sector fosters a culture of innovation that drives technological advancements (Haldar, 2021). Government support for enterprise development programs can provide

essential resources such as mentorships and business support to catalyse growth in this sector (Oduro, Uzougbo, & Ugwu, 2024).

### **2.5.2 Proposition 2**

The factors that drive incremental innovation in the energy sector include financial considerations, compliant policies and regulations, and capacitation of stakeholders.

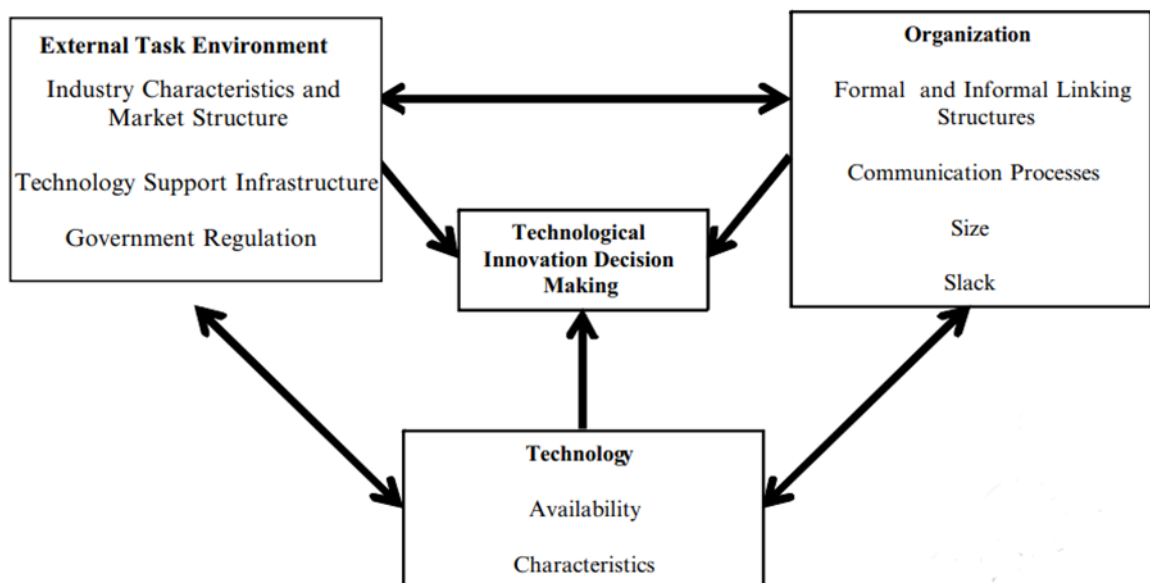
## **2.6 Conceptual or Theoretical Framework**

A theoretical framework is best defined as a comprehensive review of existing theories and assumptions that guide the development of how a researcher structures their research (Ngulube, Mathipa, & Gumbo, 2015). This framework not only situates the research within the broader academic discourse but also aids in understanding and explaining various aspects of the reality being investigated. Furthermore, it serves as a foundation for constructing arguments that will be utilized throughout the research process (Ngulube, Mathipa, & Gumbo, 2015).

In this study, the **Technology–Organization–Environment (TOE)** framework will be employed as a guiding theory. Awa and Ojiabo (2016) describe the TOE framework as a pioneering approach that identifies essential factors capable of explaining and predicting the likelihood of innovation adoption. This model posits that several dimensions influence adoption, specifically technological development, organisational conditions, and the industry environment. Tornatzky and Fleischer (1990, as cited in Baker, 2012) elaborate on this by explaining that for decisions regarding innovation adoption to be made at the organisational level, three influencing contexts must be considered: the technological context, the organisational context, and the environmental context.

The TOE framework has been widely applied in numerous studies investigating innovation adoption at the firm level (Amini & Jahanbakhsh Javid, 2023). Chiu, Chen and Chen, (2017) argue that incorporating technological, organisational, and environmental factors makes the TOE framework more suitable than other models for examining innovation and technology adoption. Its extensive validation across various studies focusing on innovative technologies highlights its effectiveness in diverse fields such as information systems, e-commerce, telecommunications, web services, e-CRM, and cloud computing.

Given that this study focuses on identifying barriers and drivers of incremental innovation within Eswatini's energy sector, the TOE framework is appropriately chosen as the research model. The framework's holistic approach allows for a nuanced understanding of how technological advancements interact with organisational dynamics and external environmental pressures. This is visually represented in Figure 1 below.



**Figure 2-1: TOE framework (Source: Tornatzty and Fleisccher,1990)**

### **2.6.1 The Technological Context**

The technological context of a firm encompasses both the internal technologies it has adopted and the external technologies that are available in the market but not yet utilized (Awa & Ojiabo, 2016). This duality is influenced by various factors, including the firm's technical capabilities, the suitability of technologies for its operations, organizational compatibility, and the complexity of implementation (Awa & Ojiabo, 2016).

At the firm level, the existing technological landscape serves as a critical driver for innovation and technology adoption. The status quo of available technologies not only reflects a firm's current capabilities but also shapes its strategic decisions regarding future technological investments (Baker, 2012). Firms must navigate between utilising to their advantage the existing technologies and exploring new ones to ensure continued adaptability and growth (Baker, 2012).

The choice between internal development and external acquisition of technology is a strategic decision that firms face in today's competitive environment (Gnekpe & Coeurderoy, 2017). Internal R&D allow firms to cultivate proprietary technologies that align closely with their operational needs (Ullah, Qayyum, Thaheem, Al-Turjman, & Sepasgozar, 2021). Conversely, external acquisition—whether through licensing or partnerships—can provide access to innovative solutions that may not be feasible to develop in-house. This interplay between internal and external sources of technology is vital for fostering an environment conducive to innovation.

### **2.6.2 The Organisational Context**

The organisational context encompasses various characteristics that shape how an organisation functions and innovates. Key elements include organisational culture, top management support, business

scope, human capital competency, size, available slack resources, decentralisation, complexity, and the formal and informal linking structures between employees, as well as their intra-firm communication processes (Al-Hujran, Al-Lozi, Al-Debei, & Maqableh, 2018). These factors significantly influence decision-making related to the implementation and adoption of innovations.

One of the most critical characteristics within this context is organisational structure (Baker, 2012). Research indicates that decentralised organisations tend to be more flexible and supportive during the innovation stage, allowing for greater creativity and adaptability. In contrast, centralised organisations often excel during the implementation stage of innovation processes due to their ability to streamline decision-making and enforce consistency (Amini & Jahanbakhsh Javid, 2023). This distinction highlights the importance of aligning organisational structure with the specific needs of innovation at different stages. Moreover, the role of top management behaviour is paramount in either facilitating or hindering the adoption of new ideas. Effective leadership can create an environment that encourages innovation by fostering a culture of openness and support for creative initiatives (Awa & Ojiabo, 2016). Leaders who are committed to innovation not only set a positive example but also help in overcoming resistance to change within the organisation.

### **2.6.3 The Environmental Context**

The environmental context is a critical aspect of the framework within which organisations operate, as articulated by Tornatzky and Fleischer (1990, as cited in Baker, 2012). This context encompasses various factors, including industry structure, competitive landscape, geographical location, access to technology service providers, and the regulatory environment. Each of these elements plays a significant role in shaping the operational dynamics of an organisation (Baker, 2012).

Competition at the firm level can catalyse innovation, driving organisations to seek competitive advantages through new technologies and practices. Conversely, regulatory requirements and government policies can have mixed effects on innovation levels; they may either foster innovation through supportive measures or hinder it through restrictive regulations (Al-Hujran, Al-Lozi, Al-Debei, & Maqableh, 2018). In rapidly growing industries, the frequency of innovation adoption tends to increase, bolstered by the availability of skilled workers who can implement new solutions effectively (Amini & Jahanbakhsh Javid, 2023).

The TOE framework's holistic approach is invaluable for examining technology adoption and innovation dynamics. By considering technological readiness, organisational characteristics, and environmental pressures, researchers can gain deeper insights into how these factors interact and influence an organisation's capacity for innovation. This framework facilitates a nuanced exploration of the interplay between technology and organisational strategy in various contexts, enriching our understanding of innovation processes within organizations.

## **2.7 Conclusion of Literature Review**

### ***2.7.1 Proposition 1***

Barriers to incremental innovation in the energy sector include financial constraints, outdated policies and inadequate regulatory frameworks, and knowledge gaps.

### **2.7.2 Proposition 2**

The factors that drive incremental innovation in the energy sector include financial considerations, compliant policies and regulations, and the capacitation of stakeholders.

**Table 1: Consistency table: research objectives and propositions**

| <b>RQ #</b> | <b>State Research Objectives</b>                                                             | <b>Prop #</b> | <b>State Proposition</b>                                                                                                                                                       |
|-------------|----------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | To investigate incremental innovation constraints in Eswatini's energy sector.               | 1             | Barriers to incremental innovation in the energy sector comprise financial constraints, outdated policies and inadequate regulatory frameworks, and knowledge gaps.            |
| 2           | To determine the factors that drive incremental innovation in the energy sector of Eswatini. | 2             | The factors that drive incremental innovation in the energy sector include financial considerations, compliant policies and regulations, and the capacitation of stakeholders. |

## **CHAPTER 3. RESEARCH METHODOLOGY**

This chapter outlines the research methodology employed in this study, which serves as a systematic approach to addressing the research problem. A well-defined research methodology encompasses various steps that a researcher adopts to tackle the research question effectively (Mohajan, 2018). It not only elucidates the techniques for data collection and analysis but also clarifies the limitations and resources involved, thereby providing insight into the potential consequences of the study (Patel & Patel, 2019). The choice of research approach—qualitative, quantitative, or mixed methods—depends on the nature of the data required and the specific objectives of the study (Taherdoost, 2022).

Researchers must be able to apply research techniques that are appropriate and relevant to the applicable problems (i.e., the researcher must be able to design their methodology for a research problem). Qualitative methods are typically used to explore complex phenomena through detailed narratives, while quantitative methods focus on numerical data to identify patterns and relationships (Taherdoost, 2022). Mixed methods combine both approaches to offer a more comprehensive understanding of the research problem (Taherdoost, 2022).

Researchers must select appropriate methodologies tailored to their specific research questions and contexts. This adaptability ensures that the chosen techniques are relevant and effective in addressing the identified problems. Thus, researchers must design their methodologies thoughtfully, aligning them with their research objectives.

Formulating research questions and identifying the problem significantly influence the selection of research design methods. Consequently, presenting clear research objectives derived from these questions is essential. This study

aims to investigate incremental innovation constraints/barriers and factors driving incremental innovation within Eswatini's energy sector. By articulating these objectives, this chapter sets the stage for a detailed exploration of how these elements will be examined through the chosen methodological framework.

### **3.1 Research paradigm**

In research, the philosophical perspective is inherently shaped by the author's worldview, which significantly influences their study design and interpretation of findings (Alharahsheh & Pius, 2020). This perspective must be anchored in fundamental philosophical assumptions that consider the nature of the study, the methods employed, and the available supporting evidence (Alharahsheh & Pius, 2020). These foundational assumptions are commonly referred to as paradigms (Alharahsheh & Pius, 2020).

Paradigms are composed of four essential components: Ontology, Epistemology, Methodology, and Methods (Alharahsheh & Pius, 2020).

1. Ontology refers to the essence of a phenomenon's existence; it encompasses our beliefs about reality (Alharahsheh & Pius, 2020).
2. Epistemology addresses how researchers comprehend reality and the approaches they employ to uncover knowledge about it (Rehman & Alharthi, 2016).
3. Methodology outlines the research strategy and specifies the methods that will be utilised to collect and analyse data (Alharahsheh & Pius, 2020).

4. Methods detail the techniques for gathering and analysing data from various sources (Rehman & Alharthi, 2016).

The significance of paradigms lies in their role as guiding frameworks for researchers in conducting investigations and drawing conclusions. A research paradigm serves as a lens through which reality is understood. The predominant types of paradigms include positivism, interpretivism, and critical theory (Rehman & Alharthi, 2016).

**Positivism** is grounded in the belief that knowledge can be obtained through objective observations and measurements. It emphasises a singular reality that can be empirically verified through quantitative methods (Ryan, 2018).

**Interpretivism**, in contrast, posits that reality is socially constructed and subjective, emphasising the importance of understanding individuals' experiences and interpretations (Ryan, 2018).

**Critical theory** seeks to address power dynamics and social inequalities, often incorporating perspectives from feminist theory and other social critiques. It aims not just to understand but also to change societal structures (Rehman & Alharthi, 2016).

### **3.1.1 Interpretivism**

Interpretivism is a qualitative research paradigm that emphasises understanding the complex and subjective nature of human experiences. It posits that humans are distinct from physical phenomena due to their capacity to ascribe deeper meanings to their experiences, which cannot be adequately explored through quantitative methods alone (Alharahsheh & Pius, 2020). This approach acknowledges the influence of cultural, contextual, and temporal variations on the formation of social realities, thereby recognizing that these factors contribute significantly to how individuals perceive and interpret their

world (Alharahsheh & Pius, 2020). In contrast to positivism, which seeks to establish universal laws through objective measurements and statistical analysis, interpretivism aims to capture the richness and complexity of human experiences. Interpretivists argue that knowledge is best derived from exploring the meanings individuals attach to their experiences, rather than relying solely on observable phenomena (Ryan, 2018). This fundamental difference highlights the interpretivist focus on subjective insights rather than objective facts, leading to a preference for qualitative research methods such as in-depth interviews, participant observation, and focus groups.

The following could be the results when a researcher adopts a positivist position:

1. Relativist ontology: Positivism often leads to a relativist ontology where reality is perceived through shared experiences and perspectives. This perspective emphasises understanding the meanings and social experiences of participants (Alharahsheh & Pius, 2020).
2. Subjective epistemology: Positivism also entails a subjective epistemology that recognises the interconnectedness between researchers and their subjects. This viewpoint suggests that knowledge is co-constructed through interactions between researchers and participants, indicating that human experiences cannot be fully separated from the knowledge derived from them (Alharahsheh & Pius, 2020).

Overall, interpretivism provides a framework for understanding the nuanced ways in which individuals construct meaning within their social contexts, contrasting sharply with the more rigid structures of positivist methodologies. By prioritising qualitative insights over quantitative data, interpretivism allowed for a deeper exploration of human behaviour and social phenomena.

