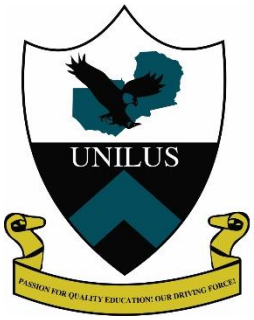

UNIVERSITY OF LUSAKA

School of Postgraduate Studies

An Assessment of the Challenges of Private Sector Involvement in the development of Renewable Energy Projects in Zambia

A dissertation submitted to the University of Lusaka in partial fulfillment of the requirements for the Degree of Master of Science in Project Management

By

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DECLARATION

I, **Misheck Mubita Mubuyaeta**, do declare that this work is my own and that the work of other persons utilized in this dissertation has been duly acknowledged. This work presented here has not been previously presented at this or any other university for similar purposes.

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SUPERVISOR'S RECOMMENDATION

I hereby confirm that the dissertation written by Misheck Mubita Mubuyaeta has been checked and read through by myself; it meets the minimum standard of the University and is therefore recommended for examination.

Supervisor: Dr. Janis Kabwe

Signature: 

Date:20/03/2025

DEDICATION

I dedicate this work to my beloved wife Lonica, my daughter Tumelo and son Tato, who have been my support system during this research.

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Firstly, my appreciation goes to the Almighty God, who accorded me the strength and wisdom to undertake this study.

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LIST OF ABBREVIATIONS AND ACRONYMS

ERB	Energy Regulation Board
GETFIT	Global Energy Transfer Feed In Tariff
GRZ	Government of the Republic of Zambia
HFO	Heavy Fuel Oil
IA	Implementation Agreement
IPP	Independent Power Producer
IDC	Industrial Development Corporation
GW	Gigawatt
MW	Megawatt
MOE	Ministry of Energy
MFNP	Ministry of Finance and National Planning
NEP	National Energy Policy
OPPPI	Office for Promoting Private Power Investment
PPA	Power Purchase Agreement
PPP	Public-Private Partnership

REFIT	Renewable Energy Feed In Tariff
IRENA	International Renewable Energy Agency
EU	European Union
USA	United States of America
REIPPP	Renewable Energy Independent Power Producer Procurement Programme
PV	Photovoltaic
RETs	Renewable Energy Technologies
CEC	Copperbelt Energy Corporation
RESAP	Renewable Energy Strategy and Action Plan
PSDMP	Power Systems Development Master Plan
ZPDF	Zambia Power Development Framework
REA	Rural Electrification Authority
ZDA	Zambia Development Agency
IEA	International Energy Agency
UNILUS	University of Lusaka

ABSTRACT

Globally, the pursuit for the development of renewable energy projects has gained traction due to environmental concerns, energy security considerations, socio-economic requirements, shift in market dynamics and the need for sustainable energy sources. Like many countries in Sub-Sahara Africa, Zambia faces energy challenges due to the limited-utilization of the renewable energy potential from solar, wind and hydropower. In recent years, the Zambian Government has made efforts to encourage and foster private sector development of renewable projects, however, the pace of renewable energy deployment still remains low, especially from the private sector. The objective of this research is to assess the challenges of private sector involvement in the development of renewable energy projects in Zambia.

A cross-sectional study was conducted, involving a survey questionnaire administered to representatives from the private sector, government and non-governmental organisations involved in the development of renewable energy projects in Zambia. The questionnaire included closed-ended questions covering various facets of private sector involvement in the development of renewable energy, such as regulatory, financing, institutional and technical. The data collected underwent descriptive and inferential analysis to assess the relationship between the variables.

The analysis of the results indicates a solid positive correlation among the independent variables (regulatory and legislative challenges, financial challenges, technical challenges, institutional challenges, and social and environmental challenges) with the dependent variable (development of renewable energy projects in Zambia). The study categorized the factors constraining private sector development of renewable energy projects in Zambia as: (i) regulatory and legislative challenges, (ii) financial challenges, (iii) technical challenges, (iv) institutional challenges, and (v) social and environmental challenges. The study found that the major financing challenges are high interest rates on loans and limited financing sources, while the major technical challenges were lack of expertise, inadequate infrastructure and insufficient training and capacity building, with the major institutional, policy and regulatory challenges being corruption and poor governance structures. To these challenges, the study recommended for sensitisation and public awareness on regulations and legislation, introduction of mechanisms such as tax incentives and streamlining the processes, and setting up of efficient and effective governance structures. The study provides a valuable body of knowledge for

future researchers, policymakers, and stakeholders seeking to enhance private sector participation in the development of renewable energy projects in Zambia.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

1. Introduction

This chapter has provided a brief account of the development of renewable energy globally, in the Sub-Sahara African region and in the Zambian context. Also, this chapter summarizes the various challenges that constrain private sector participation in the development of renewable energy in the Sub-Sahara African region and in Zambia, and highlights a number of interventions that the Zambian Government has put in place to encourage the development of renewable energy projects in the country. The chapter, further highlights the statement of the problem, justification of the study, objectives, study questions and the scope of work for the study.

1.1 Background of the study

The global transition towards sustainable energy sources has become imperative due to the increasing evidence of rising environmental concerns, energy security of supply considerations and socio-economic requirements (Cambridge University Press, 2012). Renewable energy characteristics of low-carbon footprint, resource abundance and high potential for decentralization has made it emerge as a cornerstone for a variety of activities, offering a viable alternative to the dependency on traditional energy sources (Gayen, 2013). In addition, the development of renewable energy projects in the world has been significant in the pursuit for sustainable energy sources, motivated by the dual requirements of mitigating climate change and ensuring security of energy supply. The International Renewable Energy Agency (IRENA) reports that by the end of 2022, the renewable energy electricity generation capacity globally reached 3,372 gigawatts (GW), representing an increase of nearly 10% from the previous year. The growth was spearheaded by countries like China, the United States of America (USA) and Germany, which together accounted for a substantial portion of the world's renewable energy installed capacity (IRENA, 2023). In Sub-Sahara Africa, the development of renewable energy projects has shown promising growth in recent years, mostly driven by the region's vast renewable energy resource potential and the urgent need to increase electricity access to the majority of the population in the region (World Bank, 2020). According to IRENA (2023), the installed renewable energy generation capacity in Sub-Sahara Africa increased by about 13% annually from

2010 to 2022, with solar PV projects leading the increase, particularly in South Africa, Kenya and Nigeria. For instance, South Africa has made significant strides in its renewable energy projects development, with the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) attracting over 6GW of renewable energy capacity from wind and solar PV power projects (Eberhard & Naude, 2021).

Despite the increase in the development of renewable energy projects, numerous challenges have constrained the Sub Sahara African region's ability to utilize the available renewable energy resource potential. One of the major challenges to the development of renewable energy projects in the region has been limited access to local financing for large-scale projects (Power, Newell, & Baker, 2016). A number of countries have struggled to secure investments for the development of renewable energy projects because of the perceived risks such as political instability, regulatory uncertainty and nascent financial markets (Power, Newell, & Baker, 2016).

Zambia like many other countries in Sub-Sahara Africa struggles with energy challenges stemming from inadequate electrical infrastructure, limited access to electricity and overreliance on traditional energy generation sources like hydropower. The Ministry of Energy (MOE, 2022) reports that Zambia's electricity generation is highly reliant on hydropower production which accounts for over eighty (80) percent of the installed electricity capacity.

Private sector participation is widely recognised as critical for unlocking the full potential of renewable energy markets, bringing in capital, expertise and innovation. However, in Zambia despite the conducive renewable energy resource base and the government's commitment to promoting sustainable energy and participation of the private sector, the level of private sector involvement remains low. Several challenges impede private sector involvement, covering regulatory, financial, technical and market-related dimensions (MOE, 2022).

The Government of Zambia expressed its commitment to the promotion of renewable energy projects through various policy initiatives and legal and regulatory frameworks such as the formulation of the Power System Development Master Plan (PSDMP, 2010), Renewable Energy Feed-In Tariff (REFIT, 2017), Zambia Power Development Framework (ZPDF, 2022) and the Renewable Energy Strategy and Action Plan (RESAP, 2022). The REFIT strategy aims to increase the country's electricity generation output through private sector investments in renewable energy technologies that contribute to increased electricity

generation capacity through the development of small and medium scale projects of up to 20MW to contribute to a diversified energy mix and enhanceed security of energy supply. The challenges in the development of renewable energy projects are classified into policy and regulatory gaps, financial and economic barriers, technical challenges, limited human resource skills and institutional capacities. Alleviating the challenges is very importance in unlocking the potential of renewable energy projects in Zambia and realizing the socio-economic benefits associated with sustainable energy development.

This research seeks to undertake an assessment of the challenges constraining private sector involvement in the development of renewable energy projects in Zambia. By clarifying the intricate dynamics at play and identifying the challenges constraining the private sector's participation in the development of renewable energy projects, this study aims to provide valuable insights to policymakers, investors and stakeholders at large. Further, providing recommendations and strategies on how to address the challenges, this study seeks to contribute to the discourse on fostering a conducive environment for the private sector in the development of renewable energy projects in Zambia.

1.2 Statement of the problem

Historically electricity generation around the world has been dominated by fossil fuels such as coal, diesel and heavy fuel oils with only hydropower being the only renewable energy resource utilised for power generation. However, with evidence of the effects of carbon emissions on the global climatic conditions, there has been efforts by world leaders to reduce carbon emissions through the development of climate friendly technologies such as renewable energy technologies for power generation.

To ensure a speedy transition towards the development of sustainable energy systems, governments globally have looked to the private sector to provide the needed financial resources for the development of renewable energy projects (IRENA, 2020). According to Brazillian et al (2013) the increased development of renewable energy projects has been largely driven by private sector led research and development (R&D) and economies of scale which has contributed to significant cost reduction in solar technology. Further, IEA (2021), reports that the availability of supportive policy frameworks has influenced the increased participation of the private sector in the renewable energy sector and increased electricity generation from renewable energy projects globally.

In Sub Sahara Africa the situation is more critical, as the region faces dual challenges of low electricity access and a heavy reliance on traditional biomass and fossil fuels (IEA,

2022). Although the region has high renewable energy resources which can be utilized for the generation of electricity from hydropower, solar PV, wind turbines etc, there is insufficient renewable energy power generation projects due largely to the lack of private sector investment in the renewable energy sector. Private sector investments in the region's renewable energy sector has been hindered by barriers such as weak regulatory frameworks, currency volatility, underdeveloped financial markets and perceived risks of infrastructure investments (Eberhard et al., 2017). Eberhard et al (2017), further reports that a few countries in Sub Sahara Africa have achieved private sector investments in the renewable energy sector through the adoption of clear policy frameworks, consistent and fair regulations, credit worthy off-takers and secure and adequate revenue streams among other factors.

Zambia like many other Sub Sahara African countries is endowed with a variety of renewable energy resources for the development of electricity generation projects ranging from hydropower, solar, biomass, wind and geothermal. Despite the availability of the renewable energy resources for the development of electricity projects, the country has inadequate electricity supply to satisfy the growing demand due to the limited number of power plants and the adverse impacts of climate change which has reduced the power generation from the hydropower plants in the country.

Zambia has a total installed electricity generation capacity of 3,705MW comprising of large hydropower, small hydropower, coal fired power, Heavy Fuel Oil (HFO) and solar power plants (Integrated Resource Plan Report, 2023). Most of the power is generated from hydropower plants accounting for over 80% of the total electricity generation capacity. The majority of the power plants are owned and operated by ZESCO Limited the public power utility company.

Further, major energy sector reforms in Zambia occurred around the 1990s, with the formulation of the National Energy Policy in 1994, the establishment of the Energy Regulation Board (ERB), the abolishment of the Zambia Electricity Supply Company monopoly and allowing the participation of private operators in the energy sector (REFIT Strategy, 2017). The Government furthermore, formulated the National Energy Policy in 2008 and the revised National Energy Policy in 2019 both of which provide a framework for the development of renewable energy and promotion of the participation of the private sector in developing renewable energy projects in Zambia.

However, despite the formulation of policies by the Government to encourage and foster the participation of the private sector in the development of renewable power projects, only

a few renewable energy power plants have been implemented and operated by the private sector, with many of the projects by the private sector not having reached financial close and failing to progress to construction. Therefore, this research seeks to undertake an assessment of the challenges of private sector involvement in the development of renewable energy power projects in Zambia.

1.3 Research Objectives

The main objective of the study is to assess the challenges of the private sector involvement in the development of renewable energy projects in Zambia.

The specific objectives of the study are:

i. To identify and categorise the factors that constrain private sector development of renewable energy projects in Zambia.
ii. To analyse the challenges in financing renewable energy projects in Zambia.
iii. To assess how the challenges in the existing institutional, policy and regulatory frameworks constrain the private sector involvement in the development of renewable energy projects in Zambia.

1.4 Research Questions

The questions for the study are as follows:

i. What are the categorises of the factors constraining private sector development of renewable energy projects in Zambia?
ii. What are the challenges in financing renewable energy projects in Zambia?
iii. How are the challenges in the existing institutional, policy and regulatory frameworks constraining the private sector in the development of renewable energy projects in Zambia?

1.5 Significance of the Study

This study is relevant due to the small number of private sector institutions having developed and are operating renewable energy power plants in Zambia. The small number of the renewable energy power plants has resulted in the reliance on large hydropower plants for power generation which has resulted in reduced electricity supply because of the reduced water levels in the hydropower dams caused by the adverse effects of climate change and weather conditions which have led to reduced rainfall in the country.

In addition, the identification of the challenges faced by the private sector through this study could provide recommendations for the formulation of policies and strategies to diversify the electricity generation sources, reduce dependency on the hydropower supply

and tap into the economic benefits of private sector investments such as job creation. The insights gained from the assessment could lead to improvements in policy and regulatory frameworks making the investment climate more conducive for the participation of the private sector and foster a more resilient energy sector in the country.

Moreover, identifying and addressing challenges can lead to more investments, stimulate competition and innovation, and facilitate knowledge transfer from developed markets thereby building local capacity in the renewable energy sector. The study also supports Zambia's alignment with regional and international energy and climate goals. Therefore, by increasing the participation of the private sector in the development of renewable energy projects, Zambia will effectively harness its renewable energy resources and provide adequate power supply for economic and social development.

1.6 Scope of the Study

This study endeavoured to assess the challenges of private sector involvement in the development of renewable energy power projects in Zambia. The study sought to identify and categorise the challenges that constrain the involvement of the private sector in the development of renewable energy projects in Zambia such as solar, wind, hydropower, biomass and geothermal.

The research analysed how the existing policies, legal and regulatory frameworks contribute to the challenges of the private sector involvement in the development of renewable energy power projects in Zambia. The study targeted private sector institutions with successfully implemented renewable energy power projects and those unable to progress their projects to implementation. Further, the study engaged officials from the government institutions such as the Ministry of Energy, Ministry of Finance and National Planning, Energy Regulation Board (ERB), Zambia Development Agency (ZDA) and ZESCO Limited and also non-governmental organisations that deal with the development of renewable energy projects, as the key institutions and organisations involved in the development of renewable energy projects in Zambia.

1.7 Limitations and Delimitations of the Study

This study was limited in scope as it focused on the challenges of private sector involvement on the development of renewable energy power generation projects in Zambia and did not focus on the challenges for the participation of the private sector in the development of other energy generation sources and other sectors in Zambia. The research findings may only be of use in Zambia.

Further, because of time and financial limitations the number of participants engaged in the data collection exercise was limited and the data was collected through a survey by administering a questionnaire. The focus of the study was on electricity generation and did not consider the transmission and distribution (T&D) of electricity. The targeted respondents in the research was limited to Independent Power Producers (IPPs) with renewable energy projects in operation and with potential projects, non-governmental organizations with experience in renewable energy development in Zambia and the Ministries of Energy and Finance in Zambia.

1.8 Dissertation Structure

This research consists of six chapters, with chapter one constituting the background to the Study, statement of the problem, objectives of the research, significance and organization of the Study. Chapter two consists of the literature review. Chapter three consists of the theoretical and conceptual framework. Furthermore, chapter four contains the research methodology while chapter five presents the analysis of the data and discussion of the results. Chapter six which is the last part of the research contains the conclusion and recommendations emanating from the research findings.

1.9 Chapter Summary

Chapter one presented among others the background to the study, statement of the problem, justification of the study, objectives of the study, study questions and the scope of the study. The following chapter presents the literature and empirical review of the study.

CHAPTER TWO

LITERATURE REVIEW

2. Introduction

The literature review chapter starts with a global overview of renewable energy, then narrows to the regional and Zambian contexts. It traces Zambia's renewable energy history and recent reforms, examines scholarly works, and identifies gaps in the literature that justify this study. The review of scholarly works is arranged according to the research objectives.

2.1. General Overview of Literature on Private Sector participation in Renewable Energy Development

Globally, the pursuit for renewable energy deployment has gained traction largely driven by international agreements, technological advancements and a shift in market dynamics (IRENA, 2019). The International Energy Agency (IEA, 2021) reports that electricity generation from renewable energy accounted for nearly 29% of the global electricity generation in the year 2020 up from 19% in 2000 with most of the contributions coming from hydropower, wind, solar and biomass power generation projects. The rise in the development of renewable energy projects has been more manifest in the continents of Europe, North America, and parts of Asia, which have made significant investments in the development of renewable energy technologies, such as wind, solar, and hydropower (IRENA, 2023).The increased electricity generation from renewable energy projects has been influenced by advancements in technology, declining projects development costs, availability of supportive policy frameworks and increased participation of the private sector in the renewable energy sector (IEA, 2021).

As of 2022, China was leading the race for the development of renewable energy projects in the world, with a total installed power generation capacity of over 1,200GW which included the world's largest power generation capacities in solar and wind energy projects (IRENA, 2023). China's dominance in the development of renewable energy projects was motivated by significant government support, including policy enhancement and provision of subsidies aimed at accelerating the transition to a low-carbon economy (IRENA, 2023). In Europe on the other hand, the European Union (EU) has been a strong advocate for the development of renewable energy projects among its member states, with Germany, Spain

and Denmark leading in the deployment of wind and solar power projects (European Commission, 2022). The EU's Green Deal and the Renewable Energy Directive (RED) have set the stage for substantial growth in the development of renewable energy projects, with the region achieving a combined installed capacity of over 600GW by 2022 (European Commission, 2022). Germany in particular, stands out with its energy transition policy, which has propelled the country to becoming one of the world's top producers of wind energy, having reached an installed wind energy generation capacity of approximately 66GW and solar capacity of around 59GW (Fraunhofer ISE, 2022). The United States of America (USA) on the other hand, stands out as a leader in development of renewable energy projects in North America, particularly in wind and solar energy. In 2022, the USA had an installed renewable energy generation capacity of about 340GW, with 140GW of wind energy and more than 125GW of solar energy (U.S. Energy Information Administration, 2023).

The participation of the private sector in the renewable energy sector has been among the major drivers which has led to the increased global electricity generation capacity from renewable energy sources (IEA, 2021). The participation of the private sector in the development of renewable energy projects has been as independent power producers (IPPs), energy service companies (ESCOs) and financing institutions which has contributed to the scaling-up of power generation from renewable energy sources globally, for example the deployment of solar photovoltaic (PV) and wind power projects has been fast-tracked by private sector investments accounting for over 90% of the investments in the development of renewable energy projects in 2019 (BloombergNEF, 2020). Private sector investment has played a vital role in reducing the costs of renewable energy technologies for power generation through the economies of scale, innovation and competition which have been widely documented (REN21, 2020).

In spite the progress made in the development of the renewable energy sector globally, private sector investments still face a number of challenges such as legal and regulatory uncertainties, inadequate electrical grid infrastructure, barriers to financing and market risks (World Bank, 2018). The World Bank (2018) cited the critical barriers to renewable energy investment as the lack of stable and predictable policy frameworks, lack of established feed-in tariffs, lack of standardized power purchase agreements (PPAs) and non-availability of tax incentives. Furthermore, owing to the intermittent nature of renewable energy technologies such as solar PV and wind, there is need for investments in

grid infrastructure and energy storage solutions which require substantial capital (IRENA, 2019).

On the other hand, the Sub-Sahara African region presents a unique situation in the development of renewable energy projects largely due to its vast untapped renewable energy resources, coupled with the need to expand access to electricity and promote social economic development. With more than 600 million people lacking access to electricity, the Sub-Sahara African region is faced with a significant electricity access deficit which could potentially be addressed through the development of renewable energy projects (IRENA, 2019). Sub-Sahara Africa is well endowed with renewable energy resources such as solar, wind, hydropower and biomass resources which offer substantial potential for the development of renewable energy projects for power generation (Baker & Sovacool, 2017). The Africa Renewable Energy Initiative (AREI, 2020) elaborates that the participation of the private sector in the development of renewable energy projects in Sub-Sahara Africa has been growing, helped by the need to mobilize capital, expertise and innovation to address the energy challenges in the region (AREI, 2020). The AREI (2020), further reports that in 2019 the Sub-Sahara African region attracted approximately $7.4 billion in renewable energy projects investments, with a significant contribution from the private sector.

However, the participation of the private sector in the development of renewable energy projects in Sub-Sahara Africa encounters several challenges such as unclear regulations, limited availability of financing, technical inadequacies of the electrical infrastructure and the unpredictable socio-political dimensions. According to Zang et al (2018), legal and regulatory challenges such as inconsistent policy frameworks, cumbersome licensing processes and lack of clarity on land tenure pose significant challenges to the participation of the private sector in the development of renewable energy projects. Challenges in the financial and economic space such as limited access to affordable long-term financing, high risk perception and inadequate financial instruments are among the barriers that constrain private sector involvement in the development of renewable energy projects in Sub Sahara Africa (IRENA, 2016). On the other hand, technical challenges such as electricity grid instability, inadequate electrical infrastructure and limited local expertise also constrain the development of renewable energy projects in the region (Eberhard et al., 2017). Furthermore, the high costs of the renewable energy technologies and the limited availability of concessional financing have made it difficult for governments and the private sector to secure financing for projects development, the financial challenges are further

intensified by limited access to international capital markets which restricts the Sub-Sahara African countries to be able to secure required financing for the development of the renewable energy projects (World Bank, 2020).

Despite having a number of challenges that constrain the development of renewable energy projects, the region has witnessed notable successes in the development of renewable energy projects led by countries like South Africa, Kenya and Ethiopia which have been able to attract significant private sector investments in their renewable energy sectors (Eberhard et al., 2017). For instance, South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has successfully attracted over $14 billion in private sector investments since 2011, leading to the development and construction of over 6GW of renewable energy projects capacity (Eberhard & Naude, 2016). Kenya has also made remarkable progress through the development of geothermal and wind power projects propelled by significant private sector investments (Owino, 2020).

Eberhard et al (2016), in a study on the development of independent power projects in Sub-Sahara Africa (SSA) identified twelve (12) factors that contribute to the successful implementation of power projects by the private sector. The study was based on five (5) case studies of countries with the most IPPs in the SSA namely South Africa, Uganda, Kenya, Tanzania and Nigeria. The factors are highlighted in table 2.1.

Table 2.1: Factors contributing to successful independent power projects in Sub-Saharan Africa

S/N	FACTOR
1.	Stable country context
2.	Clear policy framework
3.	Transparent, consistent, and fair regulation
4.	Coherent power sector planning
5.	Competitive bidding practices
6.	Favorable equity partners
7.	Favorable debt arrangements
8.	Creditworthy off-taker
9.	Secure and adequate revenue stream
10.	Credit enhancements
11.	Positive technical performance
12.	Strategic management and relationship building

Source: (Eberhard et al., 2016)

Table 2.1 has highlighted the twelve (12) factors that contribute to the development of IPP projects in Sub Sahara African countries as: (i) stable country context; (ii) clear policy framework; (iii) transparent, consistent, and fair regulation; (iv) coherent power sector planning; (v) competitive bidding practices; (vi) favorable equity partners; (vii) favorable debt arrangements; (viii) creditworthy off-taker; (xi) secure and adequate revenue stream; (x) credit enhancements; (xi) positive technical performance; and (xii) strategic management and relationship building. According to Eberhard et al (2016), South Africa, Uganda, Kenya, Tanzania and Nigeria have achieved successful IPP projects development because of having attained most of the factors, thereby attracting private sector investments. Looking at the Zambian context, the country has a high renewable energy resources base ranging from hydropower, solar, wind, biomass and geothermal, which have great potential for electricity generation (MOE, 2022). However, Zambia has been facing insufficient electricity supply challenges, attributed to the over-reliance on hydropower generation which makes the country vulnerable to climate variability and hydrological risks (MOE, 2022). Zambia's installed electricity generation capacity is dominated by hydropower accounting for over 80% of the country's electricity generation capacity, which is mostly owned and operated by the national utility company (Energy Regulation Board, 2023). The vulnerability of hydropower generation to climate variability and the potential impacts of climate change has posed significant risks to the country's energy security. The country's installed electricity generation capacity is highlighted in table 1.1.

Table 1.1. Installed Electricity Generation Capacity

Technology	***Station***	***Licensee***	***2023 MW***	***2024 MW***
Hydro	Itezhi Tezhi	Itezhi Tezhi Power Corporation	120.00	120.00
	Lunsemfwa	Lunsemfwa Hydro Power Company	24.00	24.00
	Mulungushi	Lunsemfwa Hydro Power Company	32.00	32.00
	Kasanjiku	Rural Electrification Authority	0.64	0.64
	Ikelengi	Zengamina Limited	0.74	0.74
	Chishimba	ZESCO Limited	6.00	6.00
	Kafue Gorge	ZESCO Limited	990.00	990.00
	Kafue Gorge Lower	ZESCO Limited	750.00	750.00
	Kariba North Bank	ZESCO Limited	720.00	720.00

Technology	*Station*	*Licensee*	*2023 MW*	*2024 MW*
	Kariba North Bank Extension	ZESCO Limited	360.00	360.00
	Victoria Falls	ZESCO Limited	108.00	108.00
	Lunzua River	ZESCO Limited	14.80	14.80
	Lusiwasi	ZESCO Limited	12.00	12.00
	Lusiwasi Upper	ZESCO Limited	15.00	15.00
	Musonda Falls	ZESCO Limited	10.00	10.00
	Shiwang'andu	ZESCO Limited	1.00	1.00
Coal	Dangote Power Plant	Dangote Cement Zambia Limited	30.00	30.00
	Maamba Power Plant	Maamba Collieries Limited	300.00	300.00
Diesel	Bancroft	Copperbelt Energy Corporation	20.00	20.00
	Kankoyo	Copperbelt Energy Corporation	10.00	10.00
	Luano	Copperbelt Energy Corporation	40.00	40.00
	Mclaren	Copperbelt Energy Corporation	10.00	10.00
	Chama	ZESCO Limited	1.45	1.45
	Lundazi	ZESCO Limited	1.75	1.75
	Shangombo	ZESCO Limited	1.60	1.60
Solar	LSMFEZ	Bangweulu Power Company Ltd	54.00	54.00
	Chibwika	Chief Chibwika Chiefdom Development Trust (REA)	0.03	0.03
	Itimpi & Riverside	Copperbelt Energy Corporation	34.00	94.00
	Milala Eco Lodge	Endeva Power Zambia Limited	0.01	0.01
	Chitandika	Engie Power Corner Zambia	0.03	0.03
	Kabamba	Kafue Gorge Regional Training Centre	0.04	0.04
	Nsombo Village	MPower	0.01	0.01
	Sinda Village	Muhanya Solar Limited	0.03	0.03
	LSMFEZ	Ngonye Power Limited	34.00	34.00
	Samfya	Rural Electrification Authority	0.06	0.06
	Luangwa bridge	Solera Power Company Limited	0.01	0.01
	Chanyalubwe	Solera Power Vending Machine	0.03	0.03
	Chikomeni	Solera Power Vending Machine	0.02	0.02
	Kacholola, Nyimba	Solera Power Vending Machine	0.02	0.02
	Kapasa	Solera Power Vending Machine	0.02	0.02
	Ken, Katete	Solera Power Vending Machine	0.03	0.03
	Madzi-A-Tuwa, Lumezi	Solera Power Vending Machine	0.03	0.03
	Taferansoni	Solera Power Vending Machine	0.03	0.03

Technology	*Station*	*Licensee*	*2023 MW*	*2024 MW*
	Kafue	Standard Microgrid	0.02	0.02
	Ngwerere	Standard Microgrid	0.02	0.02
HFO	Ndola	Ndola Energy Company Limited	110.00	110.00
Total Installed Capacity			**3,811.37**	**3,871.37**

Source: 2024 Mid-Year Statistical Bulletin, ERB

Table 1.1 highlights the national installed generation capacity increase to 3,871.32MW in 2024, up from 3,811.32MW in 2023, the increase was driven by additional power generation capacity from solar power plants, notably the Kitwe solar plants (CEC's Itimpi & Riverside), which expanded from 34MW in 2023 to 94MW in 2024 (ERB, 2024). An analysis of table 1.1 indicates that power generation from Government institutions (ZESCO Ltd and REA) accounts for 2,990.85MW (77.2%), while the Public Private Partnership (PPP) power stations (Itezhi Tezhi and the two LSMFEZ) account for 208MW (5.4%) and the private sector account for 672.52MW (17.4%) of the national installed generation for on-grid and off-grid power plants. The electricity generation landscape is dominated by hydroelectric power generation with a share of 82%, with coal and solar power plants contributing 9 and 5 percent to the energy mix respectively (ERB, 2024).