## **3.2 Research approach**

A well-defined research approach is crucial for guiding any study effectively. This section explores three primary research methodologies: qualitative, quantitative, and mixed methods, highlighting their unique characteristics, strengths, and limitations.

Qualitative research methods focus on gathering empirical materials such as case studies, personal experiences, patterns, routines, and societal issues. According to Taherdoost (2022), this approach emphasises understanding the extensive meanings and motivations behind phenomena that cannot be quantified numerically. The primary aim of qualitative research is to collect information from primary sources, document it, and analyse it through appropriate interpretive methods.

One of qualitative research's key strengths is its exploratory nature, which makes it particularly useful for studying phenomena with limited existing information. This methodology has the potential to unearth new insights and generate unique ideas, thereby contributing to the creation of new knowledge. However, it is important to note that qualitative research tends to focus on specific timelines and events, often overlooking results that may evolve over time or in different contexts.

In contrast, a quantitative research approach is employed when the objective is to test theories by examining relationships among variables (Taherdoost, 2022). This method involves the collection of numerical data through various instruments, which is then analysed using statistical processes to yield reliable quantitative insights. Quantitative research aims to address specific questions aimed at providing explanations or predictions regarding individuals, events, or locations (Habib, 2021). This approach typically follows a clearly defined problem statement and hypothesis based on the study's objectives.

The mixed methods approach requires that both quantitative and qualitative data be collected and the two forms of data be used for a thorough investigation of the research problem to determine if they lead to a similar conclusion (Taherdoost, 2022) . This approach allows for the widening of a study, adding value in that, in some respects, quantitative and qualitative data are complementary, and the strengths of qualitative methods offset the weaknesses of the quantitative and vice versa. (Dawadi, Shrestha, & Giri, 2021).

A qualitative approach was adopted for this study, due to its exploratory characteristics and its ability to generate comprehensive and detailed insights into the research topic. Given that quantitative and mixed methods require numerical data and statistical procedures for analysis, elements that are not suitable for this study, the qualitative approach was deemed more appropriate. By focusing on rich narratives and detailed accounts from participants, this methodology facilitated a deeper understanding of the subject matter at hand.

### **3.3 Research Design**

The study employed a qualitative approach utilising a case study design to explore the barriers and drivers of incremental innovation within the energy sector. This methodology was particularly suited for capturing the complexity of the phenomenon being investigated. A case study allowed for an in-depth analysis that provided real-world insights into specific contexts, such as particular sectors or organisations (Lindgreen, Di Benedetto, & Beverland, 2021). By focusing on selected groups, the researcher aimed to gain comprehensive knowledge regarding the research problem.

The choice of a case study design was justified by its effectiveness in examining how programs evolved in response to various circumstances and interventions (Lindgreen, Di Benedetto, & Beverland, 2021). This design

facilitated a detailed understanding of how incremental innovation is influenced by both internal and external factors within Eswatini's energy sector. The research specifically concentrated on identifying the barriers that hindered and the drivers that promoted incremental innovation, thereby contributing valuable insights into the dynamics of innovation in this critical field.

### **3.4 Data collection methods**

In qualitative research, various techniques are employed to collect data, with the most common being document studies, observations, semi-structured interviews, and focus groups (Busetto, Wick, & Gumbinger, 2020). Among these methods, semi-structured interviews stand out for their interactive nature, allowing researchers to delve into unanticipated topics that may arise during discussions. This flexibility enabled a deeper exploration of participants' personal experiences and opinions, which are often subjective rather than purely factual (Busetto, Wick, & Gumbinger, 2020).

This study utilised semi-structured interviews to gain insights into participants' experiences and perspectives. The interview format consisted of open-ended questions designed to encourage detailed responses. In addition to the primary questions, a guide was provided that outlined areas of interest and included sub-questions for clarity or further exploration when necessary.

The question guide was shared with participants in advance to ensure that they were well-prepared and comfortable during the interviews. This approach allowed interviewees time to reflect on their responses and fostered a more thoughtful and engaging dialogue during the interview process. By employing this methodology, the study aimed to capture rich qualitative data that reflected the nuanced views of participants, ultimately contributing to a deeper understanding of the research topic.

## **3.5 Population and Sample**

### **3.5.1 *Population***

In research, the term population refers to the complete set of individuals or objects that a study aims to examine or draw conclusions about (Thacker, 2020). This concept is crucial for researchers as it defines the scope and context of their inquiry.

This study focused on a specific population comprising energy sector employees, including those working for energy regulators and companies involved in the petroleum and electricity industries. This targeted group was selected account of its significant influence and pivotal role in the energy landscape.

Moreover, the extensive experience these individuals have accumulated over the years provided a rich source of data for identifying specific characteristics and relationships within the sector. By examining this population, the research aimed to uncover insights that are relevant to the energy industry and contribute to broader discussions on energy regulation and policy. This approach ensured that the findings were grounded in real-world experiences and perspectives and enhanced the study's relevance and applicability.

### **3.5.2 *Sample and sampling method***

Sampling is a fundamental procedure in research that involves selecting a subset of elements, known as a sample, from a larger set of elements that are the focus of interest (Baltes & Ralph, 2022). The primary aim of sampling is to obtain a smaller collection of elements that can effectively represent the larger population, allowing researchers to make generalisations about the entire group.

In this study, a purposive or judgmental sampling method was employed. This approach allowed the researcher to use discretion in selecting sample members based on specific attributes relevant to the research (Baltes & Ralph, 2022). According to Shaheen and Pradhan (2019), this method is particularly valuable in qualitative research as it enables the researcher to choose participants who meet predetermined criteria deemed essential for addressing the research question and achieving the study's objectives.

By utilising purposive sampling, the study ensured that the selected participants possessed characteristics critical for providing rich, relevant data. This targeted approach not only enhanced the quality of the findings but also aligned closely with the goals of qualitative research, which seeks to explore and understand complex phenomena through in-depth insights from the carefully chosen individuals.

### ***3.5.3 Demographic Profile of Respondents***

The target audience for this study consisted of managers, experts and leaders from various organisations within the energy sector. These individuals strongly understood the industry, including the current legislation and regulatory environment that governs it. This study aimed to explore the dynamics within the energy sector, particularly as they relate to innovation and regulatory challenges.

In qualitative research, determining sample size is guided by the principle of saturation, which suggests that data collection should continue until no new themes or insights emerge (Vasileiou, Barnett, Thorpe, & Young, 2018). Previous studies have indicated that a minimum sample size of 12 participants is necessary to achieve saturation in a homogeneous group (Boddy, 2016). Given that this study focuses on the energy sector in Eswatini, the selected participants meet the criteria for homogeneity.

The study aimed to have a sample size of 18 participants drawn from key organisations in Eswatini's energy sector, to achieve a balanced selection that would provide valuable insights and useful data. However, only 14 interviews were conducted in total, as the remainder of the participants were not available for interviews.

The energy sector participants' organisations were as follows

1. Energy Regulators

- Eswatini Electricity Regulatory Authority (ESERA)
- Ministry of Natural Resources and Energy (MNRE)

2. Energy Companies

- Eswatini Electricity Company (EEC)
- Eswatini National Petroleum Company (ENPC)

3. Private Sector Participants

- Independent Power Producer (Ubombo Sugar Limited)
- Petroleum Company

These organisations represented the major and minor players in Eswatini's energy sector. Major players are predominantly government-owned entities with extensive experience and expertise, playing crucial roles in ensuring energy supply security. These selected organisations effectively represented the entire population.

Interviewees were chosen based on their seniority and extensive experience within the Eswatini energy sector. Their insights yielded rich data and valuable perspectives on innovation in the industry.

**Table 2: The following table outlines the distribution of interviewees from the energy sector, specifically focusing on electricity and petroleum as per interviews conducted.**

| Energy Companies                  |                        |
|-----------------------------------|------------------------|
| Organisation                      | Number of interviewees |
| EEC                               | 3                      |
| ENPC                              | 2                      |
| Total                             | 5                      |
| Energy Regulators                 |                        |
| Organisation                      | Number of interviewees |
| ESERA                             | 3                      |
| MNRE                              | 3                      |
| Total                             | 6                      |
| Private Sector Participants       |                        |
| Independent Power Producers (USL) | 2                      |
| Petroleum Company                 | 1                      |
| Total                             | 3                      |
| Overall Interviewees              | 14                     |

This structured approach to participant selection ensures that the study captures a comprehensive range of insights from influential figures within Eswatini's energy sector, ultimately contributing to a deeper understanding of innovation and regulatory practices in this critical industry.

### **3.6 The research instrument**

Research instruments are essential tools researchers use to collect data as part of their research projects systematically. These instruments can take various forms, including questionnaires, surveys, and observation schedules (Alamri, 2019). By employing these tools, researchers can gather information

in a structured manner, enabling them to test hypotheses, answer specific research questions, and draw meaningful conclusions.

In this study, the research tool used was based on semi-structured questions as our primary research instrument. This approach allowed for a balance between guided inquiry and the flexibility to explore topics in greater depth. In-person interviews were conducted with key respondents, including energy regulators and representatives from incumbent companies within the energy sector of Eswatini.

The primary aim of this research was to investigate the barriers and drivers of incremental innovation in Eswatini's energy sector. Engaging directly with industry stakeholders through interviews, the study aimed to uncover insights that quantitative methods alone may not reveal. This qualitative approach facilitated a deeper understanding of the dynamics at play within the sector, contributing valuable knowledge to both academic discourse and practical applications in energy policy and innovation strategies.

### **3.7 Procedure for Data Collection**

In a case study, researchers often collect extensive data using various methods to gain a deep understanding of the phenomenon under investigation. The combination of these diverse data collection methods—such as interviews, observations, and questionnaires—plays a crucial role in enriching the research findings (Alamri, 2019). This study focused on qualitative data collection, which was frequently pre-planned and structured to ensure comparability across all participants.

Qualitative interviews were conducted face-to-face with a purposive sample of individuals working in the country's energy sector. These semi-structured interviews allowed for open-ended discussions that encouraged participants to

share their insights and experiences freely. This format facilitated a deeper exploration of the topics at hand and fostered a more natural exchange of ideas between the interviewer and interviewee.

An interview is fundamentally a verbal exchange where the interviewer seeks to acquire information and gain an understanding of the interviewee's perspectives (Thunberg & Arnell, 2022). The interviewees were critical to this process, as they served as the primary source of evidence in a case study. Given that most cases involved human affairs or actions, interviews provided invaluable insights into these complex matters (Alamri, 2019).

The interview questions were meticulously designed based on the study's critical research objectives and the supporting theory that informed this investigation. To enhance the quality of responses, the interview guide was shared with participants in advance, allowing them time to reflect on the questions. Before the in-person interviews, participants had to sign consent forms to ensure ethical compliance and respect for their autonomy.

A notebook and recording device were employed to capture the dialogue during interviews accurately. This approach ensured that all information was documented comprehensively. It was important to note that any sensitive information disclosed during the interviews was omitted from the final report to protect participant confidentiality.

### **3.8 Data Analysis and Interpretation**

Data analysis plays a crucial role in systematically examining datasets to uncover trends, relationships, and insights that enhance our understanding of the subject matter. This process involves applying various analytic techniques to both numeric and non-numeric data, ultimately evaluating how the gathered information addresses the research questions posed in a study.

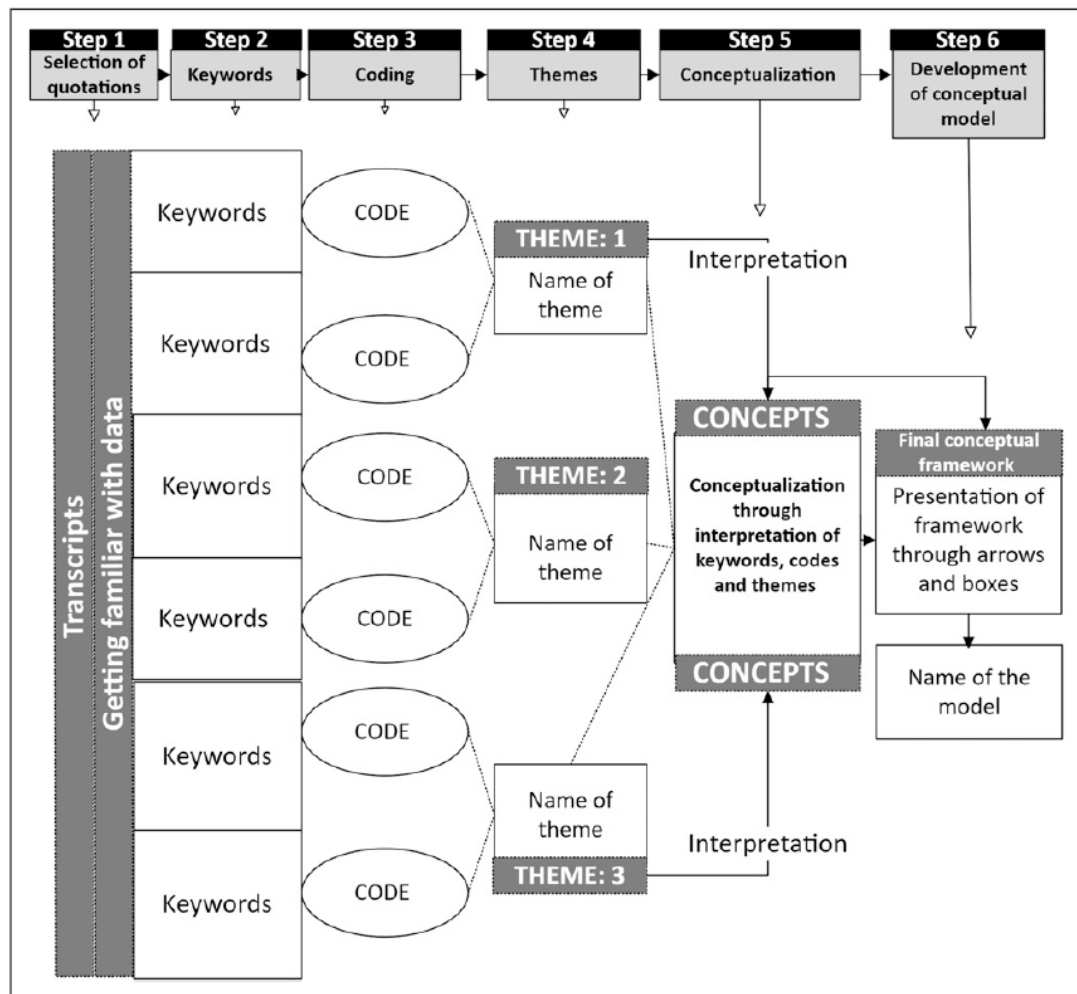
Qualitative data analysis is particularly diverse and offers a deeper understanding of individual cases (Shaheen & Pradhan, 2019). Among the various methods available for analysing qualitative data, thematic analysis is highly effective. This method is particularly suitable for exploring complex phenomena and generating rich insights (Clarke & Braun, 2017).

The thematic analysis focuses on identifying significant information within the data and organising it into relevant themes that align with the research questions or objectives and the phenomenon under investigation (Loraine, Wick, & Christoph, 2020). It has a six-step approach that enables a researcher to conduct a proper analysis of the data until the data makes sense or a conclusion is drawn (Naeem, Ozuem, Howell, & Ranfagni, 2023)

Therefore, this study employed Naeem, Ozuem, Howell, and Ranfagni (2023), six-step thematic analysis approach. Initially, the interview recordings were transcribed, and the researcher became familiar with the data through repeated listening. Subsequently, a systematic analysis was conducted to select keywords. These keywords were then used to code the data for potential themes. Following the coding process, themes were developed by mapping connections and relationships between them. Conceptualisation involved interpreting these social patterns and aligning them with the research questions. Finally, a conceptual model was developed to represent the key findings of the analysis visually.

The audio-recorded data acquired from participants from semi-structured interviews was satisfactorily transcribed and edited manually, and thematic analysis was applied as Naeem, Ozuem, Howell, and Ranfagni (2023) implemented.

The following Figure 3 illustrates this analytical process in detail.



**Figure 3-1: A systematic thematic analysis process: A novel six-step process for conceptual model development in qualitative research (Source: Naeem, Ozuem, Howell and Ranfagni (2023))**

### **3.9 Quality Assurance**

In qualitative research, establishing credibility is paramount. It pertains to the consistency and stability of all data collection methods (L. Haven & Van Grootel, 2019). In this study, the researcher implemented several strategies to enhance the credibility of the interviews conducted. First, detailed notes were taken during participant narratives, complemented by audio recordings. This dual approach ensured that the data collected accurately reflected the participants' perspectives and experiences, thereby bolstering the overall credibility of the qualitative research. Furthermore, this meticulous documentation facilitated transferability, allowing other researchers to understand and apply the findings in different contexts.

To guarantee that the interviews authentically represented respondents' articulations, the researcher reviewed all transcripts and confirmed their accuracy with participants before concluding each session. This practice aimed to mitigate potential biases stemming from the researcher's interpretations, thereby increasing the dependability of the findings.

Dependability focuses on the consistency of results over time and across various contexts. Similar to how credibility is established, dependability was reinforced through a systematic data analysis process that subsequent researchers could replicate when attempting to recreate this study.

However, it was essential to recognise that the dynamic nature of the subject matter may have introduced variables that could have affected the replication of this research. As such, ongoing reflection on these changing circumstances was necessary.

The interviews in this study utilised a pre-populated and pre-tested questionnaire. Notably, participants involved in the pilot testing were not included in the main study. Conducting a pilot test is particularly beneficial for

researchers new to this field, as it equips them with practical experience and prepares them for challenges that may arise during the main study (Malmqvist, Hellberg, Möllås, Rose, & Shevlin, 2019). This preparatory phase fostered greater confidence in data collection using the research instrument and allowed researchers to identify and rectify any weaknesses before full-scale implementation.

Pre-testing of the collection instrument was done within one week (25-30 November 2024). Two randomly selected participants from the energy sector—one from electricity and the other from petroleum—were requested to participate in responding to a questionnaire pretest for the study. Before conducting the interviews, the researcher explained the study to selected pretest participants and emphasised why conducting a pretest was necessary. Both participants pointed out that questions 12 and 13 were repetitions but phrased differently. This led to their omission in the final interviews conducted because they repeated questions 10 and 11, respectively. Due to time constraints, changes could not be made to questionnaires; however, researchers explained to participants that these repetitions were identified during pretest sessions. Therefore, they will not be part of sessions.

Ultimately, these measures collectively enhanced the quality of the research, ensuring that it met high standards of credibility and dependability while providing valuable insights into the participants' experiences.

### **3.10 Ethical Considerations**

Ethical considerations are established guidelines and protocols that researchers must follow when conducting research (Pietilä, Nurmi, Halkoaho, & Kyngäs, 2020). Ethical considerations were very important in research as they ensured minimal risk to participants. The primary purpose of these ethical considerations was to ensure that the dignity and well-being of research

participants were not compromised or violated. The researcher applied for ethics clearance from the University of Witwatersrand (where the study was registered) and obtained permission from organisations in Eswatini's energy sector to conduct the study at their respective esteemed organisations.

To ensure that the research was ethically conducted, the following was done.

1. The study purpose was communicated to participants.
  - They signed a consent form.
2. Participants learned their participation was voluntary.
  - They could withdraw from any point during studies.
3. The anonymity of respondents remained intact through notation (e.g., Participant 1).
4. Participants gave consent for session recordings.
  - Data storage remained secure throughout the study.
5. Organisational identities stayed confidential.
  - Reports referenced energy industry companies instead. (e.g., Company A)
6. Research permissions adhered strictly to university guidelines, ensuring proper protocol adherence during research approvals.

### **3.11 Consistency table**

**Table 3: Consistency table: research objectives, propositions, data collection and data analysis**

| <b>RQ #</b> | <b>State Research Objectives</b>                                                             | <b>Prop #</b> | <b>State Proposition</b>                                                                                                                                                       | <b>Data collection detail</b> | <b>Data analysis method</b> |
|-------------|----------------------------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------|
| 1           | To investigate incremental innovation constraints in Eswatini's energy sector.               | 1             | Barriers to incremental innovation in the energy sector comprise financial constraints, outdated policies and inadequate regulatory frameworks, and knowledge gaps.            | Semi structured interview     | Thematic analysis           |
| 2           | To determine the factors that drive incremental innovation in the energy sector of Eswatini. | 2             | The factors that drive incremental innovation in the energy sector include financial considerations, compliant policies and regulations, and the capacitation of stakeholders. | Semi structured interview     | Thematic analysis           |

## **CHAPTER 4. PRESENTATION OF FINDINGS & DISCUSSION**

### **4.1 Introduction**

Chapter 3 outlines the research methodology adopted for this study. This Chapter presents the results obtained from interviews. This study employed a qualitative approach, with data collected through interviews with a purposively sampled group of experts working in the energy sector of Eswatini.

The study's objective was to explore the drivers and barriers to incremental innovation within Eswatini's energy sector. A sample size of 18 participants was selected, specifically targeting leaders from organizations in this field. However, only 14 interviews were conducted in total, as the remainder of the participants were not available for interviews.

Data was analysed thematically using an inductive approach. Individual cases were analysed according to the study's objectives and the conceptual framework adopted for the study (TOE framework). The codes generated in this process were then assigned to various categories to allow for a detailed examination of these themes. Additionally, the relationships among these themes were mapped, with each theme defined and named accordingly. The findings in this chapter are presented according to the study's objectives.

### **4.2 Overview of Cases**

This section presents the overview of the cases interviewed. The information focused on five aspects: gender, level of education, position, sector and experience. Interviewees' responses are captured in the Table 2 below. Interviewed managers were spread across the different energy companies in

Eswatini, hence giving a good representation of the different companies. All interviewees have extensive working experience and are actively involved in decision-making processes.

**Table 4: Summary of Interviewees**

| Company                             | Company A                                         | Company B                                                                      | Company C                                | Company D                                    | Company E                                   | Company F                    |
|-------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------|---------------------------------------------|------------------------------|
| <b>Sector</b>                       | Electricity                                       | Petroleum & Electricity                                                        | Electricity                              | Petroleum                                    | Electricity                                 | Petroleum                    |
| <b>Gender</b>                       | Female                                            | Male                                                                           | Male                                     | Female                                       | Male                                        | Male                         |
|                                     | Male                                              | Female                                                                         | Male                                     | Female                                       | Female                                      |                              |
|                                     | Male                                              | Male                                                                           |                                          |                                              |                                             |                              |
|                                     |                                                   | Male                                                                           |                                          |                                              |                                             |                              |
| <b>Level of education</b>           | Master of Science: Power Systems Management       | Bachelor of Electrical Engineering                                             | MBA & Bachelor of Engineering Electrical | Bachelor of Engineering Chemical Engineering | Bachelor of Technology Chemical Engineering | Bachelor of Commerce         |
|                                     | MBA                                               | Bachelor of Commerce & Accounting                                              | Bachelor of Engineering Electrical       | Bachelor of Engineering Chemical Engineering |                                             |                              |
|                                     | Master's Degree Engineering & Project Management. | Masters in Finance & Investment, Bachelor of Technology Electrical Engineering |                                          |                                              |                                             |                              |
|                                     |                                                   | Masters in Financial Mathematics                                               |                                          |                                              |                                             |                              |
| <b>Interviewee current position</b> | Engineer                                          | Regulation Manager                                                             | Head of Estate                           | Principal Energy Officer                     | General Manager Operations                  | Legal and compliance Officer |
|                                     | Legal & Corporate Scretariat                      | Tariff Specialist                                                              | Engineering Manager                      | Principal Energy Officer (Petroleum)         | Business Development Manager                |                              |
|                                     | Research & Development General Manager            | General Manager Operations                                                     |                                          |                                              |                                             |                              |
|                                     |                                                   | Petroleum Manager                                                              |                                          |                                              |                                             |                              |
| <b>Experience (Years)</b>           | 10                                                | 5                                                                              | 10                                       | 15                                           | 20                                          | 5                            |
|                                     | 20                                                | 5                                                                              | 15                                       | 12                                           | 4                                           |                              |
|                                     | 15                                                | 20                                                                             |                                          |                                              |                                             |                              |
|                                     |                                                   | 20                                                                             |                                          |                                              |                                             |                              |

### 4.3 Results pertaining to Proposition 1 (Electricity Sector Barriers)

This section presents findings and subsequent themes emerging from Proposition 1 which is the electricity sector, three themes emerging from the findings, alongside the barriers that hinder these themes, which are presented in the table below.

The information provided presents the individual interviewee's perceptions on the barriers that hinder innovation.

**Table 5: Themes of barriers to innovation from thematic analysis**

| Themes                            | Major findings/ Barriers                                                                                                                                                            |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Economic Constraints              | <ul style="list-style-type: none"><li>• Non-cost reflective and out-dated tariffs</li><li>• High capital cost</li><li>• Limited finances</li><li>• Lack of tax incentives</li></ul> |
| Policy and Regulation Constraints | <ul style="list-style-type: none"><li>• Delayed policy implementation</li><li>• Overregulation</li></ul>                                                                            |
| Human Capital Deficiencies        | <ul style="list-style-type: none"><li>• Resistance to change by incumbents.</li><li>• Knowledge gap and Skills shortage</li></ul>                                                   |

#### 4.3.1 Economic Constraints

Economic constraints emerged as a major barrier to innovation. The study findings indicate that these barriers are due to non-cost-reflective and outdated tariffs, high capital costs, limited finances, and a lack of tax incentives.

a. ***Non-Cost Reflective Tariffs and Outdated Tariffs methodology***

Non-cost reflective and outdated tariffs affect innovation in many ways. Most interview respondents highlighted that in Eswatini it was a significant barrier within the energy sector due to the limited investment capacity stemming from

the country's small economy, the tariffs that are not cost-reflective and outdated are supposed to cater for the investments. Additionally, this limitation is worsened by the fact that Eswatini has a low household GDP, which inadvertently fails to get approval for cost-reflective tariffs despite the electricity tariffs approved for utilities in the electricity sector.

In support, participant 1 indicated that:

*“Our economy’s current limitations that stem from its relatively small size indicate that it is not capable of fully absorbing the true cost of electricity, resulting in lower electricity prices. If the country were rooted on a stronger economy with a more diversified industrial base beyond a general service-based model, it would likely offer more scope for incremental innovation in the electricity sector”*

In the same vain, participant 3 stated that:

*“There is very little you can do to invest in innovation in the energy sector, as revenue collected is limited by the economy, and made worse by the fact that energy companies usually do not get proposed tariffs”*

This is an indication that the scale of the economy has a significant influence on shaping the strategic direction that companies adopt. Despite the economy being a major player in advancing innovation, the government also affects channelling innovation.

Participant 7 stated that:

*“The regulator has academically and theoretically tried to be independent, however, the government has been seen at times in the past to interfere with a tariff award, because the people cannot afford the proposed prices. The main reason why it is not awarded at the right prices. The environment is without certainty, as tariffs that cover production and marginal costs are*

*not awarded as per the need due to government interference, So it's a problem."*

Some of the participants highlighted the use of out-dated tariff methodology to be another barrier as it is based on the current utilities vertically integrated structure, despite emerging methodologies. This distortion in tariff setting serves as a hiccup, as it does not reflect the true representation of the actual costs associated with production and distribution of electricity.

Participant 7 emphasised that:

*"The current methodology, or rather maybe before I get there like in terms of tariff setting, we are actually guided by principles set out in the type of methodology. So, the tariff methodology is a legal document that actually has the various principles that are necessary for price setting. The one we have was developed in 2011, which only focused on the old structure, which was easy at the time. And that this structure is no longer in line with our revised market structure."*

Therefore, further, discouraging investment in the energy sector and hinder the country's ability to move with the trends in the global energy transition.

b. ***High capital costs, limited finances and lack of incentive in the energy sector***

The energy sector is capital-intensive; therefore, access to finances for businesses is paramount for sustainability and growth. The majority of the respondents emphasised that the lack of resources hampers the ability to develop a sustainable energy sector swiftly, especially with socio-economic challenges that limit the allocation of necessary resources for innovation and infrastructure development. This creates a bottleneck for sustainable energy sector advancements. Several respondents stated that the government's failure to provide adequate funding results in developers facing financial limitations, and

the burden falls on consumers who are already financially strained. Most of these entities resort to acquiring loans from financial institutions. However, the loans conditions are not favourable as the government fails to provide guarantees to local companies, which hinders the advancements and development in the energy sector.