2.2. History Development of Renewable Energy in Zambia

In 1991, the Government of Zambia instituted structural reforms which were aimed at introducing a market-based and private sector-driven economy, rather than the state-dominated economic system that prevailed (Simutanyi, 1996). To achieve the objectives of the reforms, the Government of Zambia developed laws and policies to implement the introduction of a market-based and private sector-driven economy. Among the laws and policies that were developed by the Government, was the National Energy policy (NEP) of 1994 with the objective of promoting the optimal supply and utilisation of energy, especially indigenous energy forms, for socioeconomic development in a safe and healthy environment (MOE, 2008). The objectives of the policy were to be achieved through the restructuring of the electricity industry; improving accessibility to electricity; promoting electrification of productive areas and social institutions; and developing the hydro power generation potential.

The implementation of the National Energy Policy of 1994 led to the opening of the electricity industry to private sector participation, through the enactment of the Energy Regulation Act of 1995 and the Electricity Act of 1995. The Energy Regulation Act of 1995

espoused the establishment of an Energy Regulation Board (ERB) and to define its functions and powers; to provide for the licensing of undertakings to produce energy or the production or handling of certain fuels; to repeal the National Energy Council Act and the Zambia Electricity Supply Act; and to provide for matters connected with or incidental to the foregoing. The Energy Regulation Act of 1995 resulted in the setting up of the Energy Regulation Board (ERB), an institution established for the regulation of the energy sector in Zambia. The Electricity Act of 1995 provided for the repeal of the Zambia Electricity Supply Act, which resulted in the abolishment of the statutory monopoly of the state-owned public utility, the Zambia Electricity Supply Corporation (ZESCO) and the establishment of the utility company, ZESCO Limited as a commercial entity incorporated under the Companies Act of 1994 of the laws of Zambia.

In 2004, Zambia introduced the Private Sector Development Reform Programme (PSDRP), with its first phase (PSDRP I, 2006-2009) aimed at improving the investment climate to boost the private sector's contribution to economic growth in the country. The PSDRP focused on strengthening public agencies that support private sector development by improving the investment code and regulatory framework, encouraging private sector investments in infrastructure development, business facilitation and economic diversification, trade expansion and citizens' empowerment (NEPAD, 2011). The implementation of the PSDRP I lead to the revision of the energy policy in 2008 and the development of strategy documents and plans in the energy sector.

In 2008, the Government of the Republic of Zambia (GRZ) developed a new national energy policy aimed at creating conditions that ensure the availability of adequate supply of energy from various sources, which are dependable, at the lowest economic, financial, social and environmental cost consistent with national development goals (MOE, 2008). The implementation of the policy aimed at moving the energy sector towards a less vertically integrated electricity sector with a clear ambition to increase among other issues, electricity generation and the involvement of the private sector in the construction of new electricity generation facilities. The 2008 energy policy, defined the renewable energy sources to include the following: solar (thermal and photovoltaic); mini/microhydro; biomass (agricultural wastes, forestry waste, industrial/municipal organic wastes, energy crops & products and animal waste); geothermal and wind. The policy (2008) stated that renewable energy sources had great potential for the generation of electricity and other uses in the country. The energy policy (2008) also stated that, despite the availability of the renewable energy resources in the country the Renewable Energy Technologies (RETs)

and small-scale energy systems have high investment capital costs which require fiscal incentives and some form of subsidies to make them financially attractive for the participation of the private sector in Zambia.

In 2019 the Government of Zambia revised the Energy Policy of 2008 in order to incorporate changes in developments not only in the energy sector and the country's economy but also in the regional and international environments (Ministry of Energy, 2019). Amongst its objectives the 2019 policy was expected to facilitate the development and deployment of renewable and alternative energy sources, promote security of energy supply through diversification of energy sources at cost reflective pricing and have consideration of climate change mitigation and adaptation while advancing sustainable development of the energy sector in Zambia. According to the energy policy of 2019, the Government established the Office for Promoting Private Power Investment (OPPPI) under the Ministry of Energy, in order to promote private sector participation in the development of power in the country. The mandate of the OPPPI is to coordinate the development and implementation of projects by the private sector in Zambia (Ministry of Energy, 2019). The energy policy of 2019 further highlights that despite the measures and interventions undertaken by the Government of Zambia, most of the projects commenced by the private sector have stalled and failed to reach financial close mostly due to the low electricity tariffs that have been found inadequate and unsustainable to generate a return on investment by the respective developers (Ministry of Energy, 2019).

It's a known fact that the participation of the private sector in renewable energy is important in scaling up renewable energy projects, increasing electricity generation, expanding access to electricity and fostering economic development. In Zambia, this was demonstrated by the development of the 54MW and 34MW Solar PV Power Plants in Lusaka District by Bangweulu Power Company Limited and Ngonye Power Limited respectively (World Bank, 2018). Other renewable energy projects developed are the 34MW and 60MW solar PV power plants in the Copperbelt Province by the Copperbelt Energy Corporation (CEC). However, despite the notable development of the solar PV power projects in Zambia, the level of private sector involvement in the development of renewable energy projects remains below its potential hampered by a number of challenges (Ministry of Energy, 2022).

In order to actualise the renewable energy resource potential in the country, the Ministry of Energy in collaboration with the World Bank implemented the Resource Mapping Project for solar and wind resources in Zambia which can be used for power generation (World

Bank, 2019). The goal of the Resource Mapping Project (2019) was to provide the Zambian policy makers, stakeholders and independent power producers (private sector) with accurate and valuable knowledge of the national wind and solar resource, including complementary tools, which can be of direct practical use, both for formulating energy policies and implementing wind and solar projects (World Bank, 2019). In addition, the Ministry of Energy working with the Enel Foundation conducted a study on the integration of the variable renewable energy sources such as wind and solar energy in the national electricity system of Zambia (CESI, 2019). All the efforts outlined above were aimed at encouraging the participation of the private sector in the development of renewable energy projects.

The ZPDF (2022) was developed with the objectives of; (i) guiding power project developers through the Zambian legal and institutional framework required to develop power projects and (ii) promoting the participation of the private sector and the development of power projects in Zambia among others (MOE, 2022).

The ZPDF (2022) describes the electricity industry in Zambia as being overseen by the Ministry of Energy which is charged with the responsibility of developing and managing energy resources in a sustainable manner for the benefit of the people of Zambia. Further, the ZPDF (2022) describes the government institutions in the Zambia electricity industry as the Energy Regulation Board (ERB), the Rural Electrification Authority (REA) and ZESCO Limited. The ZPDF (2022) highlights the players in the Zambia electricity industry as legal and regulatory institutions, which includes government institutions, industry interconnected network which includes the electricity utility ZESCO Limited, private sector institutions, consumers of electricity, mining companies, power imports and power exports. The ZPDF (2022), depicts the structure of the electricity sector in Zambia as indicated in figure 1.

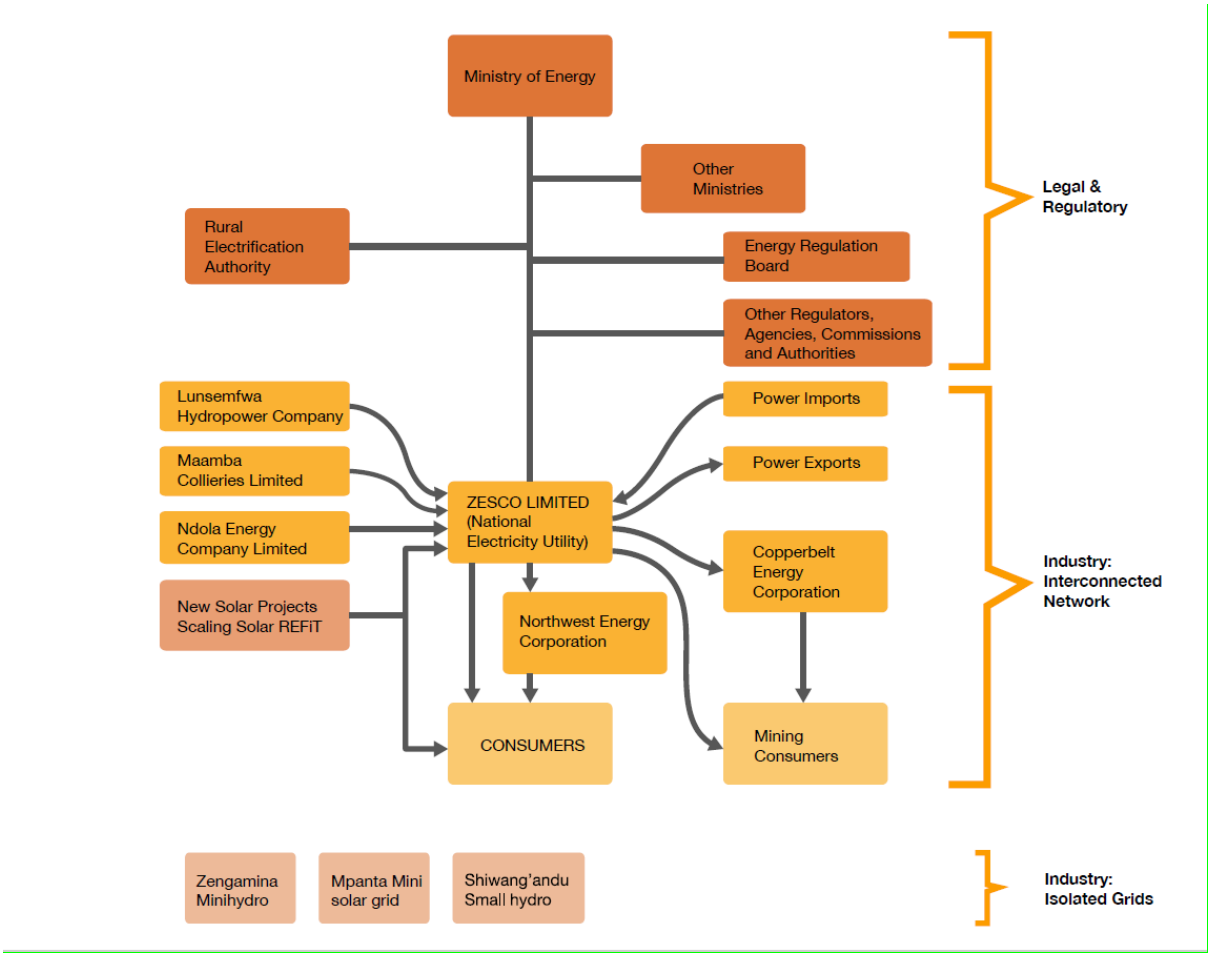

Figure 1. Structure of the Electricity Industry in Zambia (Source ZPDF)

According to MOE (2022), there are several challenges affecting the exploitation of renewable energy resources in Zambia, such as high investment requirements with electricity tariffs that are not cost reflective and limited availability of projects financing instruments. The high capital costs especially limit the local private sector companies who struggle to create viable business models for the development of profitable renewable energy projects (MOE, 2022).

The participation of the private sector in Zambia's renewable energy sector has been growing, evidenced by the Scaling Solar Program which was implemented with the support of the World Bank Group and attracted private sector investment in the renewable energy sector (World Bank, 2020). Under the Scaling Solar Program, Zambia successfully awarded contracts for the development of 100MW solar PV power projects to private sector developers through a competitive bidding process, attracting investments of over $200 million (World Bank, 2020).

However, despite the implementation of policies and strategies by the government to enhance the renewable energy sector, several challenges such as legal and regulatory

barriers, unclear licensing requirements, delays in project approvals and inconsistent policy implementation continue to constrain private sector investment in Zambia (Meyer-Renschhausen, 2018). Financial and economic challenges such as limited access to local financing, high cost of borrowing and lack of targeted financial instruments also hinder private sector investment in the development of renewable energy power projects in the country (Kabamba, 2020).

Further, technical capacity challenges such as limited skilled personnel, inadequate electrical infrastructure and limited technological know-how on renewable energy hinder projects development and operation (Mphande & Chama, 2019). The absence of standardized processes and procedures and quality assurance mechanisms for renewable energy projects hampers scalability and replicability affecting the long-term viability of projects (Mphande & Chama, 2019). Market dynamics such as limited power off-take arrangements, uncertain electricity demand projections and nascent supply chains pose additional challenges for the participation of the private sector in Zambia's renewable energy sector (Ng'ambi, 2021).

Despite the challenges, there has been successful developments of renewable energy project such as the Scaling Solar Program in Zambia which attracted private sector investments through competitive bidding and transparent procurement processes resulting in the development of two (2) solar PV power projects in Lusaka Province (World Bank, 2020).

2.3. Analysis of Literature on Private Sector Participation in Renewable Energy Development

Various scholars have written about private sector participation in the development of renewable energy projects. The findings, arranged according to the research objectives of this paper, are discussed below:

2.3.1. Factors Constraining Private Sector Development of Renewable Energy Projects in Zambia

A review of literature has identified three main categories of constraints of renewable energy projects discussed below:

Bureaucracy and Regulatory Environment

Othman and Khallaf (2022) aimed to identify the main barriers and key success factors (KSFs) for renewable energy projects delivered through public-private partnerships (PPPs) globally. The study conducted a comprehensive literature review followed by a

questionnaire survey, collecting opinions from 60 experts with extensive experience in renewable energy PPPs across multiple countries. The analysis, using structural-equation modelling, revealed that political and regulatory barriers are the main risks while, well-prepared contract documentation and skilled parties were identified as key success factors.
Di Foggia et al. (2024) examined the global energy transition to understand the factors influencing success or failure in achieving renewable energy targets. The study analysed data from 63 countries, highlighting the roles of political stability, regulatory quality, and investment freedom in achieving energy targets. The study argued that accelerated administrative procedures are needed to reduce investment uncertainty and improve energy systems' flexibility. Involving local communities in decision-making processes was also recommended to ensure the acceptance of renewable energy project
Hope et al. (2024) reviewed the principals constraining factors and examples of successful development of wind and solar energy in Latin America and Africa. The study conducted a detailed literature review and provided recommendations based on successful case studies and expert consultations. The main constraints identified include structural and financial factors, policy regimes creating investment uncertainty, resistance from local communities, and failure of independent power producers (IPPs) to understand the local context. Success factors included financial incentives, stable regulatory frameworks, international investment in grid infrastructure, and effective social acceptance.
Percy J. Saili (2019) investigated the best practices of project selection in Zambia's renewable energy sector and identified factors contributing to optimal project selection. Using a modified Delphi approach to gather expert opinions, the study identified environmental issues, governance, strategic alignment, and time as significant factors for project selection.
Mhango (2024) investigated the drivers and barriers affecting the implementation of renewable energy technologies in Zambia. It identified regulatory, financial, infrastructural, and societal challenges that intersect with opportunities presented by abundant alternative renewable energy resources
The common feature in the global, regional and local literature is that bureaucracy and clear regulatory environment play a critical role. Political and regulatory barriers are significant risks, with well-prepared contract documentation and skilled parties as key success factors. Policy regimes creating investment uncertainty and resistance from local communities have been identified as major constraints.