Participant 4 brought into light that:

*“Our government is not able to provide guarantees for companies to access funding, because of the poor state of our economy, and a lot of companies rely on that for bankability”.*

Similarly, participant 4, highlighted that:

*“The government has other priorities, availing finance for the energy sector capital intensive projects for development is least of her worries.”*

The lack of proper funding and financial empowerment significantly affects the energy sector, resulting in staggered growth, no improvements, and less efficiency.

Some respondents also highlighted that the lack of tax incentives serves as a hurdle for development, which is crucial for stimulating investment (investors) in the energy sector. Participant 3 stated that “tax incentives is crucial as it reduces the financial burden on businesses and individuals, for instance, making renewable energy projects economically viable and promoting broader participation in the clean energy transition”. Overall, such tax incentives lower costs and drive innovation and investment in sustainable energy solutions.

Participant 7 in the sector highlighted this issue, stating that:

*“Our policies in the energy sector lack incentives. Potential investors often inquire about available tax-related incentives, but the response is consistently, “Please go and ask the Ministry of Finance or get in touch*

*with the Eswatini Revenue Services (ERS)." The reality is that there are no such incentives. However, we continually advise people to use energy efficiently. I believe that many of our policies are not conducive to facilitating certain developments in the sector."*

Likewise, participant 1 stated that:

*"It is so disappointing that we lack similar policies with SA that incentivise for initiative driving or promoting the efficient use of energy, to allow business have tax breaks, that would attract more business to invest in terms of innovation on the energy sector"*

The absence of tax-related incentives in Eswatini's energy sector discourages innovation, making investments and stifles development. Presenting a significant barrier to attracting investment and enhancing energy efficiency.

#### **4.3.2 Policy and Regulation constraints**

To assess the policy and regulatory constraints emerging from proposition 1, the researcher established contributory factors to the barriers to incremental innovation in the energy sector. The study participants' responses indicated that they were due to delay in policy implementation and overregulation.

##### **a. *Delay in policy implementation***

In light of the National Energy Policy (NEP), which emphasises energy access and the promotion of renewable energy, participants have noted significant challenges in implementation. These challenges often stem from policy complexities and bureaucratic red tape that can delay progress. Delays in execution and lack of decision-making have been identified as barriers to effective policy implementation.

Participant 4 explained that:

*“I really don't think we innovate quickly enough, and part of the problem is that we are not agile enough even when we develop solutions. We don't implement them quickly enough, to then go through the cycle of assessing the impactable solution, assessing the changes in the environment and then coming back to possibly further find opportunities for incremental innovation because if we don't implement quickly enough, then essentially, we can't move on otherwise”*

The same sentiments were shared by participant 3, who stated that:

*“Most of the policies were developed in 2018, by design they are subject to review every 5 years, the next review was supposed to be done last year, but it hasn't happened, so as such, we find that most the policy positions are outdated. I think incremental innovation in that instance will speak to updating and reviewing those policies, to ensure that they are up to date”*

Furthermore, the frameworks that have been developed have not been implemented because of inadequate policies. The frameworks cannot function optimally without corresponding policies in place because they are essentially structured approaches that guide the implementation of policies. This interdependence highlights the necessity for coherent policy development that aligns with established frameworks.

Participant 7 highlighted that:

*“We have developed frameworks, and they had to be put on the shelves and wait for the parent Ministry to have a policy that will enable developed framework to work. It takes time for policies to be developed and implemented”*

Participant 9 stated that:

*“Policy approvals are being delayed by the government, and we know that the pace at which the government executes is generally slow, therefore affecting the level of improving the frameworks utilise in the sector as a way of incremental innovation”*

Without a conducive policy environment, potential investors are discouraged from entering the market.

b. **Overregulation**

Eswatini’s regulatory landscape has significantly impacted investment decisions, particularly in the energy sector. The assertion that "the regulation of the country is too much" by participants reflects a growing concern among investors who face barriers when trying to engage with local incumbents for energy supply. Some participants stressed that this situation complicates efforts to enhance energy security, which is increasingly critical for obtaining balanced economic growth with sustainable practices. Participant 5 noted that *“excessive regulation has deterred potential investors due to the complexities and costs associated with compliance.”* Notably, investors often seek environments where they can engage directly with local suppliers without navigating cumbersome regulatory frameworks.

In support, Participant 2 stated that:

*“Investors currently face significant challenges due to the mandated competitive bidding process for the participation in electricity sector in particular in generation space, limiting them to engage directly with incumbents.”*

Excessive regulatory requirements in the energy sector causes too many red obstacles for potential entrants leading to lengthy permitting processes. These obstacles impede incremental innovation and investment by imposing

unnecessary burdens on startups and small businesses, thereby diverting resources away from core activities.

#### **4.3.3 Human Capital Deficiencies**

To assess Human Capital Deficiencies, the researcher sought to establish contributory factors to the barriers to incremental innovation in the sector. The participants' responses indicated that it was due to incumbents' resistance to change, a knowledge gap, and a skills shortage.

##### **a. *Resistance to change by incumbents.***

Resistance to change is a significant hindrance stemming from deeply ingrained organisational cultures that prioritise stability over innovation. Some of the participants explained that many organisations may feel threatened by new processes or technologies, which often leads to reluctance to embrace change.

The study's findings reveal that in the electricity sector, incumbents exhibit significant resistance to new models or tariff methodologies, particularly regarding the segmentation of financial models for generation, transmission, and distribution. These incumbents express scepticism about the necessity of such changes, questioning how these reforms would benefit the country's small economy. Their primary focus remains the protection of their existing market positions and current operational models.

Participant 11 expressed that:

*“For the revised proposed tariff structure, henceforth, incumbents need to implement four financial models—one for each segment—along with supporting documentation for each of those segments. Therefore, it is going to be a hectic process; the resistance comes from there. People are comfortable with the way the systems are currently run without introducing any new changes.”*

Participants 8 shared the same sentiment in that:

*“It will be expensive for consumers if we change current model of tariff methodology, as it might prove to be resource wasteful exercise as we know we make energy affordable”*

Therefore, new entrants with innovative solutions might struggle to gain traction due to entrenched interests and a lack of support from major industry players who prefer maintaining their existing business models.

b. ***Knowledge gap and skills shortage***

Some participants revealed that the culture within the energy sector has been unsatisfactory, as it lacks the fundamental elements of strategic agility necessary for innovation. Participants believed that the energy sector tends to develop solutions and cling to them for an extended period despite operating in a constantly evolving environment.

Participant 4 thought that:

*“I believe we have not yet developed a culture or the skills necessary for continuously scanning our environment and engaging in ongoing trade, which are essential for sustaining incremental innovation. Overall, it seems that we lack the strategic agility—both in skills and culture—that is required to achieve this.”*

In support, participant 8 mentioned that:

*“There is no growth in not exploring innovative solutions, biggest issue is knowledge gap, our neighbours are far ahead”*

Participants also emphasised that the lack of adequate skills and limited understanding of the current RETs’ in the energy sector has resulted in the slow development and missed opportunities for enhancing efficiency. Eswatini relies

heavily on neighbouring countries, particularly SA to introduce new technologies, as they are deemed as experts, before adopting these innovations locally. Additionally, participants opined that the dependency on external sources created a cycle of underdeveloped local capacities, which adversely impacts development as it fosters knowledge gaps.

In support of this observation, Participant 12 emphasised:

*“Another issue is that I don’t know if we have the adequate skills within the country to effectively address all the challenges we face. If we had the funding and wanted to innovate by building a new coal-fired power station, do we possess the necessary skills to accomplish this? The country lacks sufficient technical expertise to drive the innovation we seek.”*

Participant 10 expressed support by stating that:

*“The reason we lack any form of innovation in the energy sector is that we lack exposure and capacity building”*

This underdevelopment leads to missed opportunities for enhancing efficiency, which negatively impacts the overall economic growth by limiting domestic innovation and hindering the country's goal to achieve energy self-sufficiency by 2030.

#### **4.4 Results pertaining to Proposition 1 (Petroleum Sector Barriers)**

This section discusses findings and subsequent themes emerging from Proposition 1 petroleum sector. Four themes emerged from the findings of the study and are as follows:

1. Policy and Governance Challenges
2. Economic constraints

3. Resource limitations
4. Knowledge and information gaps

#### **4.4.1 Policy and Governance Challenges**

Policy and governance challenges often affect innovation. Some participants believed that slow changes to policy adjustments hinder innovation within the sector, with participant 8 indicating that in Eswatini, most politicians “*focus was on serving the interests of their respective constituents rather than developing the energy sector*”. This focus leads to trivialised decision-making driven by a lack of knowledge and personal gain, which undermines the sector’s integrity and stalls progress. In addition, participants stated that the protracted process of developing operational frameworks delays implementation, while poor decision-making has led to inadequate project coordination, rendering the sector inefficient and causing it to miss out on valuable opportunities. Despite numerous changes in the sector over the recent years, it continues to lag and struggles to advance. Consequently, the parliamentary decision-making and approval processes take considerable time to finalise.

Participant 7 highlighted this issue by stating that:

*“The process of establishing a framework and ensuring that regulations are approved takes about 3-5 years to pass through Parliament; it is a significant stumbling block.”*

In a similar manner, participant 11 noted that:

*“Politicians do not understand the consequences of their actions when some policies are not approved on time”*

Participant 13 expressed support by stating that:

*“We have allowed the politicians to have too much control, Technocrats are not given much voice in Eswatini, yet they lack the technical understanding, limiting their decision making, compromising innovation in the process and prioritising their own interest for popularity”*

Participants further indicated that due to either delayed policy adoption or delayed decision making, the sector is overregulated. These excessive regulations have stifled innovation and slow down the necessary changes.

Participant 6 highlighted that:

*“New regulators are formed to oversee various ministries, which leads to increased public spending. Once established, these regulators feel compelled to demonstrate their effectiveness, often leading to excessive regulation, making it difficult for investors to come and setup.”*

In a comparable way, participant 5 expressed that:

*“Everything just generally takes time, there is too much approval processes and paperwork. Too many people that you need to convince, the energy sector is overregulated”*

Challenges in policy and governance make it hard for small improvements to happen (i.e. incremental innovation) because the environment isn't supportive. Slow decision-making and alleged focus on individual benefits instead of group progress make things worse. These challenges result in to delays in the implementation of important plans into action, thereby limiting growth and development within the sector, which limits growth and development in the sector.

#### **4.4.2 Economic Constraints**

Participants in the study consistently observed that the country's economy is relatively small (i.e., people cannot afford) and predominantly characterized as a

consuming economy. This limited economic size poses significant challenges to growth and resource allocation, hampering the introduction of innovative ideas.

Several participants highlighted that new ideas often struggle to gain traction due to insufficient government support. Specifically, the lack of guaranteed markets for new products discourages investment. Without a stable market environment, potential investors are hesitant to commit resources to innovative projects, leading to stagnation in economic development.

Another critical observation from participants was the limited opportunities for investment in infrastructure. Although borrowing funds is theoretically an option, many private businesses lack the financial resources to pursue infrastructure projects. This financial constraint further exacerbates the challenges faced by entrepreneurs and innovators within the economy

Participant 11 cited a specific example related to government initiatives:

*"The government piloted a collaboration project with a sugar belt company to blend all vehicle fuel with ethanol. However, it failed to enact legislation that would make this blending mandatory, thus preventing the establishment of a guaranteed market for the company. As a result, there was no incentive for the company to invest in expansion"*

Along the same lines, participant 5 mentioned that:

*"Unfortunately, we do not have the money, which limits the funding for innovative solutions, because it is not economically viable to pursue such innovative projects."*

These economic constraints subsequently hinder innovative ideas' advancement, stemming from insufficient government support and the absence of guaranteed markets to ensure viability.

#### 4.4.3 Resource Limitations

Most participants highlighted that in Eswatini's petroleum sector, the scarcity of resources, especially crude oil and natural gas, significantly limits opportunities for innovation, particularly in energy production capabilities. The country's heavy reliance on imported petroleum products and limited commercial storage capacity pose substantial risks to supply stability. Furthermore, participants expressed concerns that the lack of development stemming from this resource scarcity diminishes the attractiveness of investing in infrastructure within the sector. This situation is exacerbated by the high costs associated with such investments, particularly given Eswatini's small economy and its largely consumption-driven nature.

The debate over whether to invest is provocative; participants expressed that investments might become obsolete before any return on investment is realised, as global policies to which Eswatini subscribes discourage investment in fossil fuels. Additionally, participants emphasised that deficiencies in infrastructure hinder operational efficiency and service delivery, resulting in a stagnation of innovation.

Participants also pointed out that it is worth noting the limited availability of expertise and skilled personnel in the sector. The relatively small workforce further affects decision-making processes, as insufficient competent resources can effectively implement informed decisions.

Participant 8 highlighted this issue by stating that:

*“We don’t have crude oil, but we have plenty of coal we can have the same products similar to SASOL, we can produce petroleum products.”*

Similarly, participant 14 expressed that:

*“We don’t have access to natural resources such as crude Oil, there is not much we can innovate in the petroleum sector as we rely on imported products.”*

This indicates that resource limitations, such as uncertainty and the unavailability of raw materials for commercialisation, can hinder incremental innovation in the sector.

#### **4.4.4 Knowledge and Information Gaps**

Knowledge and information are key drivers in innovation. a major concern amongst the study’s participant was the fact that a number of individuals working in the sector are resistant to change, preferring conventional operations. When changes are proposed, there is often resistance due to fear of the unknown. In some instances, current processes are favoured over new approaches due to the uncertainty that change brings. During these periods of transition, most of the managers were swamped with misconceptions from subordinates.

The study participants observed that the sector's strategy of consulting experts often proves unfruitful. This ineffectiveness was noted and stems either from the biased selection of participants in benchmarking exercises/consulting experts or from conducting these exercises within organizations that are lagging organisations. Participants noted that qualified candidates are frequently overlooked and excluded from critical discussions, leading to a reliance on incomplete information from the teams involved in these benchmarking activities. Consequently, if key teams capable of delivering effective solutions are excluded, catching up through mere imitation or path following becomes impossible. This exclusion creates a persistent grey area that ultimately limits innovation within the sector.