Lack of Incentives

Othman and Khallaf (2022) found that the absence of robust incentives deters private sector investment. Hope et al. (2024) reviews the principal constraining factors and examples of successful development of wind and solar energy in Latin America and Africa. The paper provides examples of successful incentive schemes, such as tax breaks and subsidies, that have attracted private sector investment in renewable energy projects.

Walimwipi (2012) discusses the economic incentives offered by the Zambian government to encourage investment in renewable energy. The study conducted a detailed review of existing policies and incentives and analyzed their effectiveness in attracting private sector investment. Fiscal incentives (tax breaks) and non-fiscal incentives (risk cost guarantees) are key measures to attract investment. However, these incentives are often insufficient to overcome the high initial costs and financial risks associated with renewable energy projects.

The common findings of the papers were the emphasis that fiscal and non-fiscal incentives are crucial for attracting private sector investment.

Technical and capacity challenges

Khallaf (2022) highlighted the importance of skilled parties as critical for the success of renewable energy projects. Technical expertise and capacity within the private sector are essential for the successful development and management of projects. Hope et al. (2024) identified the failure of independent power producers (IPPs) to understand the local context as a constraint, suggesting international investment in grid infrastructure and capacity building as solutions to address these challenges. Effective social acceptance efforts and community engagement are also crucial for the success of renewable energy projects.

Percy J. Saili (2019) found that limited technical know-how and capacity are significant challenges in Zambia.

2.3.2. Challenges in Financing Renewable Energy Projects in Zambia

The second research objective of this paper aims to determine challenges in financing renewable energy projects in Zambia. Various papers were reviewed on this subject.

Beschloss and Mashayekhi (2019) examined the role of green bonds in financing environmentally sustainable projects globally. The study highlighted the potential of green bonds to attract investment for renewable energy projects, identifying high initial costs, limited access to concessional finance, and high perceived risks as significant challenges.

It also emphasized the importance of stable and predictable policy frameworks to support green bond markets.

Camelo (2024) highlighted the crucial financing pathways needed to achieve a successful clean energy transition, focusing on Africa, Asia and the Pacific, Latin America and the Caribbean, and Europe. The study identified high financing costs, fiscal constraints, and inconsistent regulatory frameworks as common challenges across regions. It emphasized the importance of innovative financing mechanisms, such as green bonds and blended finance, to attract private sector investment in renewable energy projects.

The SEC (2024) report on Sustainable Energy Investment Opportunities in Zambia, discussed investment opportunities and financial challenges in Zambia's renewable energy sector. The report identified high initial costs, limited access to concessional finance, and high perceived risks as significant challenges. The report also emphasized the importance of stable and predictable policy frameworks to support investment.

2.3.3. Institutional, Policy, and Regulatory Framework Challenges

The third objective of this paper is to assess the institutional, policy, and regulatory framework challenges. Related papers on this subject from a global, regional, and local level were reviewed.

Jordana et al. (2024) examined the evolving institutional challenges of global governance by analyzing sectors such as trade, security, environment, and finance. The study identified decision-making gridlocks, organizational inefficiencies, and regulatory challenges as significant barriers. It emphasized the importance of strong institutions and clear regulatory frameworks to support sustainable development.

Zinaman (2022) explored the policy and regulatory implications of peer-to-peer energy communities, emphasizing the need for new frameworks to support renewable energy development. The study identified complex and sometimes contradictory regulations as significant barriers, emphasizing the importance of clear and consistent regulatory frameworks to support the deployment of renewable energy projects.

IRENA (2022) examined the key factors influencing investors in mini-grid projects in Zambia, including licensing, tariff regulation, access to finance, and specific project risks. IRENA identified inconsistent policies, complex regulations, and weak institutions as significant barriers. The findings highlighted the importance of strong institutions and effective coordination among stakeholders.

2.3.4. Research Gaps

Othman and Khallaf (2022) provide a broad continental analysis of barriers and success factors for renewable energy PPP projects, which may overlook specific regional or country-specific challenges. Their study lacks a deep dive into the local socio-economic and political contexts that are crucial for understanding the unique challenges faced in Zambia.

Hope (2024) focuses on both Latin America and Africa, which may dilute the specific challenges and opportunities in Zambia. While the report offers general recommendations, it lacks detailed case studies or examples from Zambia that could provide more actionable insights.

Saili (2019) narrowly focuses on project selection criteria without addressing broader challenges such as financing, regulatory barriers, and stakeholder engagement, which are critical for understanding private sector involvement.

Beschloss and Mashayekhi (2019) provide a global overview of green bonds and sustainable finance, which may not address specific challenges faced by Zambia. Their discussion of theoretical aspects of green bonds lacks practical insights for implementation in Zambia.

Camelo (2024) covers multiple regions, which might not provide a detailed analysis of Zambia's specific financing challenges. The recommendations are broad and may be difficult to implement for Zambia.

Jordana et al. (2024) discuss global governance challenges, which may not directly address the specific institutional barriers in Zambia. Their study covers a wide range of institutional challenges, potentially diluting the focus on renewable energy sector-specific issues.

Zinaman et al. (2022) focus on microgrid deployment, which may not cover broader renewable energy project challenges. The emphasis on regulatory models lacks detailed analysis of business models and financial mechanisms specific to Zambia.

These weaknesses and gaps highlight the need for a Zambian study that focuses specifically on Zambia's unique socio-economic and political context, provides updated data and trends, and addresses broader challenges such as financing, regulatory barriers, and stakeholder engagement.

2.4. Chapter Summary

This chapter has presented a review on the development of renewable energy globally, in Sub-Sahara Africa and in Zambia. The chapter presented the history on the development of

renewable energy in Zambia, analysed several literatures on private sector participation in renewable energy development globally and in Zambia focusing on the objectives of the study. The next chapter presents the theoretical and conceptual frameworks of the study.

CHAPTER THREE

THEORETICAL AND CONCEPTUAL FRAMEWORK

3. Introduction

Chapter three provides an analysis of the theoretical and conceptual frameworks to necessitate for a comprehensive assessment of the factors that influence the development of renewable energy projects. The chapter borrows from the literature review and looks at development theories and how they relate to the development of renewable energy projects by the private sector. It also discusses the study's independent, intervening and dependent variables and closes with a conclusion.

3.1. Theoretical Framework

A theoretical framework for a study can be described as an orderly set of ideas and rules arranged to explain logical connections between ideas that can be used as a framework for analysing a phenomenon and a foundation for classifying known variables (Kawulich, 2016). Based on the provided literature review in chapter three, this theoretical framework integrates theories to interrogate the challenges and opportunities of private sector involvement in the development of renewable energy projects globally, in Sub-Sahara Africa and in Zambia.

To understand the relationship of the factors that influence the development of renewable energy projects the following theories have been selected:

i. Institutional theory;
ii. Financial market imperfection theory; and
iii. Technological diffusion and innovation theory.

The three (3) theories have been considered because of their focus on the perspectives of the governance, financial and economic and technological and social adaption environment of a country. Therefore, by integrating the theories the study has provided a framework for the assessment of the challenges of private sector involvement in the development of renewable energy power projects in Zambia.

3.1.1. Institutional Theory

Institutional theory has been selected to examine the influence of legal and regulatory frameworks, policy and institutional arrangements on the participation of the private sector in the development of renewable energy projects. The institutional theory provided a focus

on how formal and informal rules, norms and regulations shape organizational behaviour and decision-making processes (North, 1990). For the context of renewable energy developments, institutional theory helps to explain how legal and regulatory uncertainties, bureaucratic inefficiencies and inconsistent policy implementation by governments affect the participation of the private sector in the development of renewable energy projects.

The empirical review highlighted that globally, the development of renewable energy is largely influenced by stability and predictability of legal and regulatory frameworks such as established feed-in tariffs, standardized power purchase agreements (PPAs) and availability of tax incentives (World Bank, 2018). While in the context of Sub-Sahara Africa, it was highlighted that institutional challenges such as inconsistent policy frameworks, complex licensing processes and lack of clarity on land tenure present major challenges for the participation of the private sector in the development of renewable energy projects (Zhang et al., 2018). Meanwhile, for the Zambian context the role of institutional theory is evident in the analysis of legal and regulatory challenges that constrain the participation of the private sector such as unclear licensing requirements, delays in project approvals and inconsistent policy implementation by the government (Meyer-Renschhausen, 2018).

Therefore, institutional theory provides a clear understanding on the significance of having stable, supportive and predictable regulatory environments for attracting private sector investments in the renewable energy sector. The theory further highlights the importance of streamlined processes, clear guidelines and transparent decision-making for mitigating investment risks and foster a conducive environment for the development of renewable energy projects.

3.1.2. Financial Market Imperfection Theory

The Financial Market Imperfection Theory looks at the challenges that arise from imperfections in financial markets such as inadequate financing sources, high transaction costs and limited access to long-term financing. The theory is relevant to understand the challenges that the private sector encounter in accessing financing for the development of renewable energy projects, especially in developing countries (Stiglitz & Weiss, 1981).

Globally renewable energy projects often face challenges of access to affordable and long-term financing due to risk perceptions, high upfront capital costs and limited availability of financial instruments (IRENA, 2019). In Sub-Sahara Africa, financial constraints are a significant barrier to the participation of the private sector in the development of renewable

energy projects as commercial and multilateral banks are often reluctant to provide long-term loans because of the high-risk perception and local currency volatility (Eberhard et al., 2017). While in the Zambian context, financial constraints such as limited access to local financing, high costs of borrowing and inadequate risk mitigation instruments have been identified as key challenges to the participation of the private sector in the development of renewable energy projects (Kabamba, 2020).

The Financial Market Imperfection Theory provides a framework for the analysis of the financial barriers and challenges that constrain private sector investments in the development of renewable energy projects. The theory highlights the need for innovative financial instruments, risk mitigation mechanisms and supportive policies that enhance access to project financing and reduce investment risks in the renewable energy sector.

3.1.3. Technology Diffusion and Innovation Theory

The Technology Diffusion and Innovation Theory focuses on the processes for the adoption and scaling-up of new technologies across different markets and regions. The theory is relevant to provide understanding for the adoption and scaling up of renewable energy technologies such as solar, wind and biomass and the role that innovation plays in overcoming the technical and operational challenges (Rogers, 2003).

Globally the decline in the costs of renewable energy technologies, particularly solar PV and wind have been attributed to technological advancements, economies of scale and innovative practices (REN21, 2020). For Sub-Sahara Africa, the adoption of renewable energy technologies has been constrained by technical capacity challenges, inadequate electrical infrastructure and limited local technological knowledge of the renewable energy technologies (Eberhard et al., 2017). While for Zambia, the implementation of the solar PV power plants under the Scaling Solar Program highlights the role of technology diffusion and innovation in scaling up renewable energy developments (World Bank, 2020).

The Technology Diffusion and Innovation Theory provides understanding to the factors that influence the adoption and scalability of renewable energy technologies. It emphasizes the importance of fostering innovation, building technical capacity and developing supportive ecosystems to accelerate renewable energy deployment to achieve sustainable energy transitions.

By examining the relationships among the theories, this study aims to identify the critical barriers that constrain the participation of the private sector and propose interventions to

enhance private sector involvement in the development of renewable energy projects in Zambia.

3.2. Conceptual Framework

A conceptual framework is a crucial aspect of conducting a study because it provides a structured approach to understand the relationships among the concepts and ideas related to the study topic (Tumi, 2015). It provides guidance for the researcher in defining and clarifying the key concepts, theories and relationships that exist within the study. It also provides a visual representation of the connections between the study variables thereby allowing for the identification of the most relevant variables and the establishment of a theoretical model that guides the research.

The conceptual framework for this study has integrated the key concepts from the Institutional, Financial Market Imperfection and Technology Diffusion and Innovation theories discussed in the theoretical framework to examine the drivers, barriers and challenges that constrain the participation of the private sector in the development of renewable energy projects in Zambia.