Participant 13 highlighted this issue:

*“A person took a photo behind a large tank in Texas during a benchmarking trip for the construction of a petroleum reserve we want to build in the country. I asked about its capacity, whether it has a floating or fixed roof, its throughput, and other features. Those are questions he could not answer, which justifies my assertion that the country remains unexposed. However, they would claim they are conducting benchmarking.”*

Participant 10 in the same vein, narrated that:

*“As a country, we do not have adequate knowledge, skill sets to effectively address the situations we are facing as a country.”*

Without objective selection criteria or a transparent framework for selecting candidates, bridging the knowledge and information gap becomes difficult. This can diminish the value of information sessions and limit incremental innovation in the energy sector.

#### **4.5 Results pertaining to Proposition 2 (Electricity Sector Drivers)**

This section presents findings and subsequent themes emerging from Proposition 2 electricity sector, two themes emerged from the findings, alongside the drivers that encourage these themes, which are presented in the table below.

The information provided is a presentation of the individual interviewee's perceptions on the drivers that encourage incremental innovation.

**Table 6: Themes of drivers to incremental innovation from thematic analysis**

| Themes              | Major findings/ Barriers                                                                                                |
|---------------------|-------------------------------------------------------------------------------------------------------------------------|
| Sustainable finance | <ul style="list-style-type: none"><li>• Governance</li><li>• Financial Structures for sustainable development</li></ul> |
| Empowerment         | <ul style="list-style-type: none"><li>• Inclusive education</li><li>• Technological Integration</li></ul>               |

#### **4.5.1 Sustainable Finance**

Sustainable finance emerged as a major driver to incremental innovation. The study findings indicate that these drivers are due to Governance and Financial Structures for sustainable development.

##### **a. Governance**

Governance plays a crucial role in ensuring stability within Eswatini as it provides a conducive environment for businesses to thrive in as attested by some of the interviewees. In turn, this enables the energy sector to be transparent with regards to processes and how decisions are made on issues that affect the citizens.

Participant 6 was of the view that:

*“There is stability in Eswatini. If there is stability in eSwatini, it means you can implement your plans for that predefined period without worrying that a change in the head of state, nothing might alter how things are done on the ground. This ensures that long-term projects can be executed without concern over leadership changes.”*

Along the same lines, participant 11 mentioned that:

*“With good governance the sector can thrive and allow for more innovation in the sector.”*

Effective governance, characterized by transparency, accountability, and innovation, is crucial for fostering stability, facilitating successful economic planning and execution, and driving sustainable development through innovative solutions.

b. ***Financial structures for sustainable development***

A common observation amongst the interviewees was that effective governance plays a crucial role in promoting economic growth and ensuring the equitable distribution of resources. Participants elaborated on the existing energy policy which addresses the availability of funds to assist with energy access for all the citizens. It was noted that the on-going liberalisation in the energy sector has led to significant changes, such as the development of revised and new policies. Notable examples from interviewees include the revised energy policy, the IPP policy, and the short-term generation plan. These initiatives have fostered incremental innovation by establishing stringent targets. Consequently, regulatory frameworks and standards have been developed to ensure fair opportunities for participants, transparency in tariffs and introduced competition, particularly for new entrants in the market.

Participant 5 emphasised that:

*“Another significant driver has been the fund established from recouping 2.5% of revenue from every unit of electricity sold. This fund is dedicated to financing electricity projects, including rural electrification and other initiatives. The funding for rural electrification promotes energy access for marginalized communities, particularly those affected by economic disadvantages. This initiative stemmed from the policies currently in place”*

In similar manner, participant 6 expressed that:

*“The energy policy with a mandate to create the fund has allowed Eswatini to help underprivileged communities to have access to electricity”*

Sustainable development financial structures facilitate equitable resource distribution through dedicated funds from electricity revenue that improve energy access for marginalised communities. Meanwhile, the liberalisation of the energy sector—supported by innovative regulatory frameworks—enhances competition and innovation.

#### **4.5.2 Empowerment**

To assess the Empowerment theme, the researcher sought to establish contributory factors to the drivers of incremental innovation in the electricity sector. The participant's responses indicated that it was due to Inclusive education and Technological integration.

##### **a. *Inclusive Education***

Collaborative efforts across the energy sector are crucial as they promote inclusivity and alignment with activities in this particular sector. Participants emphasised the need for clear communication among the stakeholders involved, as they are well-educated about industry dynamics, including the reasons behind certain decisions and the processes through which these decisions are made. This understanding was crucial to avoid implementing changes without adequate feedback and buy-in from all parties. Whether the changes are small or large, all stakeholders are involved. This alignment in education and information symmetry, to the extent possible, ensures that decisions are made based on facts.

In support, participant 7 expressed that:

*“We recently reviewed our grid code, and we had to ensure that there is capacity building for the stakeholders. Stakeholders needed to understand the*

*role of a network operator, as this knowledge enables them to contribute meaningfully to the grid. We also use periodic webinars with the aim to inform and educate participants about the industry as we move forward. Each session features industry experts who discuss specific topics affecting the sector. Additionally, these webinars serve as a platform for gathering feedback from stakeholders and generating ideas from the public on how to address certain challenges.”*

Similarly, participant 11, submitted that:

*“Stakeholders must be well-informed about the industry's current state, including key drivers and challenges. This shared understanding will facilitate the adoption of incremental innovations, as stakeholders are ultimately the users of these solutions.”*

This implies that a collaborative and communicative approach, where stakeholders are educated and aligned to ensure that all changes—whether small or large—are made with full understanding and buy-in from all parties involved, assist the energy sector in incremental innovation.

b. ***Technological Integration***

The research participants highlighted the significance of learning from the experiences of others, particularly their mistakes, as a crucial strategy for minimizing risks and optimizing outcomes in various contexts. They emphasised that failures should not be perceived merely as setbacks; rather, they should be regarded as valuable lessons that inform and guide future endeavours. This perspective is particularly relevant in the context of adopting new technologies aimed at enhancing performance and expediting processes to align with energy policy objectives.

Technological integration is crucial for fostering innovation in the energy sector, especially as the global focus shifts toward sustainable energy solutions. The rise

of 4IR has spurred significant advancements in RETs', allowing energy sectors to improve efficiency and lower carbon emissions. Innovations such as artificial intelligence (AI) for predictive maintenance in wind and solar systems, smart grid technologies, and energy storage solutions are revolutionising energy production and consumption. These advancements enhance operational efficiency and support the incorporation of variable renewable energy sources into existing power grids, facilitating a transition to a low-carbon future.

Various stakeholders, including government entities, regulators, and existing industry players, are actively engaged in developing solutions to address shortfalls in the energy sector. This collaborative approach not only fosters innovation but also enhances understanding of the industry's multifaceted challenges.

By working together, these stakeholders can identify and implement potential solutions that are scalable and effective. This is crucial for meeting the growing global energy demand while adhering to climate goals. Through shared expertise and resources, they can create a more sustainable and resilient energy landscape for the future.

Participant 9 articulated sentiments by stating that:

*“People are learning from the challenges of wind generation, including whether there is sufficient space and appropriate technology available. Studies are being conducted to assess the viability of wind energy in the country. One of the primary objectives is to facilitate the transfer of technology and information from other countries and regions to evaluate what solutions are feasible and effective.”*

Participant 2, highlighted that:

*“In, future will see more of incremental innovation, for instance, will so more smart grids, to assist in regulating power usage as part of improving energy utilisation efficiently.”*

Facilitating for technology transfer from other regions is crucial for fostering innovation in the energy sector of Eswatini, as it encourages collaboration among stakeholders.

## **4.6 Results pertaining to Proposition 2 (Petroleum Sector Drivers)**

This section discusses findings and subsequent themes emerging from Proposition 2 for the petroleum sector. Three themes emerged from the findings of the study and are as follows:

1. Alignment with Global Sustainability Policies
2. Economic Stability and efficient Debt Management
3. Inclusive Policy and Regulatory Framework

### **4.6.1 Alignment with Global Sustainability Policies**

Participants emphasised that Eswatini's engagement on Global Sustainability Policies, including the Paris Agreement (2015), Kyoto Protocol (2005), and Kigali Amendment (2016), represents a significant step forward in addressing climate change. This commitment aligns with international efforts to mitigate global warming and reduce greenhouse gas emissions and brings substantial benefits to the country. By actively participating in global climate agreements, Eswatini has attracted investments in low-carbon technologies and sustainable practices across various sectors, such as energy, agriculture, and waste management. These efforts contribute to mitigating climate change, fostering job creation, and stimulating local economies.

Eswatini has committed to sourcing 50% of its energy from renewable sources by 2030, aligning with international climate agreements. This commitment is expected to enhance the country's reputation in global markets and attract foreign investment, particularly in the transportation sector, where the integration of renewable technologies is being explored. Such efforts emphasise innovation within the energy sector and contribute to the overall goal of reducing greenhouse gas emissions

Participant 3 in support mentioned that:

*“For incremental innovation in the country in the electricity and petroleum sectors, a lot can happen to alleviate because of the emerging technologies that are coming in the sector”*

Participant 8, expressed that:

*“As a result of policy changes aligning with global trends, we have seen initiatives encouraging energy transition, which lead to more incremental innovation in soft infrastructure, such as evolving policies.”*

Integration of Global sustainability policies into local policies breaks barriers and catapults policy development to “leapfrog” and remain relevant to emerging trends that foster incremental innovation in the energy sector, while allowing for broader participation from various stakeholders.

#### **4.6.2 Economic Stability and Efficient Debt Management**

Economic stability and efficient debt management are key factors for enhancing innovation in the energy sector. The energy sector is capital intensive, requiring a stable economy to function effectively, as evident in Eswatini. Participants believed that despite the country's small economy, its consistent and timely debt payments indicate a stable economic environment.

In another vein, participants believed that having a fund derived from petroleum taxes and levies was crucial for ensuring fuel supply in the country and servicing associated debts. The taxes collected from motorists in this sector help mitigate significant shocks due to global fuel price fluctuations. These funds have also been successfully used to establish a state-owned enterprise, ENPC, which serves to ensure an efficient petroleum supply in the country.

Participant 13 noted that:

*"It is very easy for Eswatini to attract foreign direct investments because when investors examine the country's profile regarding debt servicing, it is truly impressive."*

Similarly, participant 9 expressed that:

*"The strong financial performance of Eswatini is a result of a well-balanced economy, which enables the country to borrow money, as demonstrated by the ongoing projects funded by the World Bank."*

When a country's economy is stable, it's easier for new ideas and inventions to flourish. This happens because the country can build strong systems, educate its people, improve its roads and internet, and create more advanced markets. At the same time, the country needs to manage its debts well. This ensures the country can pay its bills in the long run and helps the economy grow. Good debt management makes it cheaper for the country to borrow money, gives it more options for making policies, and makes the economy work better overall. If all is occurring concurrently, it creates a positive cycle that leads to long-term economic growth.

#### **4.6.3 Inclusive Policy and Regulatory Framework**

Most participants emphasized that well-established policies and regulations facilitating the involvement of diverse stakeholders are crucial for petroleum

sector development. These frameworks act as catalysts, significantly encouraging private sector participation, particularly from financial institutions and pension funds that have demonstrated a keen interest in investing in this industry.

The participants further underscored the importance of transparency, as it contributes to enhanced efficiency and sustainability within the industry. They noted that transparency is vital for fostering competition and innovation. By ensuring stakeholders are informed about regulatory processes and decisions, transparency builds public trust and encourages broader participation in policymaking. Promoting an environment where information is readily available and accessible allows stakeholders to understand market dynamics better, leading to more informed decision-making. This participatory approach not only empowers stakeholders but also enhances the overall governance structure of the petroleum sector, enabling adaptive strategies that respond to emerging challenges and opportunities.

Participant 11 articulated this sentiment as follows:

*"You can't innovate unless you know what needs to be innovated. Knowledge sharing or collaboration is the solution to overcoming barriers. Another enabling factor is policy, if your policy or regulation stifles innovation, then you're not going to see much innovation in the sector."*

In the same manner, participant 2 expressed that:

*"It is important to consult before policies come into effect. The energy sector can continue to improve if local stakeholders are involved in the development of policies and regulations."*

A participatory approach to governance is essential for developing adaptive strategies that effectively tackle emerging challenges and seize new

opportunities within the sector. This approach enhances efficiency and sustainability while fostering competition and innovation. By incorporating incremental innovations, organisations can gradually improve processes, allowing for continuous adaptation without the risks associated with radical change.

#### **4.7 Summary of the results/findings**

The analysis identified twelve key themes impacting incremental innovation in Eswatini's electricity and petroleum sectors, with seven highlighting barriers and five focusing on drivers. Economic limitations significantly restrict innovation, as outdated financial models and a small market size hinder cost-reflective tariffs, limiting stakeholder participation. Additionally, a non-conducive policy environment lacking supportive policies and timely implementation, combined with overregulation, impedes new entrants. Organisational culture fosters resistance to change, and the absence of strategic agility causes reliance on outdated solutions. Skills shortages and knowledge gaps further exacerbate challenges, collectively constraining innovation within the energy sector.

Conversely, effective governance emerged as a crucial driver for innovation, fostering robust financial frameworks that promote sustainable development and equitable resource distribution. Participants emphasised the importance of inclusive education and technology integration to enhance the sector's capacity and efficiency. These drivers provide pathways for overcoming existing barriers and advancing incremental innovation to improve energy sector performance in Eswatini.