The conceptual framework has broken down the theories into the following concepts to illustrate the relationships:

3.2.1. Institutional Theory is broken down into regulatory and institutional environment, which presents the regulatory and legal frameworks, policies and institutional arrangements that shape the renewable energy sector. Having supportive and stable regulatory, legal and institutional environment positively influences the participation of the private sector by reducing the investment risk perception and increasing predictability of the investment environment;

3.2.2. Financial Market Imperfection Theory is broken down into financial market conditions and access to financing, illustrating the financial environment and access to financing for the development of renewable energy projects. Presence of favorable financial market conditions and access to financing positively impacts the participation of the private sector by reducing the costs of borrowing and mitigating financial risks for investments;

3.2.3. Technology Diffusion and Innovation Theory is broken down into technology innovation, social environmental and capacity building, illustrating the diffusion and adoption of renewable energy technologies as well as the technical expertise required for the development of renewable energy projects and the social acceptance of the

renewable energy projects. Having high levels of technological innovation, social acceptance and capacity building largely enhances the participation of the private sector by improving project development efficiency, scalability and operational performance. The conceptual framework for the study is illustrated in figure 2 as follows:

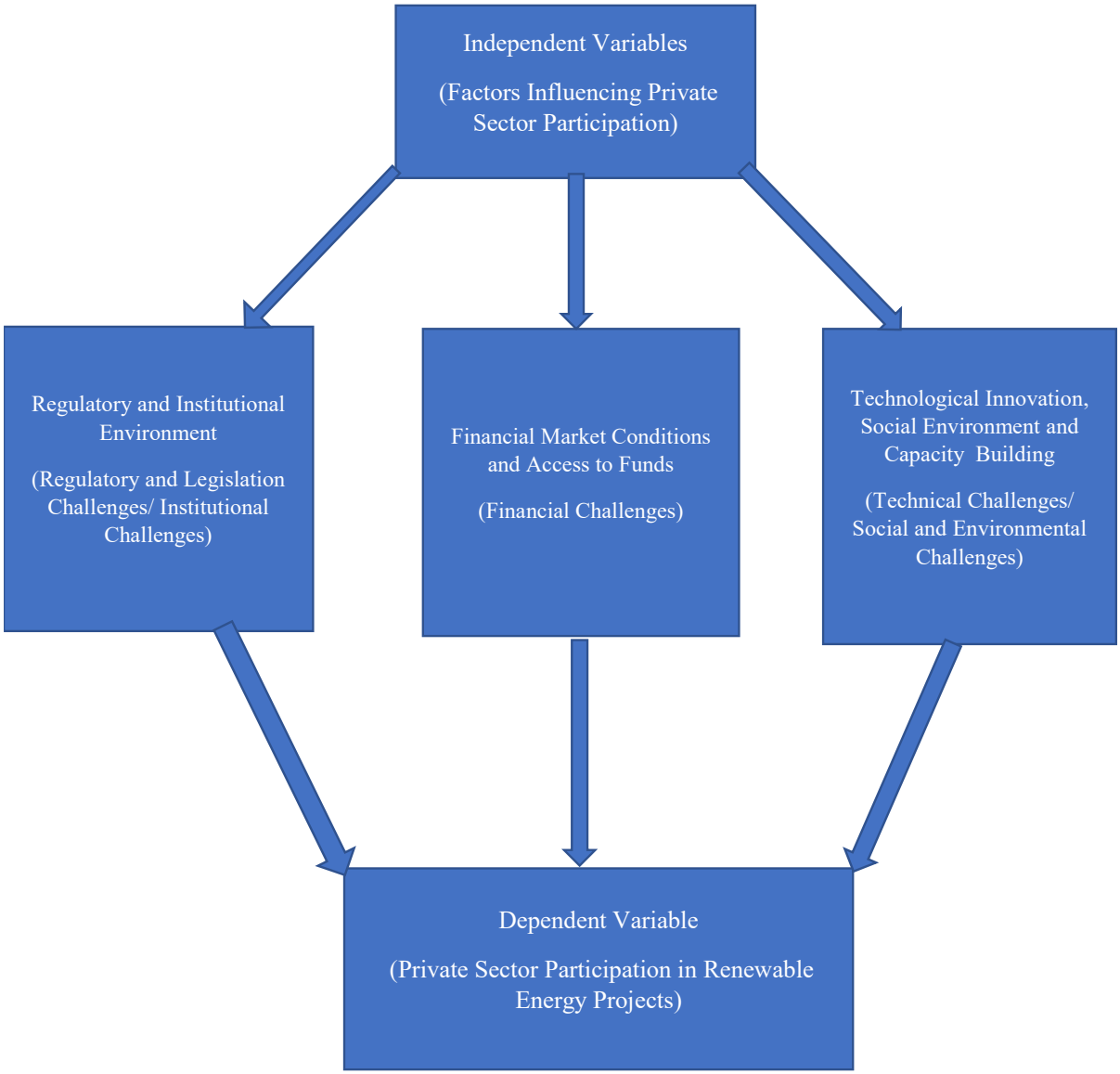

Figure 2: Conceptual Framework Source: Author

The highlighted conceptual framework provides a model for analyzing the factors that influence or affect the participation of the private sector in the development of renewable energy projects. Through the integration of the theories of regulatory and institution arrangements, financial markets and technology diffusion the framework offers a valuable

understanding of the multifaceted nature of the enablers and barriers and offers a basis for identifying and implementing solutions to enhance the participation of the private sector in the development of renewable energy projects in Zambia.

3.3. Explanation of the Study Variables

3.3.1. Independent Variables

The independent variables for the study are the challenges or factors constraining private sector involvement in the development of renewable energy projects in Zambia.

The following are the challenges: regulatory and legislative challenges; financial challenges; technical challenges; institutional challenges; and social and environmental challenges. Which include factors such as regulatory barriers, financial constraints, lack of infrastructure, political instability, technological limitations and poor government structures.

3.3.2. Dependent Variables

The dependent variable for the study is the level or extent of private sector involvement in the development of renewable energy projects in Zambia.

This would be measured using indicators such as the number of renewable energy projects developed by private sector companies, the amount of investment made by the private sector in renewable energy projects, the installed capacity of renewable energy projects led by the private sector and the overall contribution of private sector initiatives to the renewable energy sector in Zambia.

3.3.3. Intervening variables

The following are the intervening variables that were used for the study:

i. Demand for Renewable Energy Projects. According to the IRP (2023) the national electricity demand is expected to increase significantly from 3,705MW in June 2023 to 10,013MW by 2030. Therefore, there is adequate demand for the development of renewable energy projects to meet the country's electricity demand for the future. Further, the diversification of the electricity generation mix through the development of renewable energy projects will make the electricity sector more resilient to climate change effects; and

ii. Electricity Tariffs. According to the RESAP (2022) the lack of cost reflective electricity tariffs is among the challenges affecting investment in the renewable energy sector. Therefore, it is hoped that the approval of the new electricity tariffs

for all ZESCO customers in May 2024 by the ERB would provide an incentive for private sector development of renewable energy projects.

3.4. Chapter Summary

The chapter has presented theoretical and conceptual frameworks of the study, highlighting the factors that contribute to the development of renewable energy projects by the private sector. Lastly, the chapter defined the variables for the study. The next chapter presents the study methodology for conducting the research.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.0 Introduction

A study methodology refers to the procedures which are used to locate, choose, process and evaluate materials on a subject matter (Mugenda & Mugenda, 2015). The methodology section of a study aids the reader in evaluating the reliability and validity of a study. The section on the study techniques responds to the following two (2) major queries: (i) How was the data compiled or produced? and (ii) What technique was used to observe it?

This chapter also covers the methods used by the researcher to collect the data used in the study. It covers the study design, the target population from which the study sample was drawn from and the sampling technique applied to select the sample. Further, the chapter highlights the data collection tools used in the study.

4.1 Philosophy of the study

According to Salife & Williams (1995), philosophical ideals greatly influence the research practice in that they explain why a particular research approach be it qualitative, quantitative or mixed approach was adopted by a researcher. According to Cresswell (2014), philosophies are worldviews (sets of beliefs that influence actions) that a researcher conveys to a research study and arise from past research experiences, mentor-under study predispositions and the field of orientation of the researcher.

The research philosophy underpinning this study was grounded in positivism. Saunders (2023), describes positivism as a philosophical stance of the natural scientist and entails working with an observable social reality to produce law-like generalisations. Positivism emphasizes objectivity, use of empirical evidence and belief that reality is stable and can be observed and described from an objective viewpoint without interfering with the phenomena being studied.

The study seeks to uncover the evidence of the research through empirical data collection. Therefore, the study utilized the use of questionnaires and statistical methods to gather and undertake analysis of the data, ensuring that the findings were not influenced by the researcher's biases.

4.2 Study Approach

A study approach refers to the method that a researcher utilises to gather, examine and interpret data for a particular research (Cresswell, 2014). There are three types of research methods namely qualitative, quantitative and mixed methods (Dawson, 2009). According to Dawson (2009) qualitative research explores attitudes, behaviour and experiences through methods such as interviews or focus groups, and quantitative research generates statistics through the use of survey methods such as questionnaires or structured interviews, while mixed research is the combination of the qualitative and the quantitative research methods.

The study utilised a quantitative methodology for the collection and analysis of the data. The quantitative methodology in this study was used to characterise, explain and to draw conclusions on the challenges of the private sector involvement in the development of renewable energy projects in Zambia.

4.3 Study Design

Study design refers to the processes of data collection, data analysis and report writing (Abdullahi, 2019). The study entails conducting a correlational research design focusing on the challenges of private sector involvement in the development of renewable energy projects in Zambia. A correlational research design, is a nonexperimental form of research in which investigators use the correlational statistics to describe and measure the degree or association (or relationship) between two or more variables or sets of scores (Creswell, 2012). The research used a structured survey questionnaire and a stratified random sampling approach for the selection of participants from private sector companies, government institutions and non-governmental organisations who are involved in the development of renewable energy projects in Zambia.

The questionnaire included closed-ended questions covering various facets of private sector involvement in the development of renewable energy projects, such as regulatory and legislative challenges, financial challenges, institutional challenges, technical challenges and social and environmental constraints. The data collected through the survey had undergone descriptive and inferential analysis to assess the relationship between the variables and identify predictors of private sector involvement.

4.4 Study Population

Study population refers to the cluster of individuals or objects from which the researcher plans to draw deductions (Cresswell, 2014). The study population which was considered

for the study were individuals from private sector companies, government institutions and non-governmental organisations that are involved in the development of renewable energy projects in Zambia. According to the Electricity Act No. 12 of 2019, "a person who intends to undertake a feasibility study for the development of a new electricity project, shall apply for an authorisation to the Minister in the prescribed manner and form", this entails that anyone intending to undertake the development of an electricity project is required to make an application to the Minister of Energy for feasibility study authorisation. Further, Ministry of Energy (2022) elaborates that the Government of Zambia engages the private sector in the development of power projects through three (3) processes namely;

(i) Government initiated projects (solicited process); undertaken through the Ministry of Energy, Public Private Partnership Department (PPPD) and other government agencies such as Industrial Development Corporation (IDC), ZESCO Limited, Rural Electrification Authority (REA), Local Authorities and Provincial Administrations;

(ii) Private sector-initiated projects (unsolicited process); undertaken by Independent Power Producers (IPPs); and

(iii) Self-generation for industrial use and/ or local area distribution.

The three (3) processes or forms highlighted above cater for the development of electricity power projects by the public and private institutions and non-governmental organisations. The Government institutions were also considered in the study population because of their part in handling the development of renewable energy projects by the private sector in the country.

Considering the solicitation processes for the development of power projects in Zambia, the study population was determined to include the following:

i. Independent Power Producers (IPPs) with projects in operation, two (2) private sector companies;
ii. IPPs whose projects are under construction, one private sector company;
iii. IPPs with feasibility studies completed and are mobilizing financing for the construction of the projects, 24 private sector companies;
iv. IPPs whose feasibility studies are underway, comprised of 10 private companies;
v. Non-governmental organizations that deal with the development of renewable energy projects, which includes financiers and development agencies that provide assistance to the government and the private sector in the development of renewable energy projects; and

vi. Government institutions comprising the Ministry of Energy, the Ministry of Finance and National Planning, Zambia Development Agency (ZDA), ZESCO Ltd, Energy Regulation Board (ERB) and the Rural Electrification Authority (REA).

At-least two (2) officials from each institution were selected for the study bringing the total study population to 72 respondents. The number of officials was considered to ensure a higher rate of response from the institutions and organisation targeted.

4.5 Sample Size

The sample size was the number of individuals selected from all the institutions that were considered in the study which included private sector companies that are authorised by the Ministry of Energy to undertake feasibility studies for the development of renewable energy projects in Zambia and are at different stages of project development, non-governmental organisations that deal with the development of renewable energy projects and government institutions which are involved in the development of policies, regulations and implementation of renewable energy projects.

According to Phiri (2006), a sample is a finite part of a statistical population whose properties are studied to gain information about the whole. The selection of a reasonable sample size is very important as it avoids wasting resources, such as time and money especially for large sample sizes. To get the correct and reliable results, a sample size should however not be small as a small sample size may compromise the reliability of the research outcome.

A representative sample size with known confidence and risk levels was selected, based on the work of Yamane (1967). The formula used by Yamane (1967) to obtain the sample size of a known population is given by:

$$\mathbf{n = N / (1 + Ne^2)}$$

Where

n= Sample size, N = population size, and e = Margin of error (MoE), e = 0.05 based on the research condition.

According to Hussey and Hussey (1997), no survey can ever be deemed to be free from error or provide 100 % surety and error limits of less than 10% and confidence levels of higher than 90% can be regarded as acceptable.

Placing the information in the formula at 95% confidence level, with a margin of error of 5% for the population comprising 13 individuals from government institutions, 51 individuals from IPPs and 8 individuals from non-governmental organisations, resulted in a sample size of 72 respondents. However, of the sample size of 72 individuals who the questionnaire was administered to, only 65 respondents filled in and submitted the questionnaires. Table 3-1 below shows the different components of the chosen study population for the research.

Table 4.1: Sample sizes for the components of the population for the study

S/N	Institution/IPPs	Number of IPPs/Institutions	Population	Sample size	Actual sample
1	IPPs	46	51	51	50
2	Government institutions	10	13	13	10
3	Non-governmental Organizations	4	8	8	5
Total		57	72	72	65

4.6 Sample Technique

The sampling technique used was the stratified random sampling technique. Stratified random sampling is a sampling technique where the population of the study is divided into two or more relevant and significant strata based on one or several attributes, in effect, the sampling frame is divided into several subsets (Saunders et al., 2003).

The use of the stratified sampling was to ensure that the selected sample sizes included a population from all types of segments or levels of renewable energy power projects development in Zambia, such as the policy development levels and the sector regulation level in order to get a somewhat wholistic understanding of the challenges of private sector involvement in the development of renewable energy in Zambia. This also ensured that the selected study sample comprised of representation from government institutions involved in policy and regulatory development of the renewable energy sector. Further, this was to ensure that there is representation of all the challenges that constrain the private sector involvement in the development of renewable energy projects.

4.7 Data Collection Techniques

The data for the study was collected with the use of a questionnaire developed by the researcher with the approval of the supervisor. The researcher obtained an introduction letter for data collection from the University of Lusaka (UNILUS), which was attached to a letter written to the Ministry of Energy in which the researcher requested for an engagement with the Ministry and contact details of IPP companies and other organizations involved in the development of renewable energy projects in Zambia. Following a meeting with the Ministry of Energy and the submission of the contact details by the Ministry, the researcher created the questionnaire in Google forms and generated a link to the questionnaire which was sent out via WhatsApp and emails to respondents, the emails presented a link to the questionnaire with an attachment of the introduction letter from UNILUS.

The steps that were undertaken in the data collection exercise are as follows:

i. Identification of the research objective and development of the questionnaire: The first step in the collection of data was the identification of the research objective, which in this study required the collection of data from renewable energy development organisations and policy makers and regulators of the energy sector in Zambia.

ii. Sampling: The second step was the identification of the sample population. For this study, the sample population was individuals from renewable energy development organisations and policy makers and regulators of the energy sector in Zambia.

iii. Contacting participants: The third step was contacting the participants and requesting them to participate in the study. This was done firstly by obtaining the contact details for the respondents and then it was conducted through WhatsApp and emails, where phone numbers were provided, phone calls were made to the respondents to get consent for participation in the study.

iv. Conducting the survey: The survey was conducted through the administering of the study questionnaire via email and WhatsApp. To make the survey questionnaire simplified and more accessible to the respondents, the survey questionnaire was created as an online questionnaire in Google forms.

v. Data management: After completing the survey, the data was entered into a spreadsheet for analysis.

vi. Data analysis: The final step was analysis of the collected data with the use of statistical tools. The results of the data analysis were used to come up with the conclusions and recommendations for the study.

4.8 Data Analysis

The data collected through the survey was analysed using descriptive and regression analysis with the help of a statistical software tool called Statistical Package for Social Sciences (SPSS). In this study the data analysis used aided in the identification of factors influencing private sector involvement in the development of renewable projects in Zambia.

The regression analysis was used to quantify the relationship between the independent variables and the dependent variable for the study. The regression analysis method assisted in the identification of the extent to which the different factors influence the participation of the private sector, thereby providing a clear, data-driven understanding of the barriers or challenges constraining the private sector in the development of renewable energy power projects in Zambia.

4.9 Validity and reliability

Validity refers to the capacity of an instrument to measure what it is designed to measure. According to Gravetter and Forzano (2016), an assessment tool's validity is a gauge of how effectively it captures the objectives of the test. To ensure the validity and reliability of the questionnaire for the study, the questionnaire was tested for viability and reliability.

The researcher ensured the validity and reliability of the questionnaire by conducting a thorough literature review and ensuring the adoption of questions from other questionnaires undertaken by various research studies, which were carried out on similar research topics on private sector participation in the development of power generation projects. The researcher also conducted a pilot study on the first draft questionnaire, by administering the questionnaire to a few experts in the field of renewable energy for their input in order to adjust the questionnaire to make it more responsive and relevant to the study objectives. The pilot study was undertaken to ensure that the researcher obtained adequate information for the questionnaire not only to be reliable but also have high content validity.

Further, the validity and reliability of the study was achieved through the utilisation of statistical analyses such as factor analysis and Cronbach's alpha and performing repeated measures for test-retest reliability.

4.10 Ethical Considerations

In order to uphold the ethical standards in carrying out the study, the researcher undertook the necessary caution when administering the data collection instrument to the respondents, by observing the following:

i. Informed Consent: Participants were informed of the purpose and nature of the study, their rights as participants and the possible risks and benefits of their participation. The informed consent was conducted through telephone conversations where the telephone numbers were availed and through email where only the email addresses were provided. Further, the first part of the questionnaire included the informed consent.

ii. Anonymity and Confidentiality: The researcher ensured that the identified participants were protected by guaranteeing anonymity and confidentiality, ensuring that the data collected would not be linked to specific individuals.

iii. Non-harmful Study: The research would not cause any physical or emotional harm to the participants. and

iv. Ethical Clearance: The researcher obtained ethical clearance from UNILUS to conduct the data collection exercise. The researcher only commenced the data collection exercise after obtaining the ethical clearance from the University.

4.11 Chapter Summary

This chapter of the study has outlined the methodology applied to conduct the research. The chapter has explained the research philosophy, approach, design, sample population and size, sampling techniques, methods of data collection and the data analysis techniques. It has further, touched on the validity and reliability of the survey instrument and delved into the ethical consideration for the study.

CHAPTER FIVE

DATA ANALYSIS AND FINDINGS

5.0 Introduction

This chapter provides an account of the data analysis undertaken by the researcher and the findings of the study. It presents the study's results, together with the interpretation of findings related to the challenges of private sector involvement in the development of renewable energy projects in Zambia. The results obtained for the study align with the data collected to address the primary questions outlined in Chapter One. The gathered data is summarized and presented through descriptive figures and table reports.

5.1 Descriptive Statistics

The questionnaire collected descriptive statistics such as response rate, demographic profile of respondents, gender and size of the organization which the respondents represented. These descriptive statistics are presented in Section 5.1.

5.1.1 Response rate

The study achieved a high response rate, with 91% of the administered survey questionnaires completed and only 9% non-responsive. This high response rate indicates strong engagement from respondents who were interested in assessing the challenges of private sector involvement in the development of renewable energy projects in Zambia. It also enhances the reliability of the data, as it encompasses a broad range of perspectives within the target population. The response rate is detailed in Table 5.1.

Table. 5.1: Response rate

	Frequency	Percentage (%)
Returned	59	91
Not returned	06	09
Total distributed	**65**	**100**

Source: Author

5.2 Demographic Profile of the Respondents

The United Nations Economic Commission for Africa (2014), states that every study conducted should be able to generate background statistics to give an impression of age or gender dynamics of the respondents. The demographic profile of the respondents considered in this study were the gender, type of organisation, number of years of operation

for the organisation and the size of the organisation (number of employees). This was aimed at understanding the gender of the respondents, the organisation's experience in the renewable energy sector and what role the organisation plays in the development of renewable energy projects in Zambia.

5.2.1 Gender

From the findings of the study, the gender distribution of the respondents was 63% male and 37% female. The gap in the representations between male and female indicates a possible gender difference in the renewable energy sector in Zambia. However, this may not be an accurate indication of the gender distribution of the whole sector as the sample size considered for the study was small to draw such conclusions. The gender analysis has been described in Figure 3.

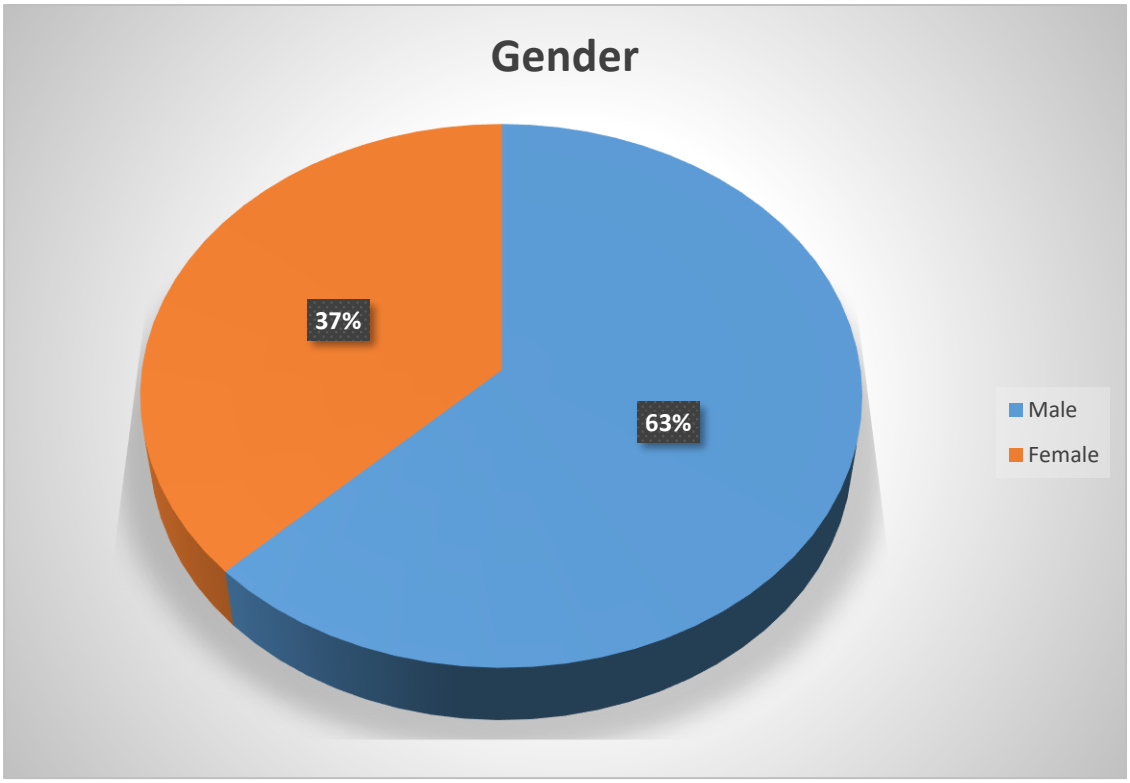

Figure 3: Gender Distribution (Author)

5.2.2 The respondent's type of organization

The findings show that most respondents are comprised of people from private companies, who make up a total of 54%, with government institutions at 24% respondents and NGOs at 22% of respondents.

The distribution was highly indicative of the sample population which had a high number of respondents from the private sector companies followed by government institutions and

non-governmental organizations with the least. The high response from the private sector is good for the study, as it ensured capturing of reliable data from the private sector companies on the challenges of private sector involvement in the development of renewable energy projects in Zambia.

The high response from the private sector companies is a great indication of how private sector companies actively participate in issues affecting their participation in the renewable energy sector in Zambia. The type of organization distribution analysis has been described in Figure 4.

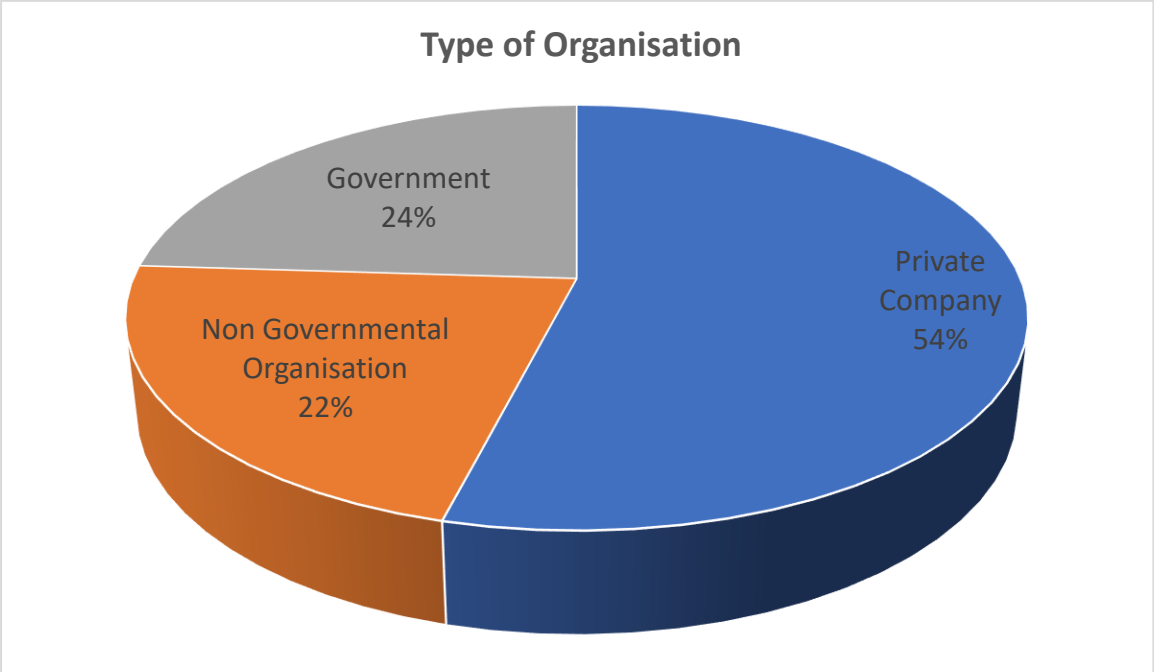

Figure 4: Type of organization distribution (Author)

5.2.3 Years of operations

The results obtained on the years of operations of the organisations indicated that a significant proportion of the organizations are more established in the renewable energy sector, as 41% of the orgnisations have operated for periods exceeding 10 years. This suggests a notable presence of stakeholders with experience in the sector who are likely to have insights of the challenges of private sector involvement in the development of renewable energy projects in Zambia. A 15% representation of the newer entrants (less than one year in operation) points to a forthcoming interest in the development of renewable energy projects in Zambia. The mixed distribution of operational years emphasizes the diversity of potential stakeholders, each encountering its own challenges regarding regulatory frameworks, financing and technical capacity, depending on how long it has been operational.

Quite obviously, the different operating years suggest competition in opportunities and challenges for private sector investments in the development of renewable energy in Zambia. For instance, established organisations may be struggling with enduring systemic bottlenecks such as inconsistent policies or limited access to affordable financing. On the other hand, the newly established private sector companies may have to contend with entry-level challenges, such as getting through thick bureaucracy. The distribution of operational years indicates that the implementation of strategies to address the concerns of the private sector in relation to the development of renewable energy projects should therefore be responsive to both mature and new organizations, which would result in an enabling environment for the entire sector. The distribution of the years of operation has been described in figure 5.

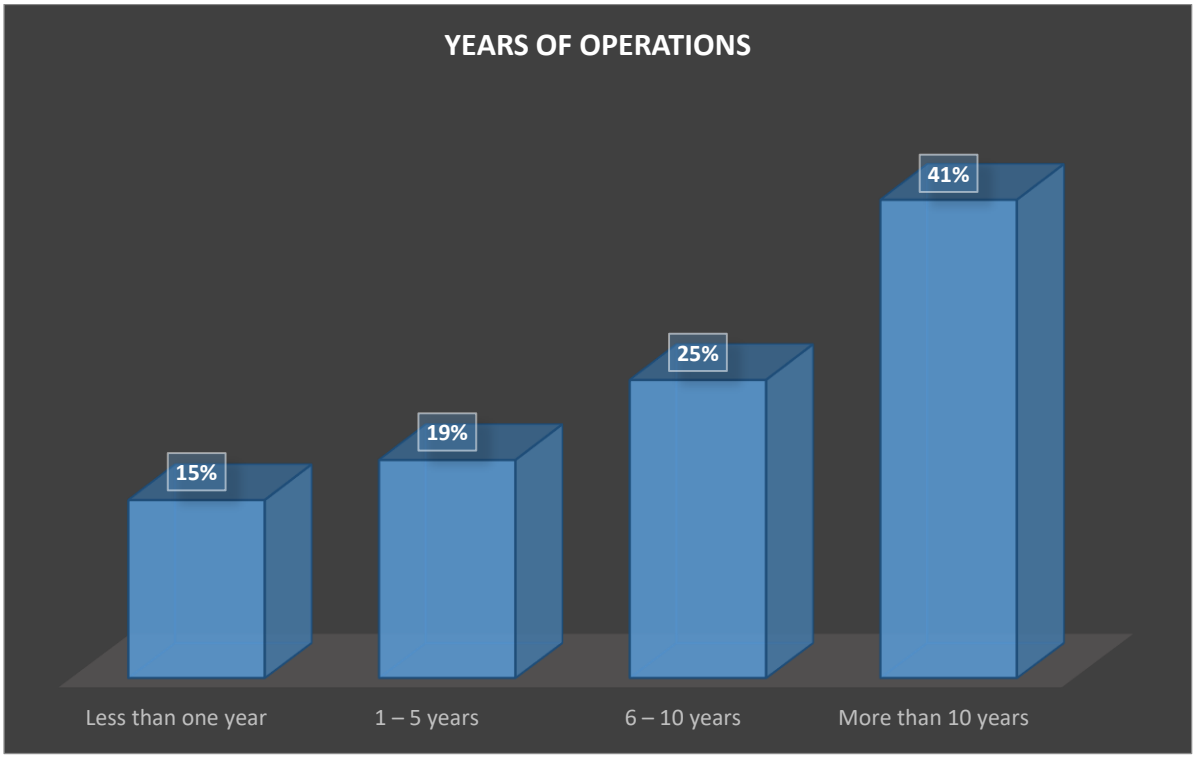

Figure 5: Years of Operations (Author)

5.2.4 Size of Organization

The results indicate that the largest number of respondents were from organizations with 200 or more employees. Individuals from such organizations accounted for 56% of the respondents. Considering that the larger number of respondents were from private sector firms, the results indicate that, larger private sector firms are more likely to get into the renewable energy sector due to strong financial muscles, technical knowledge and easy of navigating regulatory and operational obstacles. Medium-sized firms account for 27%,

which is a significant contribution, indicating a reasonable presence in the sector. The relatively small organization participation of only 17%, shows that significant barriers exist for smaller organisations, which may include poor access to funding, lack of technical capacity and challenges in navigating the legal and regulatory framework. The findings on the size of organizations offer quite an interesting perspective on the presence of large sized organizations in the renewable energy sector, thus limiting diversity and innovation from the smaller sized organizations.