## 4.8 Comparison of literature review and own findings

**Table 7: Comparison of the literature review and findings**

| RQ # | State Research Objectives                                                      | Prop # | State Proposition (literature review response to RQ)                                                                                                                | Findings from own study                                                                                                                                                                                                                                                                                                           |
|------|--------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | To investigate incremental innovation constraints in Eswatini's energy sector. | 1      | Barriers to incremental innovation in the energy sector comprise financial constraints, outdated policies and inadequate regulatory frameworks, and knowledge gaps. | <p>Policy and Governance issues that hinder effective regulatory frameworks include policy delays and overregulation.</p> <p>Economic constraints due to a small economy limit investment because of non-cost-reflective, outdated tariffs, high capital costs, unstable markets, and a lack of investment in infrastructure.</p> |

| RQ # | State Research Objectives                                                                    | Prop # | State Proposition (literature review response to RQ)                                                                                                                           | Findings from own study                                                                                                                                                                                                                  |
|------|----------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |                                                                                              |        |                                                                                                                                                                                | Resource limitations affect the availability of necessary materials and infrastructure.                                                                                                                                                  |
|      |                                                                                              |        |                                                                                                                                                                                | Knowledge and information gaps that obstruct access to critical data for decision-making.                                                                                                                                                |
|      |                                                                                              |        |                                                                                                                                                                                | Human capital deficiencies such as resistance to change and skills shortages.                                                                                                                                                            |
| 2    | To determine the factors that drive incremental innovation in the energy sector of Eswatini. | 2      | The factors that drive incremental innovation in the energy sector include financial considerations, compliant policies and regulations, and the capacitation of stakeholders. | Sustainable finance integrates governance and financial structures that enhance stability and resilience through mechanisms that ensure consistent debt repayments and the establishment of dedicated funds for sustainable development. |

| <b>RQ #</b> | <b>State Research Objectives</b> | <b>Prop #</b> | <b>State Proposition</b> (literature review response to RQ) | <b>Findings from own study</b>                                                                                                      |
|-------------|----------------------------------|---------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
|             |                                  |               |                                                             | Empowerment through inclusive education and technological integration.                                                              |
|             |                                  |               |                                                             | The alignment with global sustainability policies and the development of inclusive regulatory frameworks for sustainable practices. |

## **CHAPTER 5. DISCUSSION OF FINDINGS**

### **5.1 Introduction**

This chapter discusses the findings within the context of the literature review presented in Chapter 2 and the results from Chapter 4 of this qualitative research. The study's propositions concerning the findings from the questionnaire are discussed on a section-by-section basis.

### **5.2 Discussion pertaining to Proposition 1**

This section discusses the findings related to Proposition 1, which identifies the barriers to incremental innovation in the energy sector. These barriers include:

1. Financial constraints
2. Outdated policies and inadequate regulatory frameworks
3. Knowledge Gap.

The objective of the study was to investigate the barriers/constraints on incremental innovation in Eswatini's energy sector.

#### **5.2.1 Financial constraints**

The findings strongly align with existing literature regarding financial constraints. The results reveal that Eswatini's economy is relatively small and consuming. The approval of non-cost-reflective tariffs limits the electricity sector's revenue. This limitation primarily arises from the cross-subsidization of domestic tariffs by contributions from commercial customers (i.e. commercial customers are charged more than domestic customers in awarded tariffs). While this approach aims to make electricity affordable for low-income households, it simultaneously

deters potential investors who seek reasonable returns on their investments, particularly given that the energy sector is capital-intensive.

Furthermore, the current tariff structure is outdated and was established during a time when the EEC was the sole electricity provider. This structure does not align with recent market reforms and further exacerbates the challenges related to investment. As a result, new investors are discouraged from entering the market because the existing tariff methodology favours a vertically integrated utility, thereby restricting participation in various segments such as generation, transmission, and distribution.

However, the petroleum sector faces similar financial challenges, particularly due to the lack of guaranteed and stable markets. This instability discourages investment, as the uncertainty surrounding returns on investment limits opportunities for incremental innovation. Additionally, private businesses often lack the financial resources to pursue infrastructure projects.

Beyond financial constraints, there is a notable lack of government subsidies or funding, insufficient government guarantees, unfavourable loan conditions, and a general absence of incentives for innovation. Liubkina, Murovana, Magamedova, Siskos, and Akimova (2019) argue that without a robust financial incentive system and adequate support mechanisms, innovation in the energy sector will remain constrained. This perspective aligns with the environmental context of the TOE framework, which emphasises that government policies, market structures in the energy sector, and support infrastructure play a critical role in shaping and adopting innovation at the firm level. Similarly, Al-Hujran, Al-Lozi, Al-Debei, and Maqableh (2018) highlight how environmental factors can stifle innovation, creating conditions that are not conducive to fostering advancements across various sectors, including the energy sector.

### **5.2.2 Outdated policies and inadequate regulatory frameworks**

The research findings indicate that the current legislation is inadequate due to inherent policy complexities and delays in implementation. The parliamentary decision-making and approval processes for policies take considerable time to finalise, leading to incoherence across different policies and an overall failure to address frameworks that discourage market entry in the energy sector.

Furthermore, bureaucratic obstacles and cumbersome regulatory frameworks hinder innovation and investment by imposing unnecessary supplier demands. As highlighted in the literature review, these regulatory hurdles often stem from a lack of long-term policies, outdated policies, complex permitting processes, and misaligned or conflicting regulations at various levels of government (Oduro, Uzougbo, & Ugwu, 2024). This perspective is consistent with the environmental context of the TOE framework, which identifies government policies and regulations as one of the key influences for innovation adoption; however, in this case, it is a barrier to incremental innovation in the energy sector of Eswatini (Al-Hujran, Al-Lozi, Al-Debei, & Maqableh, 2018).

### **5.2.3 Knowledge gap**

The findings reveal a significant knowledge gap in Eswatini's energy sector, which is largely attributed to the country's heavy reliance on neighbouring countries for technological advancements. This dependency is further exacerbated by shortages in local skills. Eswatini imports most of its electricity from SA, underscoring a critical reliance on external sources. Such dependence restricts opportunities to improve local efficiency and limits incremental innovation within the energy sector.

This observation aligns with the TOE framework, which emphasizes that the availability of technology, whether internal or external, affects innovation adoption at the firm level (Awa & Ojiabo, 2016). The framework also highlights the

importance of human resource competencies in identifying suitable technologies for organisational operations and managing their implementation complexity. In this study, the technological context emerges as a barrier due to Eswatini's reliance on imported technology and a lack of local skills to drive innovation hinder incremental innovation initiatives in the process.

Simbaña-Taïpe et al. (2021) similarly note that knowledge gaps are significant obstacles to innovation, which is essential for fostering a competitive economy. These findings are consistent with existing literature that underscores the detrimental impact of knowledge deficiencies on technological progress and economic competitiveness.

The significant challenge of resistance to change within organisations is often driven by deeply ingrained cultures that prioritise stability and comfort over innovation, thereby promoting change aversion. This phenomenon was particularly noticeable in the electricity industry, where established companies frequently exhibit a reluctance to adopt even incremental innovations that could enhance operational efficiency and sustainability. These companies perceive changes as threats, leading to a defensive stance against new ideas and processes. This resistance highlights how organisational culture can stifle innovation.

The resistance to change aligns with the organisational context element of the TOE framework, which posits that organisational culture influences decision-making related to the implementation and adoption of innovations (Awa & Ojiabo, 2016). A supportive organisational culture, combined with effective leadership, significantly enhances the drive for organisational innovation. Consequently, a culture resistant to change hinders incremental innovation, as observed in the study.

The study findings also resonate with Innovation Resistance Theory, as articulated by Ram and Sheth (1989, as cited in Sadiq, Adil, and Paul, 2021). This

theory postulates that individuals resist innovation due to rational assessments and behaviours, often stemming from concerns about disrupting the status quo and established belief systems.

#### **5.2.4 Resource limitations**

The study findings reveal that the petroleum sector in Eswatini lacks indigenous resources of crude oil and natural gas, which significantly constrains innovation in energy production. This constraint is aggravated by the country's heavy reliance on imported petroleum products and limited commercial storage capacity. Consequently, this situation poses substantial risks to supply stability and discourages investment due to high costs and the small, consumption-driven nature of the economy.

Additionally, the ongoing global transition away from fossil fuels introduces further complexities into investment decisions, raising concerns that investments may become obsolete before generating adequate returns. This observation is consistent with the literature, which identifies the underdevelopment of Eswatini's upstream oil industry due to the absence of domestic crude oil and natural gas resources (MNRE, 2018). The global energy transition influences Eswatini's energy sector and its environmental policies by necessitating governmental regulations across various sectors, including energy, to align with global policies. Demonstrating alignment with the TOE framework in the environmental context, particularly in its adherence to global policies, has created challenges that impede the adoption of incremental innovation within the energy sector studied. This is a testament to the fact that the environmental context influences the adoption of innovation in organisations (Bany Mohammad, Al-Okaily, Al-Majali, & Masa'deh, 2022).

## **5.3 Discussion pertaining to Proposition 2**

This section discusses the findings related to Proposition 2, which identifies the drivers of incremental innovation in the energy sector. These driving factors include:

1. Financial considerations
2. Compliant policies and regulations
3. Capacitation of stakeholders

The study's objective was to determine the factors that could drive innovation in Eswatini's energy sector.

### **5.3.1 Financial considerations**

Eswatini, despite its low GDP, faces significant challenges in providing universal electricity access. Financial funding, particularly through the creation of funds generated from electricity purchases, is crucial in enhancing electricity access for those who cannot afford it. In Eswatini, initiatives such as the Rural Electrification Program have been supported by grants from international organisations.

Policies offering incentives are essential for driving innovation in the energy sector. These include feed-in tariffs, tax incentives, grants, and accelerated depreciation schemes. Such measures can enable organisations or businesses to allocate more resources towards improving efficiencies; for instance, tax incentives can encourage private sector investment by reducing operational costs. Similarly, in the petroleum sector, ensuring predictable fuel supplies through taxes and levies generated from petroleum activities helps stabilize business operations across all sectors. This predictability allows businesses within and outside the energy sector to plan effectively against potential disruptions.

As noted by Sonjaya and Noch (2024), the findings that finance acts as a driver for incremental innovation align with the literature; incentivizing the energy sector is crucial for attracting investments. Integrating robust financial support systems alongside well-crafted incentive-based policies offers a promising pathway to incremental innovation in this sector. The TOE framework, particularly in environmental contexts, significantly influences industry practices for adopting innovations (Bany Mohammad, Al-Okaily, Al-Majali, & Masa'deh, 2022).

In the context of Eswatini, such policies play a dual role: they facilitate funding mechanisms to assist individuals who cannot afford electricity access and simultaneously drive innovation within the energy sector. This has led to improvements such as the installation of "Ready Boards" in structures previously deemed unsuitable for electricity access, portraying incremental innovation improvement in the energy sector. In Sub-Saharan Africa, many electricity providers require homes to be built with permanent materials to qualify for connections (Golumbeanu & Barnes, 2013). However, this excludes many poor families who use less stable materials. Therefore, the ready boards and insulated conduits provide a safe, affordable electricity connection to these households. Ready boards are preconfigured electrical panels that include all necessary equipment for providing household electricity connections. These boards typically feature a few ready-to-use outlets and often a light fixture, eliminating the need for additional household wiring (Lee, Miguel, & Wolfram, 2016).

### **5.3.2 Compliant policies and regulations**

The findings indicate that regulation plays a pivotal role in stimulating innovation by fostering an environment conducive to it, as mentioned in the literature. Costa and Matias (2020) support this perspective by mentioning that numerous studies have highlighted the importance of state regulation in promoting innovation. Furthermore, the TOE framework explicitly highlights the influence of government

regulation on the adoption of innovation. This observation aligns with the findings of this study.

The study findings align with the literature that states that in the energy sector, collaborative policy development involving stakeholders is crucial for driving innovation. Research conducted by Oduro, Uzougbo, and Ugwu (2024) underscores the importance of stakeholder engagement in developing regulatory frameworks that support rather than impede innovative activities. Through stakeholder engagement, policymakers can effectively identify barriers to regulation and craft policies that create an ecosystem that is supportive of or a driver of innovation in the energy sector. This approach not only supports incremental advancements but also positions stakeholder collaboration as a driver of transformative progress in the energy sector.

Eswatini's integration of global sustainability policies into its national framework plays a pivotal role in guiding efforts toward compliance with policy objectives, particularly in climate change policies. These policies serve as an innovation driver, significantly impacting the energy sector, which is a major contributor to greenhouse gas emissions due to its reliance on fossil fuels. Given the critical role of energy as an economic driver globally and in Eswatini, the energy sector must adopt incremental innovations to enhance its policies and drive improvement. This involves incorporating reforms that align with Eswatini's policy objectives without disrupting the economy. This aligns with the TOE framework that identifies government policies and regulations as key influences on innovation adoption (Bany Mohammad, Al-Okaily, Al-Majali, & Masa'deh, 2022). In this context, the integration of global policies shapes government regulations, which were identified in this study as drivers of various types of innovation across sectors. This includes incremental innovations in the energy sector, demonstrating alignment with the study findings.

In the electricity sector, the introduction of IPP policies has facilitated the integration of renewable energy sources, enhanced energy availability and

security while mitigating climate change. Similarly, the petroleum sector has developed frameworks to accommodate electric vehicles and is pursuing pilot projects for charging stations. These developments underscore the importance of evolving policies and legal structures to effectively mitigate climate change and facilitate a transition towards a sustainable energy future, as emphasised by researchers like Akpuokwe (2024).

The integration of incremental innovation in the electricity and petroleum sectors has significantly contributed to advancing renewable energy adoption and enhancing climate resilience. Policy frameworks have been instrumental in driving these innovations, providing a pragmatic pathway toward decarbonisation. Comparing the study findings and the TOE framework used as the conceptual framework for the study, this study identified government policies as essential drivers of incremental innovation. Within the environmental context of the TOE framework, innovation adoption is heavily influenced by these government regulatory frameworks (Awa & Ojiabo, 2016), which, in turn, aligns with the findings of this research by demonstrating their pivotal role in fostering incremental innovations within the energy sector.

### **5.3.3 Capacitation of stakeholders**

The study's findings indicate that collaboration among stakeholders in industry engagement is a key driver of incremental innovation in the energy sector. This collaborative approach enhances inclusivity by providing stakeholders with a clear understanding of changes, enabling them to align themselves effectively with these changes. It also empowers stakeholders to thrive in the sector, avoid costly decisions, and create a positive impact within the industry. The stakeholders include energy sector players, other government spheres, private investors, and the public.

In line with the literature review, a study by Liubkina, Murovana, Magomedova, Siskos, and Akimova (2019) highlighted that the degree of innovation

development within a country depends on coordinated activities and an effective system that relies heavily on extensive collaboration among key stakeholders. This accentuates that collaboration is a crucial driver for innovation in the energy sector, aligning with the current study's findings.

Also, the study's findings on technology integration as a driver of innovation align with the literature review. The advent of the 4IR has spurred technological advancements, making the energy sector more advanced and efficient. This impact is felt in operational activities and across the entire value chain, particularly in revolutionising energy production and consumption. This is consistent with the literature and the TOE framework, as a study conducted by Hadar (2021) noted that technological advancements foster innovation.

## **5.4 Conclusion**

The study highlights financial factors as key barriers and drivers of incremental innovation in Eswatini's energy sector. Financial constraints, including a small economy, tariffs that do not reflect costs, lack of subsidies, and unfavourable loan terms, discourage investment and innovation, particularly in the electricity sector. The petroleum sector faces even greater challenges due to market instability and limited resources. The capital-intensive nature of the energy industry compounds these issues. However, financial support programs such as Rural Electrification, international grants, and incentives like feed-in tariffs have been essential in improving electricity access and encouraging innovation.

Compliant policy and regulations also significantly impact innovation. Outdated laws and slow policy implementation create barriers for new market entrants and suppliers, hindering energy sector progress. Collaborative policymaking is needed to address these obstacles. Eswatini's efforts to integrate global sustainability policies into local frameworks demonstrate commitment to climate compliance and innovation promotion. Additionally, knowledge gaps and

organisational cultures that favour stability over innovation limit progress. The country's reliance on imported technologies also reduces local innovation capacity. To overcome these barriers, stakeholder collaboration and capacity building are critical. Overall, the study calls for policy reforms, financial incentives, and investments in human capital to advance incremental innovation, laying a foundation for sustainable development and energy security in Eswatini.

## **CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS**

### **6.1 Introduction**

The study aimed to investigate the constraints/barriers to incremental innovation and the driving factors for incremental innovation in Eswatini's energy sector. This chapter provides recommendations for the stakeholders identified in Chapter 1 under the significance of the study. These stakeholders include government policymakers, regulators, SOEs in the energy sector, and academia.

### **6.2 Conclusions regarding research objective 1**

The primary objective of this study was to explore the constraints/barriers to incremental innovation within Eswatini's energy sector. The findings reveal several critical challenges that impede progress in this area, including policy and governance issues, economic constraints, cultural resistance within organisations, resource limitations, knowledge gaps (insufficient data, lack of skilled personnel, inadequate training programs) and organisational resistance to change. Delays in the implementation of policies and overregulation have created a restrictive environment despite the Eswatini National Energy Policy of 2018, which aimed to liberalise the sector. Financial challenges, such as non-cost-reflective tariffs and a small consumption-driven economy, discourage private investment and limit the participation of IPPs. Resource (e.g. crude oil) scarcity forces reliance on energy imports, exposing the country to price volatility and supply uncertainties.

Beyond the barriers to incremental innovation already mentioned, this study identified a gap in adaptive decision-making processes or frameworks linked to policies. This gap results in ineffective decision-making and delays in the energy sector. To improve sustainability and efficiency, the sector needs to implement

streamlined, efficient, and flexible decision-making processes. By integrating these adaptive processes into incremental innovation initiatives, the sector can enhance its resilience and adaptability in response to evolving challenges, ultimately supporting sustainable growth.

### **6.3 Conclusions regarding research objective 2**

The primary objective of this study was to examine the factors driving incremental innovation in Eswatini's energy sector. The findings identified several key drivers, including governance, financial structures for sustainable development, inclusive education, and technological integration. These elements collectively contribute to fostering incremental innovation within the sector.

Initiatives such as the Rural Electrification Program, which is backed by international grants, demonstrates the significance of funding. Other possible finance related initiative to drive innovation in the energy sector is incentives like tax breaks and application of feed-in tariffs. These measures attract private investment and stabilise the energy sector. Policy and regulatory frameworks further enhance innovation by aligning with global sustainability standards. For example, IPP policies have facilitated renewable energy integration, while petroleum sector reforms support electric vehicle adoption.

Stakeholder collaboration is another critical factor. Capacity-building efforts among government entities, private investors, and the public ensure alignment of objectives, reduce costly missteps, and promote inclusivity. Technological advancements driven by the 4IR also enable innovation across the energy value chain. These advancements highlight the need for coordinated efforts among stakeholders to overcome barriers and achieve sustainable development. Therefore, aligning incremental innovation initiatives in Eswatini's energy sector can significantly enhance efficiency and sustainability, while concurrently making a positive contribution to the economy.

In addition to the factors driving incremental innovation in Eswatini's energy sector, the research emphasizes the vital role of good governance in establishing a stable environment that fosters business growth and incremental innovation. This stability is closely linked to the country's policies, which in turn facilitate further incremental innovation.

A robust governance system is vital for establishing clear mandates, ensuring accountability, and streamlining processes. This clarity reduces uncertainty, allowing organisations to focus on continuous improvement. As a result, businesses in the energy sector can operate efficiently and innovate incrementally while maintaining the agility needed to adapt to market changes. Stable governance ensures that policies are predictable and supportive, mitigating the risks associated with innovation activities. This alignment encourages businesses to invest in incremental improvements that enhance competitiveness by using the existing resources effectively. The energy sector can achieve sustained business growth through continuous improvement and incremental innovation by integrating clear policies, accountability mechanisms, and collaborative practices into governance frameworks.

**Table 8:Consistency table: research objectives, conclusions and contribution to knowledge**

| <b>RQ #</b> | <b>State Research Objective</b>                                                | <b>State literature-based proposition</b>                                                                                                                           | <b>State conclusion or answer based on own research</b>                                                                                                                                                                                              | <b>Highlight key differences between your initial propositions and your findings – this is your contribution to knowledge</b>                                                                                                 |
|-------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | To investigate incremental innovation constraints in Eswatini's energy sector. | Barriers to incremental innovation in the energy sector comprise financial constraints, outdated policies and inadequate regulatory frameworks, and knowledge gaps. | The findings highlighted several critical challenges that impede progress toward incremental innovation, including policy and governance issues, economic constraints, resource limitations, knowledge gaps, and organizational resistance to change | The findings align with the proposition save for the lack of adaptive decision-making processes or frameworks linked to the policies, a deficiency that leads to ineffective decision-making and delays in the energy sector. |
| 2           | To determine the factors that drive                                            | The factors that drive incremental innovation in                                                                                                                    | The findings identify several key drivers,                                                                                                                                                                                                           | The findings align with the propositions of this study, except in the case of good                                                                                                                                            |

| <b>RQ #</b> | <b>State Research Objective</b>                          | <b>State literature-based proposition</b>                                                                                     | <b>State conclusion or answer based on own research</b>                                                                     | <b>Highlight key differences between your initial propositions and your findings – this is your contribution to knowledge</b> |
|-------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
|             | incremental innovation in the energy sector of Eswatini. | the energy sector include financial considerations, compliant policies and regulations, and the capacitation of stakeholders. | including governance, financial structures for sustainable development, inclusive education, and technological integration. | governance, which is crucial for creating a stable environment that fosters business growth and incremental innovation.       |

## **6.4 Limitations of the study**

A qualitative approach was used for this research. This approach allows for an in-depth exploration of the subject matter; however, it is important to acknowledge that the absence of quantitative data may limit the generalisability of the findings.

The participants for this research encompassed a diverse range of organisations within the energy sector, including regulators, state-owned companies, IPPs, and Private Sector Participants. This selection is strategic, as it comprehensively represents the various stakeholders involved in the energy landscape. By focusing on these specific organisations, the study was well-positioned to address its research objectives effectively. The insights gathered from these stakeholders contributed valuable perspectives that enhanced our understanding of the energy sector's dynamics, despite the limitations imposed by the qualitative methodology.

Academia was excluded as part of the research participants because they have not been actively engaged in the formulation or implementation of energy policies and sector interventions in Eswatini, which are primarily driven by government agencies and private sector stakeholders. This focus is evident in existing policy design processes that prioritise contributions from government departments and industry players over academic institutions (Ministry of Commerce Industry & Trade, 2023).

Due to the unavailability of four participants (one from a state-owned petroleum company, one from independent power producers, and two from private petroleum companies) and time constraints, it was not possible to interview all remaining participants. This limitation restricted the breadth of insights that could have been obtained from additional data.

## **6.5 Recommendations**

### **6.5.1 Policy makers**

It is recommended that policymakers in Eswatini, specifically MNRE, ESERA, and members of parliament, develop and implement an adaptive decision-making framework that facilitates the timely adoption of necessary changes, fosters innovation, and enhances responsiveness to evolving global and regional energy dynamics. Such a framework should streamline decision-making processes while preserving policy coherence and integrity.

### **6.5.2 State-Owned Organisations**

It is recommended that the ESERA and the MNRE, respectively, develop comprehensive financial frameworks for the electricity and petroleum sectors. These frameworks should be designed to attract private sector investment and ensure supply security. They must include tax incentives and other fiscal measures targeted at energy sector participants. Such incentives are vital for stimulating innovation, serving as effective financing mechanisms, improving market efficiency, supporting the transition to renewable energy, promoting equitable access to energy resources, and fostering environmental sustainability.

### **6.5.3 Academia**

Academia should research barriers and opportunities for incremental innovation in the different energy sectors of Eswatini.

## **6.6 Suggestions for further research**

The research explored barriers to incremental innovation and the factors that drive it within Eswatini's energy sector. To comprehensively understand

innovation in this sector, future research could explore other innovation types, such as radical, disruptive, and architectural innovations, to identify additional barriers and driving factors. Furthermore, a mixed-methods approach, building on this study's findings and existing literature, could provide a more in-depth exploration of these barriers and drivers in Eswatini's energy sector. Also, investigating the role of policy in sculpting innovation could offer valuable insights into how policy frameworks can either support or hinder innovation efforts.

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## **APPENDIX A - Permission letters**



Eswatini Electricity Company (EEC)

Head Office, Eluvatsini House  
Mhlambanyatsi Road  
P O Box 258 Mbabane H100  
Tel: +268 2409 4000 Fax: +268 2409 4001

06 December 2024

University of the Witwatersrand  
Wits Business School  
2 St David's Place  
Parktown  
**Johannesburg**  
2050

Dear Professor

**RE: PERMISSION TO CONDUCT RESEARCH AT ESWATINI ELECTRICITY COMPANY**

This serves to confirm that Mr Bongumunzi Sukati has been granted permission to conduct research in the Eswatini Electricity Company as part of his studies towards a Master's degree in Management, with specialization in Energy Leadership.

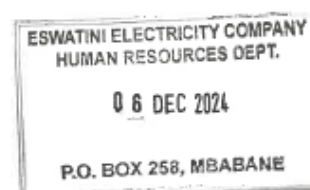
We trust that Bongumunzi will adhere to all organisational policies and standards, including confidentiality and any legal requirements related to the data being collected.

We look forward to the successful completion of this research and believe that the results will be beneficial both to your academic community and our organisation.

Should you require any additional information or have any further questions, please do not hesitate to contact us.

Yours faithfully

  
MS. HLONIPHILE NHLEKO  
**HUMAN RESOURCES DEVELOPMENT MANAGER**



*Board of Directors: Chairperson – Mr. Patrick Myosi, Members – HRH Princess Sibahle, Mr. Henry Shongwe, Mr. Vusi Dlamini, Ms. Thandazile Dlamini, Ms. Velile Dlamini, Mrs Winnie Stewart, Ms. Hlob'zile Ndzimondze.  
Managing Director – Mr. Ernest Mkhosho, Company Secretary – Mr. Thabizo Masina.*



Because we care

+268 2404 2103 / 2404 8425  
@ info@esera.org.sz  
www.esera.org.sz  
P.O. Box 7137, Mbabane, H100, Eswatini  
First floor, RHUS Office Park, Karl Grant Str,  
Mbabane, Eswatini

Our Ref: CEO/MIS/01-00

Your Ref:

17 December 2024,

Mr. Bongumenzi Sukati  
University of the Witwatersrand  
1 Jan Smuts Avenue,  
Braamfontein 2000  
Johannesburg, South Africa

Dear Sir,

**RE: Permission to Conduct Academic Research (Master of Management in Energy Leadership) with the Eswatini Energy Regulatory Authority – Research Report Module BUSA 7481A.**

1. Reference is made to the above subject matter and your letter dated 25 November 2024.
2. We acknowledge and note your request to collect data from selected employees within our organization in pursuit of your academic research titled *"Barriers and opportunities to incremental innovation in the energy sector of Eswatini"*.
3. ESERA supports such initiatives and hereby grants permission for the carrying out of this study in line with the applicable laws as well as the principles and procedures stated in your letter in so far as individual privacy and confidentiality are concerned.
4. For logistical arrangements, please liaise with our Engineering Manager: Electricity Regulation, Mr Sihle Magagula who can be reached via email at [Sihle.Magagula@esera.org.sz](mailto:Sihle.Magagula@esera.org.sz) or telephone at +268 7808 5316.
5. We hope the above is in order and wish you well as you carry out your research.

Yours faithfully,

Skhumbuzo Tsabedze  
**CHIEF EXECUTIVE OFFICER.**

28 February 2025

University Of the Witwatersrand  
Wits Business School  
2 St David's Place  
Parktown  
Johannesburg  
2050

Dear Sir/Madam,

**RE PERMISSION TO CONDUCT RESEARCH AT ESWATINI PETROLEUM COMPANY**

This letter serves to confirm that Mr. Bongumenzi Sukati has been granted permission to conduct research at the Eswatini National Petroleum Company (ENPC) as part of his studies towards a master's degree in management with specialization in Energy Leadership.

Yours faithfully,



**MS. ZIYANDA MTETWA**  
**HUMAN RESOURCES MANAGER**





KINGDOM OF  
ESWATINI

MINISTRY OF NATURAL  
RESOURCES & ENERGY

OUR REF:

DATE: 11 March 2025

University of the Witwatersrand,  
Wits Business School,  
2<sup>nd</sup> David's Place,  
Parktown,  
Johannesburg,  
2050.

Dear Sir Professor,

**RE: PERMISSION TO CONDUCT RESEARCH AT THE MINISTRY OF NATURAL  
RESOURCES AND ENERGY.**

Reference is made to the above-captioned subject matter.

This serves to confirm that Mr Bongumendzi Sukati has been granted permission to conduct research in the Ministry of Natural Resources and Energy as part of his studies for a Master's Degree in Management, with a specialization in Energy Leadership.

The Ministry trusts that Mr. Bongumenzi will adhere to all organizational policies and standards, including confidentiality and any legal requirements related to the data that is being collected.

The Ministry will be grateful for your cooperation and believes that the results will be beneficial to your academics and the country.