The gap in the representation of the organisations, means that specific interventions like targeted financial interventions, instituting capacity-building programs and reviewing the legal and regulatory provisions need to be designed to ensure that SMEs play a holistic role in the development of renewable energy projects in Zambia. The distribution of the size of organisations is described in Figure 6.

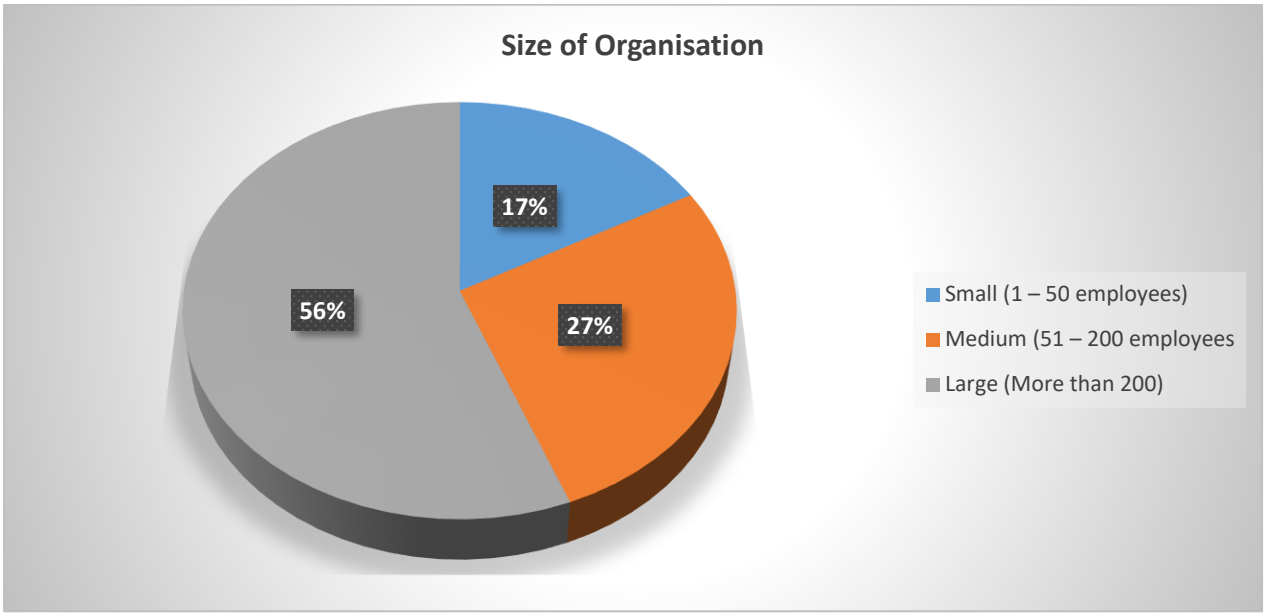

Figure 6: Size of organizations (Author)

5.3 Results based on Research objectives

The first research objective of this reserach was to identify and categorize the factors that constrain private sector development of renewable energy projects in Zambia. The factors were categories in thematic areas and respondents were asked to what extent each factor constrained their participation. The following were the results based on the questionnaire administered.

Regulatory and Legislative Challenges

The respondents were asked to what extent the following regulatory and legislative factors constrain the private sector in the development of renewable energy projects.

Given a scale of 1-5 (where 1=not at all; 2=to a small extent; 3=to a moderate extent; 4=to a large extent; 5=to a very large extent). The results are shown in the table 5.2.

Table 5.2. Results of regulatory and legislative challenges analysis

Regulatory and Legislative Challenges		N	Mean	Std. Deviation	Skewness	Kurtosis
1	Inconsistent regulatory policies	59	4.56	.610	.686	-.454
2	Lengthy approval processes	59	4.34	.667	.771	-.497
3	High regulatory fees	59	4.50	.602	.520	.613
4	unclear regulations and guidelines	59	4.68	.578	.651	1.044
5	Lack of supportive policies for renewable energy development	59	4.49	.576	.683	1.341

Source: Author

The research findings revealed that there are constraints from regulations and laws towards active involvement of the private sector in the development of renewable energy projects in Zambia. It is further confirmed by the highest mean score of 4.68 pertaining to the statement "unclear regulations and guidelines," as it depicts critical effect of such regulatory frameworks being ambiguous on the part of private sector investment in renewable energy projects. This is further strengthened with the low standard deviation (0.578), implying the strength of consensus among respondents about the challenge severity. Similarly, "inconsistent regulatory policies" (mean = 4.56) and "high regulatory fees" (mean = 4.50) highlight the nature of the existing regulatory environment in discouraging private sector participation due to uncertainties and high costs. Both skewness and kurtosis values for these variables denotes responses have a normally distributed sample, although with some skew in perceptions probably because of some peculiarity in experiences among stakeholders in the study. As such, the study findings relate well to the subject matter because it evidenced the unclear and unaided regulatory and legislative mechanisms that stand out as barriers for private sector players in the development of renewable energy projects in Zambia.

Lengthy approval processes (mean = 4.34) and lack of supportive policy (mean = 4.49) combine to produce obstacles to successful project realization within the required timelines, which undermine investor confidence in the development of renewable energy projects.

Technical Challenges

The respondents were asked to what extent the following technical factors constrain the private sector in the development of renewable energy projects. Given a scale of 1-5 (where 1=not at all; 2=to a small extent; 3=to a moderate extent; 4=to a large extent; 5=to a very large extent). The results are shown in the table 5.4.

Table 5.4. Results on the technical challenges

Technical Challenges		N	Mean	Std. Deviation	Skewness	Kurtosis
1	Lack of technical expertise	59	4.81	.630	.605	-.922
2	Inadequate infrastructure	59	4.53	.568	.527	-1.004
3	Technological challenges	59	4.74	.563	.531	-1.113
4	Insufficient training and capacity building	59	4.57	.614	-.472	-1.205

Source: Author

Technical challenges have been found to be among the constraints on the private sector's contribution to the development of renewable energy projects in Zambia. Among the identified factors, a clear lack of technical expertise is found to be rated the highest with a mean score of 4.81 (SD = 0.630), which underlines the critical influence of this variable. Such a finding indicates a general shortage of specialized skills, which are necessary for designing, implementing and operating renewable energy systems. Technological challenges also scored on the higher side with a mean of 4.74 (SD = 0.563), highlighting difficulties in accessing, deploying, or adapting advanced technologies to local contexts. The condition of inadequate infrastructure (mean = 4.53, SD = 0.568) and insufficient training and capacity building had mean scores standing at 4.57 (SD = 0.614) indicating the systemic barriers that block the private sector from operating efficiently. Negative kurtosis value for all the factors indicates that an overall flat distribution and reflects that most respondents agreed on the severity of the challenges.

The results are very much closer to the topic as it points to the fact that technical constraints really limit participation of the private sector in renewable energy projects. Lack of expertise and technological challenges could stifle innovation-financing project outcomes. Further inadequate infrastructure and insufficient training may exacerbate the problem even more.

Social and Environmental Challenges

The respondents were asked to what extent the following Social and Environmental factors constrain the private sector in the development of renewable energy projects. Given a scale of 1-5 (where 1=not at all; 2=to a small extent; 3=to a moderate extent; 4=to a large extent; 5=to a very large extent). The results are shown in the table 5.6.

Table 5.6. Results of the social and environmental challenges analysis

Social and Environmental Challenges		N	Mean	Std. Deviation	Skewness	Kurtosis
1	Environmental impact concerns	59	4.79	.739	.306	.548
2	Social acceptance of renewable energy	59	4.68	.696	.987	.636
3	Lack of public awareness about renewable energy	59	4.73	.659	.961	.599
4	Challenges in stakeholder engagement	59	4.75	.755	.636	.732

Source: Author

The results imply that social and environmental factors greatly constrain private sector participation in renewable energy projects development in Zambia. Among the factors surveyed, issues to do with environmental impact were found to score the highest mean (4.79) followed by difficulties in engaging stakeholders (4.75), unawareness of the public about renewable energy (4.73) and social acceptability of renewable energy (4.68). All these ranked above 4, thus indicating that the respondents think of these issues as major hurdles to a great extent. Unduly low standard deviations in all the variables point to a consensus among respondents. Positive but almost zero skewness values mean a bias toward higher ratings, which again strengthens the consensus of having importance related to those obstacles. Most kurtosis values are towards normal distribution levels, indicating a general agreement-no extreme responses.

The results review that Social and Environmental Challenges is one key category for identifying factors that constrain private sector involvement in the development of renewable energy projects in Zambia.

5.3.1 Financial Challenges

The second objective of this study was to analyse the challenges in financing renewable energy projects in Zambia. Respondents were asked to what extent the following financial factors constrain the private sector in the development of renewable energy projects. Given a scale of 1-5 (where 1=not at all; 2=to a small extent; 3=to a moderate extent; 4=to a large extent; 5=to a very large extent). The results are shown in the table 5.3.

Table 5.3. Results of the financial challenges analysis

Financial Challenges		N	Mean	Std. Deviation	Skewness	Kurtosis
1	Limited access to finance	59	4.66	.577	.463	-.691
2	High interest rates on loans	59	4.73	.616	.767	-.491
3	Inadequate financial incentives (e.g. subsidies)	59	4.59	.586	.585	-.647
4	High upfront capital costs	59	4.64	.704	.727	-.430
5	Difficulty in securing long-term investments	59	4.53	.578	.647	-.563

Source: Author

From the results it has been revealed that certain financial challenges constrain the participation of the private sector in the development of renewable energy projects in Zambia. All the five financial factors returned mean values above 4.5 on a scale of 1 to 5, which indicates a very heavy hindrance regarding the challenge as per the respondents. High interest rates on loans (mean= 4.73), stands as the most significant barrier for the private sector institutions venturing into renewable energy projects, followed by high upfront capital costs (mean = 4.64) with limited access to finance (mean = 4.66), talking of constraints of mobilizing finances for setting up the projects. The relatively low standard deviations across factors suggest consensus among respondents about the severity of these barriers to finance. Skewness and kurtosis values indicate normal distribution of responses with slight deviations.

These findings further suggest that the financial challenges are a significant barrier to private sector involvement in the development of renewable energy projects in Zambia. High costs, very little access to affordable finance and some other inducements, such as lack of subsidies, are great barriers for private sector involvement in the development of

renewable energy projects. Such barriers do not only block investment but also considerably slow down progress in attaining Zambia's renewable energy targets.

5.3.2 Institutional Challenges

The Third objective of this paper was to assess how the challenges in the existing institutional, policy and regulatory frameworks constrain the private sector involvement in the development of renewable energy projects in Zambia. Considering that the Regulatory framework factors have already been captured in the results of the first objective, this section will focus on the results of the assessment on institutional challenges.

The respondents were asked to what extent the following institutional factors constrain the private sector in the development of renewable energy projects. Given a scale of 1-5 (where 1=not at all; 2=to a small extent; 3=to a moderate extent; 4=to a large extent; 5=to a very large extent). The results are shown in the table 5.5.

Table 5.5. Results for the institutional challenges.

Institutional Challenges		N	Mean	Std. Deviation	Skewness	Kurtosis
1	Political stability	59	4.59	.702	-.043	-.032
2	Corruption	59	4.67	.675	.274	.736
3	Bureaucratic inefficiency	59	4.65	.714	.484	.376
4	Inadequate institutional support	59	3.58	.716	.681	.810
5	Poor governance structures	59	4.66	.813	.479	.852

Source: Author

The results bring out enormous institutional constraints to private sector involvement in the development of renewable energy projects in Zambia. All the mean scores are above 4.5 for political stability, corruption, bureaucratic inefficiency and bad governance structures, which indicates that the factors are viewed as constraints in a larger or very large extent by the respondents. The standard deviations of between 0.675 and 0.813 indicate that the responses on the individual items were relatively low concerning their variability and give the impression that respondents strongly agree on these issues. Skewness and kurtosis being close to zero indicate that the response distribution is normal for most variables and thereby

demonstrate consistent perceptions across the sample. Most noteworthy about this was that "corruption" received a mean score which was the highest among all the variables (4.67), which shows just how critical this issue is with regards to private sector participation in renewable energy projects development.

The findings relate to the topic that they have revealed how institutional issues hinder the process of attracting private sector investment in renewable energy projects investments. Political instability and corruption create an unpredictable environment that deters investors, because of the increased risk they would be taking should they invest. Bureaucratic inefficiency and poor governance structures cause further delays and increase costs, hence creating disincentives for private sector involvement. The relatively lesser mean score of 3.58 for inadequate institutional support indicates it is an issue which is less critical but still an important one.

5.4 The Regression Analysis

Regression analysis is intended to ascertain the most influential coefficients among the independent variables for the prediction of a dependent variable (Kotler, 2018). It aims to minimize the sum of squares deviation between the actual and predicted values of the dependent variable by making use of independent variables associated with dependent variables. Thus, it enables forecasting the dependent variables from independent variables through estimation of these coefficients. It also provides information on the strength, direction and statistical significance of the dependence of independent variables on the dependent variable.

Table 5.7. ANOVA table

	Sum of Squares	Df	Mean Square	F-statistic	p-value
Model	41.729	5	41.729	81.072	.001
Residual	37.153	54	.563		

a. Dependent variable: Development of Renewable Energy Projects in Zambia
b. Independent variables: Regulatory and Legislative, Financial, Technical, Institutional and Social and Environmental Challenges

The ANOVA table reveals the challenges that hinder the private sector from getting involved in renewable energy projects development in Zambia. Such independent variables include regulatory and legislative, financial, technical, institutional, as well as socio-economic and environmental challenges, whose joint summated effects, expressed as a sum

of squares (41.729) for the model, explain variability in the development of renewable energy projects. The mean square value (41.729) and the F-statistic (81.072) with a p-value of 0.001 indicate that the model is statistically significant at the 0.05 level. This implies that these independent variables inherently have a very considerable effect and statistically claim significance as far as renewable energy project development is concerned. In simple terms, sum of squares left residual (37.153) and its associated mean square (0.563) refer to the unexplained variations on the dependent variable. A relatively low residual mean square illustrates good fit of the model; independent variables account for much of the variation in developing renewable energy projects.

Table 5.8: Coefficients

Model	**Unstandardized Coefficients**		**Standardized Coefficients**		
	B	Std. Error	Beta	T	Sig.
1					
(Constant)	.476	.300		1.259	.000
Regulatory and Legislative Challenges	.606	.018	.511	7.753	.024
Financial Challenges	.418	.027	.502	6.728	.001
Technical Challenges	.527	.039	.503	5.014	.003
Institutional Challenges	.301	.041	.510	6.690	.000
Social and Environmental Challenges	.551	.019	.600	7.463	.002

a. Dependent variable: Development of Renewable Energy Projects in Zambia
b. Independent variables: Regulatory and Legislative, Financial, Technical, Institutional and Social and Environmental Challenges

The regression analysis results show that all five independent variables: regulatory and legislative, financial, technical, institutional, social and environment-related challenges, are statistically significant predictors of renewable energy project development. The highest standardized effect attributed to the commonly cited challenges therefore goes to social and environment-related concern issues: $\beta=0.600$, $p=0.002$, since it is generally indicative of

the importance attached to environmental regulations, community acceptance and social impacts related to project development. Regulatory and legislative deficiencies espoused through β=0.511, p=0.024 and financial challenges with β=0.502, p=0.001, were also found to correlate significantly with the development. This suggests the need for clear policy messages, effective regulations and access to financial resources for projects development. Technical challenges (β=0.503, p=0.003) and institutional challenges, β=0.510, p=0.000, revealed comparatively less effects but still reflected impactful stress relative to technical expertise, capacity building and institutional support. All these findings suggest that there is a need for a holistic approach to the challenges for promoting private sector investment in the development of renewable energy projects.

Table 5.9: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.758[a]	.561	.515	.663

a. Dependent variable: Development of Renewable Energy Projects in Zambia

b. Independent variables: Regulatory and Legislative, Financial, Technical, Institutional and Social and Environmental Challenges

According to the entire summary of the model, there is a very solid positive correlation among the independent variables (Regulatory and Legislative Challenges, Financial Difficulties, Technical Problems, Institutional Weaknesses, and Social and Environmental Challenges) with the dependent variable (Development of Renewable Energy Projects in Zambia). This is evident in the value of R which is 0.758. Further, the R Square value in this regard is 0.561 which indicates that about 56.1% of the variance in the development of renewable energy projects has an explanation of these challenges while the adjusted R square value decreases marginally to 0.515 after adjusting for the number of predictors such that any over fitting due to the model has therefore been avoided. The standard error which has 0.663 indicates the average distance from the regression line by which the observed values fall and therefore indicates the precision of the model in predicting the outcome.

5.5 Reliability Analysis

In order to assess the reliability of the survey instrument used for the study, Cronbach's alpha coefficients were calculated for each of the variables. Sekaran (2010), defines or categorises alpha coefficient variables as shown in Table 5.10 which depicts the range of alpha coefficient values as well as their meaning.

Table 5.10: The Alpha Coefficient Values

Alpha Coefficient value	Explanation
α less than 0.6	Poor
$0.6 \leq \alpha < 0.7$	Questionable
$0.7 \leq \alpha < 0.8$	Acceptable
$0.8 \leq \alpha < 0.9$	Good
0.9 and above	Excellent

Source: Sekaran, 2010

Table 5.11 presents the results of the Cronbach alpha analysis undertaken for the study to assess the reliability of the survey questionnaire.

Table 5.11: Cronbach's Alpha

Item	Correlation with Total	Alpha if Dropped
Regulatory	0.71	0.08
Financial	0.78	0.19
Technical	0.74	0.11
Institutional	0.75	0.09
Social Environmental	0.77	-0.07

Source: Author

The Cronbach's Alpha table proves very valuable for measuring the reliability of the scale that assesses the challenges of private sector involvement in the development of renewable energy projects in Zambia. The correlation with the total column signifies the strength of the relationship between each challenge and the overall scale. High correlations (between 0.71 and 0.78) imply that each item (Regulatory, Financial, Technical, Institutional, and Social Environmental challenges) does definitely fit into the general construct and indicates they are significant components of challenges faced. The "Alpha if Dropped" values show how reliable the scale is, supposing some item is taken out. The negative alpha value that ensues from dropping the "Social Environmental" challenge indicates the essential contribution it has to the overall reliability of the construct. Therefore, the study findings reveal that all challenges noted above are necessary components required for understanding private-sector hindrances in renewable energy development in Zambia, while financial and social-environmental challenges, based on their strong alignment and critical contributions to the reliability, are perhaps the most powerful.

CHAPTER SIX

DISCUSSION OF FINDINGS

6.0 Introduction

This chapter presents a discussion of the results of this study. The chapter further presents the results presented in chapter 4 and discusses the meaning and importance of the results to the body of knowledge on factors that constrain private sector participation in development of renewable energy projects in Zambia.

6.1 Recap of the Study Objectives and Findings

The research was aimed at assessing the challenges of private sector involvement in the development of renewable energy projects in Zambia. The study identified and assessed the factors that constrain the private sector in the development of renewable energy projects in Zambia, based on a quantitative survey on purposively sampled experts from the private sector, non-governmental organizations and government institutions. The specific objectives of the study are:

i. To identify and categorise the factors that constrain private sector development of renewable energy projects in Zambia.
ii. To analyse the challenges in financing renewable energy projects in Zambia.
iii. To assess how the challenges in the existing institutional, policy and regulatory frameworks constrain the private sector involvement in the development of renewable energy projects in Zambia.

The study identified and assessed the factors that constrain the private sector in the development of renewable energy projects in Zambia, based on a quantitative survey on purposively sampled experts from the private sector, non-governmental organizations and government institutions.

The study identified twenty-three (23) factors which were categorized as follows:

i. **Regulatory and legislative challenges.** The factors were as follows: inconsistent regulatory policies, lengthy approval processes, high regulatory fees, unclear regulations and guidelines, and lack of supportive policies for renewable energy development;

ii. **Financial challenges.** The factors were as follows, limited access to finance, high interest rates on loans, inadequate financial incentives, high upfront capital costs, and difficulty in securing long-term financing.

iii. **Technical challenges**. The factors were as follows, lack of technical expertise, inadequate infrastructure, technological challenges, and insufficient training and capacity building.

iv. **Institutional challenges**. The factors were as follows, political stability, Corruption, bureaucratic inefficiency, poor governance structures, and Inadequate institutional support.

v. **Social and environmental challenges**. The factors were as follows, environmental impact concerns, social acceptance of renewable energy, lack of public awareness about renewable energy, and challenges in stakeholder engagement.

6.2 Regulatory and Legislative Challenges

The study's findings on regulatory and legislative challenges align closely with the literature. Othman and Khallaf (2022) identified political and regulatory barriers as significant risks in renewable energy projects delivered through public-private partnerships (PPPs). Similarly, Hope et al. (2024) emphasized the importance of political stability and regulatory quality in achieving renewable energy targets. The similarity in findings can be attributed to the universal nature of regulatory challenges in the renewable energy sector. Inconsistent regulatory policies and unclear regulations create uncertainty, deterring private sector investment. This is particularly relevant in Zambia, where the lack of sensitization and public awareness campaigns exacerbates the ambiguity in existing regulations.

The literature also highlights the need for well-prepared contract documentation and skilled parties as key success factors (Othman & Khallaf, 2022). This aligns with the study's finding that unclear regulations and guidelines are major hindrances. The emphasis on clear and supportive regulatory frameworks is a common theme across different regions, indicating that regulatory clarity is crucial for private sector participation in renewable energy projects.

Baker and Sovacool (2017) examined the political economy of technological capabilities and global production networks in South Africa's wind and solar photovoltaic (PV) industries. They found that regulatory frameworks play a crucial role in shaping the development of renewable energy technologies. The tensions between commercial

priorities and requirements for economic development, including local content, highlight the importance of clear and supportive regulatory frameworks

This aligns with the study's finding that unclear regulations and guidelines are major hindrances.

6.3 Financial Challenges

Financial challenges are a significant barrier to private sector involvement in renewable energy projects, as highlighted by both the study and the literature. Beschloss and Mashayekhi (2019) identified high initial costs, limited access to concessional finance, and high perceived risks as major challenges. Similarly, Camelo (2024) emphasized the importance of innovative financing mechanisms, such as green bonds and blended finance, to attract private sector investment.

The study's findings on high interest rates on loans and limited access to financing are consistent with the literature. High interest rates can be linked to Zambia's current debt burden, making it a high-risk investment destination. This is similar to the challenges faced in other regions, where high financing costs and fiscal constraints impede the development of renewable energy projects. The literature also highlights the importance of stable and predictable policy frameworks to support green bond markets (Beschloss & Mashayekhi, 2019), which aligns with the study's emphasis on the need for better financial mechanisms. Kabamba (2020) discussed the challenges and opportunities in financing renewable energy projects in Zambia, highlighting the importance of concessional finance and the role of international financial institutions in mitigating investment risks. This aligns with the study's findings on the need for better financial mechanisms to attract private sector investment.

6.4 Technical Challenges

The lack of technical expertise and technological challenges are major constraints identified in the study, which aligns with the literature. Khallaf (2022) highlighted the importance of skilled parties for the success of renewable energy projects. Similarly, Hope et al. (2024) identified the failure of independent power producers (IPPs) to understand the local context as a constraint, suggesting international investment in grid infrastructure and capacity building as solutions.

The study's findings on the lack of expertise can be attributed to the limited number of renewable energy projects in Zambia, resulting in a shortage of personnel with relevant skills and knowledge. This is consistent with the literature, which emphasizes the need for

capacity building and the development of local industries to provide necessary equipment and expertise. The technological challenges identified in the study, such as the lack of local industries providing equipment, are also reflected in the literature, highlighting the global need for technological advancements to support renewable energy projects.

Mphande and Chama (2019) discussed the importance of enhancing technical capacity for renewable energy development in Zambia, emphasizing the need for training programs and international collaboration to build local expertise. This aligns with the study's findings on the need for capacity building.

6.5 Institutional Challenges

Institutional challenges, such as corruption, poor governance structures, and bureaucratic inefficiencies, are significant barriers identified in the study. This aligns with the literature, which emphasizes the importance of strong institutions and clear governance structures. Jordana et al. (2024) identified decision-making gridlocks, organizational inefficiencies, and regulatory challenges as significant barriers to global governance. Similarly, IRENA (2022) highlighted inconsistent policies, complex regulations, and weak institutions as significant barriers to renewable energy projects in Zambia.

The study's findings on corruption and bureaucratic inefficiencies are consistent with the literature, which highlights the impact of poor governance structures on the effectiveness of institutional processes. The literature also emphasizes the need for clear and consistent regulatory frameworks to support the deployment of renewable energy projects (IRENA, 2022). This aligns with the study's finding that unclear governance structures can lead to corruption and hinder private sector involvement.

6.6 Social and Environmental Challenges

The study identified environmental impact concerns and challenges in stakeholder engagement as major constraints to private sector involvement in renewable energy projects. This is consistent with the literature, which highlights the importance of social acceptance and environmental sustainability. Hope et al. (2024) identified resistance from local communities and the failure of IPPs to understand the local context as significant barriers. Similarly, IRENA (2022) emphasized the importance of effective social acceptance efforts and community engagement.

The study's findings on environmental impact concerns can be attributed to the lengthy and costly process of undertaking environmental impact assessments. This is similar to the challenges faced in other regions, where environmental assessments are necessary to ensure

the sustainability of renewable energy projects. The literature also highlights the need for stakeholder engagement to ensure the acceptance of renewable energy projects (Hope et al., 2024), which aligns with the study's emphasis on the challenges in accessing key stakeholders.

Gayen et al. (2013) reviewed the environmental impacts of renewable energy for sustainable development, emphasizing the importance of mitigating environmental harm and fostering long-term sustainability. This aligns with the study's findings on the need for effective environmental assessments.

6.7 Broader Implications

Overall, the study's results contribute to the broader body of knowledge by providing a comprehensive understanding of the multifaceted barriers to private sector participation in renewable energy development. The alignment with global literature indicates that the challenges faced in Zambia are part of a broader pattern of barriers to renewable energy development. This suggests that solutions implemented in other regions could be adapted to the Zambian context, providing valuable insights for policymakers and stakeholders seeking to enhance private sector involvement in renewable energy projects.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATIONS

7.0 Introduction

This chapter provides a presentation of the conclusion and recommendations of the study based on the findings discussed in the preceding chapter.

7.1 Conclusion

The research assessed the challenges of private sector involvement in the development of renewable energy projects in Zambia. Based on the study findings and analysis, and in line with the objectives of the study, the following conclusions have been drawn:

7.1.1 Categories of Factors Constraining Private Sector Development of Renewable Energy Projects in Zambia

The study identified twenty-three factors that constrain private sector development of renewable energy projects in Zambia. These factors have been categorized into five main groups:

Regulatory and Legislative Challenges: These include inconsistent regulatory policies, lengthy approval processes, high regulatory fees, unclear regulations and guidelines, and lack of supportive policies for renewable energy development.

Financial Challenges: These encompass limited access to finance, high interest rates on loans, inadequate financial incentives, high upfront capital costs, and difficulty in securing long-term financing.

Technical Challenges: These involve lack of technical expertise, inadequate infrastructure, technological challenges, and insufficient training and capacity building.

Institutional Challenges: These include political stability, corruption, bureaucratic inefficiency, poor governance structures, and inadequate institutional support.Social and