Yours sincerely,

**LINDIWE F. MBINGO**  
**PRINCIPAL SECRETARY**

MINISTRY OF NATURAL  
RESOURCES & ENERGY

12 MAR 2025

PRINCIPAL SECRETARY'S OFFICE  
P.O. BOX 57  
MBABANE 3100-ESWATINI

Physical Address: Old Income Tax Building 4<sup>th</sup> Floor, Mhlambanyatsi Road, Mbabane, Eswatini  
Postal Address: P.O. Box 57, Mbabane, Eswatini  
Tel: +268 2404 6244 Email: info\_mnre@gov.sz



25 March 2025

University Of the Witwatersrand  
Wits Business School  
2 St Davids Place  
Parktown  
Johannesburg  
2050

**TO WHOM IT MAY CONCERN**

Dear Sir/Madam

**RE: PERMISSION TO CONDUCT RESEARCH AT UBOMBO SUGAR LIMITED**

This letter serves to confirm that Mr. Bongumenzi Sukati has been granted permission to conduct research at Ubombo Sugar Limited as part of fulfilling the requirements for his Master's Degree in Management, specializing in Energy Leadership.

Mr Sukati is pursuing academic research titled "Barriers and Opportunities to Incremental Innovation in the Energy Sector of Eswatini."

As a condition of this permission, Mr. Sukati is required to adhere to the code of ethics of both the company and his tertiary institution.

Should you require any further information or clarification, please do not hesitate to contact me.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Leonard', written over a horizontal line.

**Leonard Ndzimandze**  
**Corporate Affairs Head**

**Ubombo Sugar Limited**

A member of the ABF Sugar Division

PO Box 23, Big Bend, Eswatini  
L311 Eswatini  
T +268 2363 8000  
2 of 1950

[www.ubombosugar.com](http://www.ubombosugar.com)

Directors: P. Kenward (**Chairman**), M.B. Siyaya (**Managing Director**), A. Lubbe, C.R. Jensen, N.F. Dlamini, L.M. Ndzimandze, P. Nxumalo, Dr. A.T. Dlamini, Chief M. Maziya, J. Mngomezulu.

## **APPENDIX B – Consent Forms**

**CONSENT FORM**

**Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini**

**Researcher: Bongumenzi Sukati**

I Buyile Dlamini, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about. ☒ YES ☐ NO

I understand that I can volunteer to take part in the study ☒ YES ☐ NO

I agree that the interview/focus group/other activity may be audio recorded ☒ YES ☐ NO

I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES ☐ NO

I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES ☐ NO

I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES ☐ NO

Buyile Dlamini

Signature of Participant

30.01.2025

Date

Bongumenzi Sukati

Signature of Researcher

30/01/2025

Date

**CONSENT FORM**

Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

Researcher: Bongumenzi Sukati

I Candice Stromvig, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.

☒ YES ☐ NO

I understand that I can volunteer to take part in the study

☒ YES ☐ NO

I agree that the interview/focus group/other activity may be audio recorded

☒ YES ☐ NO

I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter

☒ YES ☐ NO

I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter)

☒ YES ☐ NO

I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on

☒ YES ☐ NO

Sail

Signature of Participant

02-February 2025

Date

[Signature]

Signature of Researcher

02/02/2025

Date

**CONSENT FORM**

**Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini**

**Researcher: Bongumenzi Sukati**

I Cusi Mangan, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

- The research study was explained to me. I understand what this study is about. ☒ YES NO
- I understand that I can volunteer to take part in the study ☒ YES NO
- I agree that the interview/focus group/other activity may be audio recorded ☒ YES NO
- I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES NO
- I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES NO
- I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES NO

  
Signature of Participant

16-01-2025  
Date

  
Signature of Researcher

16/01/2025  
Date



### CONSENT FORM

Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

Researcher: Bongumenzi Sukati

I MAIDHAWA NDLOVU, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about. ☒ YES NO

I understand that I can volunteer to take part in the study ☒ YES NO

I agree that the interview/focus group/other activity may be audio recorded ☒ YES NO

I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES NO

I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES NO

I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES NO

Signature of Participant

30/01/25

Date

Signature of Researcher

30/01/2025

Date



**CONSENT FORM**

**Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini**

**Researcher: Bongumenzi Sukati**

I Mphumuzi Thembinkosi Maziya, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

- The research study was explained to me. I understand what this study is about. ☒ YES ☐ NO
- I understand that I can volunteer to take part in the study ☒ YES ☐ NO
- I agree that the interview/focus group/other activity may be audio recorded ☒ YES ☐ NO
- I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES ☐ NO
- I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES ☐ NO
- I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES ☐ NO

Signature of Participant

09 December 2024

Date

Signature of Researcher

09/12/2024

Date



### CONSENT FORM

Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

Researcher: Bongumenzi Sukati

I Nozipho Mkhumbulu, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about. ☒ YES NO

I understand that I can volunteer to take part in the study ☒ YES NO

I agree that the interview/focus group/other activity may be audio recorded ☒ YES NO

I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES NO

I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES NO

I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES NO

Signature of Participant

08/01/25  
Date

Signature of Researcher

08/01/25  
Date



### CONSENT FORM

Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

Researcher: Bongumenzi Sukati

I Patrick Simelane, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

- The research study was explained to me. I understand what this study is about. ☒ YES NO
- I understand that I can volunteer to take part in the study ☒ YES NO
- I agree that the interview/focus group/other activity may be audio recorded ☒ YES NO
- I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES NO
- I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES NO
- I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES NO

Bongumenzi Sukati

Signature of Participant

30-01-25

Date

Bongumenzi Sukati

Signature of Researcher

30/01/2025

Date

**CONSENT FORM**

**Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini**

**Researcher: Bongumenzi Sukati**

I Sihle Magapula, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

- The research study was explained to me. I understand what this study is about. ☒ YES ☐ NO
- I understand that I can volunteer to take part in the study ☒ YES ☐ NO
- I agree that the interview/focus group/other activity may be audio recorded ☒ YES ☐ NO
- I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES ☐ NO
- I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES ☐ NO
- I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES ☐ NO

Sihle Magapula  
Signature of Participant

7/01/25  
Date

Bongumenzi Sukati  
Signature of Researcher

07/01/2025  
Date



# **CONSENT FORM**

Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

Researcher: Bongumenzi Sukati

I Sihle Mauimbe/q, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

- The research study was explained to me. I understand what this study is about. ☒ YES ☐ NO
- I understand that I can volunteer to take part in the study ☒ YES ☐ NO
- I agree that the interview/focus group/other activity may be audio recorded ☒ YES ☐ NO
- I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES ☐ NO
- I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES ☐ NO
- I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES ☐ NO

[Signature] 9/01/25  
Signature of Participant Date

[Signature] 9/01/25  
Signature of Researcher Date



**CONSENT FORM**

Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

Researcher: Bongumenzi Sukati

I Simphiwe Khumalo, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

|                                                                                                                                                                                                                                              |                                         |                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------|
| The research study was explained to me. I understand what this study is about.                                                                                                                                                               | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> |
| I understand that I can volunteer to take part in the study                                                                                                                                                                                  | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> |
| I agree that the interview/focus group/other activity may be audio recorded                                                                                                                                                                  | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> |
| I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter                                                                                  | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> |
| I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter)                                                                  | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> |
| I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on | YES <input checked="" type="checkbox"/> | NO <input type="checkbox"/> |

Signature of Participant

30/12/2024

Date

Signature of Researcher

30/12/2024

Date



**CONSENT FORM**

**Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini**

**Researcher: Bongumenzi Sukati**

I Tanele Habangaan, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

- The research study was explained to me. I understand what this study is about. ☒ YES NO
- I understand that I can volunteer to take part in the study ☒ YES NO
- I agree that the interview/focus group/other activity may be audio recorded ☒ YES NO
- I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES NO
- I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES NO
- I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES NO

Tanele Habangaan  
Signature of Participant

10/12/2024  
Date

Bongumenzi Sukati  
Signature of Researcher

10/12/2024  
Date



**CONSENT FORM**

Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

Researcher: Bongumenzi Sukati

I Thabiso Masinda, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

- The research study was explained to me. I understand what this study is about. ☒ YES NO
- I understand that I can volunteer to take part in the study ☒ YES NO
- I agree that the interview/focus group/other activity may be audio recorded ☒ YES NO
- I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES NO
- I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES NO
- I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES NO

[Signature]  
Signature of Participant

16/12/2024  
Date

[Signature]  
Signature of Researcher

16/12/2024  
Date

**CONSENT FORM**

**Research topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini**

**Researcher: Bongumenzi Sukati**

I Thokozani Moubu, give my consent for participating in the interview and the use of a voice recorder during the interview between myself and the researcher Bongumenzi Sukati, an MMEL student at the Faculty of Law and Commerce. The research study was clearly explained to me and fully understand what it is about. I understand that the information that will be recorded is only for academic purposes and will appear in the research report. This information may appear in the form of direct quotes. I also understand that my identity and that of my company will not be revealed at any stage. Additionally, the use of my name or company name will not appear in any section of the research. I also understand that the recorded tapes will be kept in a safe place and that they will be destroyed after two years after the research has been completed. Moreover, participating in this study is completely voluntary. I may refuse to answer any question I am asked, and I can drop out of the study at any time without any negative consequences.

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about. ☒ YES NO

I understand that I can volunteer to take part in the study ☒ YES NO

I agree that the interview/focus group/other activity may be audio recorded ☒ YES NO

I agree that direct quotations from my interview/focus group/other activity may be used by the researcher in their research report/ manuscript/book chapter ☒ YES NO

I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report/manuscript/book chapter) ☒ YES NO

I agree that other researchers may use the information I provide in my interview/focus group/other activity (depending on their own ethics clearance being obtained), but my name and any personal information will not be used or passed on ☒ YES NO

Mpsbu  
Signature of Participant

09/01/2025  
Date

[Signature]  
Signature of Researcher

07/01/2025  
Date



## APPENDIX C – Research Instrument



### Interview Questions

Research Topic: Barriers and opportunities to incremental innovation in the energy sector of Eswatini

#### Interview Questions

Thank you for your time and for agreeing to take part in the study.

1. Can you tell me about yourself and your current professional role?
2. In your understanding, what is innovation?
3. In what ways does innovation benefit society as a whole?
4. What are some potential drawbacks or challenges associated with innovation, and how do they impact organisations or industries?
5. In your understanding, what is incremental innovation?
6. What are the key characteristics of incremental innovation? How is it different from other types of innovation?
7. What do you understand about the energy sector of Eswatini?
8. What are the energy sector objectives, and how do they vary across the different types of energy sources?
9. Please explain how the energy sector of Eswatini is regulated?
10. What are the enabling factors for incremental innovation in Eswatini's energy sector?
11. What are the barriers to incremental innovation in Eswatini's energy sector?
12. What is in place to encourage incremental innovation in Eswatini in the energy sector?
13. What seems to hinder incremental innovation in the Eswatini energy sector?
14. Are there any successful initiatives or stories of incremental innovation in Eswatini's energy sector?

UNIVERSITY OF THE  
WITWATERSRAND,  
JOHANNESBURG



**Participant Information Sheet (PIS)**

Dear Sir / Madam

My name is Bongumenzi Sukati. I am a Master's student at the University of the Witwatersrand in Johannesburg. My supervisor is Dr. Ayanda Magida. I am conducting a research study on Barriers and opportunities to incremental innovation in the energy sector of Eswatini. The research title is "The Barriers and opportunities to Incremental Innovation in the Energy Sector of Eswatini."

I kindly invite you to interview with me. If you decide to participate, your participation in this research study will last about 2 hours. The interview will take place at your location and at a time during business hours that is convenient for you.

With your permission, I would like to audio record the interview. The data will be stored on a recording device for no more than 2 years, after which it will be deleted. Only the researcher will have access to the recording.

The interview will be confidential and anonymous. During the interview, I will need to ask for personal information about you, including your experience in the energy sector. I will not include your name or any other identifying information, and the names of your companies will not be revealed at any stage.

If you decide to participate in this research, it should be voluntary. You can stop participating in the study at any time. You have the right to refuse to answer any question you are uncomfortable with or feel compromised to answer. You will not benefit in any form by participating in the research, nor will you lose any services, benefits, or rights you would normally have if you decide not to join. The study will not cost you anything, and you will not be paid. You can drop out of participating in the research at any time without any negative consequences.

The risks for this research study are no more than what happens in everyday life.

This research study will be written up as a research report. I will be pleased to send you a summary of this report if you would like it.

If you have any questions during or after this research study, feel free to contact me or my supervisor at the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27 (0) 11 717 1408, email [hrecnon-medical@wits.ac.za](mailto:hrecnon-medical@wits.ac.za).

Yours sincerely,



Bongumenzi Sukati

Researcher:  
Bongumenzi Sukati, 0614510m@students.wits.ac.za, 00268 7669 6106

Supervisor:  
Ayanda Magida, ayanda.magida@wits.ac.za, 0027 117173953



## APPENDIX D – Ethics Clearance

Graduate School of Business Administration  
University of the Witwatersrand, Johannesburg



**Wits Business School Ethics Committee**  
Constituted under the University Human Research Ethics Committee (Non-Medical)

### Ethics Clearance Certificate

**Ethics protocol number:** WBS/EL0614510m/363

*This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).*

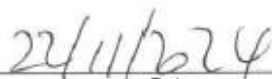
|                                  |                                                                                                                                                                                                           |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project title</b>             | Barriers and opportunities to incremental innovation in the energy sector of Eswatini                                                                                                                     |
| <b>Investigator / Researcher</b> | Mr Bongumenzi Sukati                                                                                                                                                                                      |
| <b>Nature of Project</b>         | MM (Energy Leadership)                                                                                                                                                                                    |
| <b>Decision of the Committee</b> | Approved, provided stakeholders and participants are guaranteed confidentiality.                                                                                                                          |
| <b>Issue Date of Certificate</b> | 20/11/2024                                                                                                                                                                                                |
| <b>Expiry date</b>               | Date of submission of the project / research report                                                                                                                                                       |
| <b>Chairperson</b>               | Dr Ayanda Magida<br>☎ +27 11 717 3953<br>✉ <a href="mailto:ayanda.magida@wits.ac.za">ayanda.magida@wits.ac.za</a><br> |

### Declaration by Researcher

*One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.*

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

  
\_\_\_\_\_  
Signature

  
\_\_\_\_\_  
Date: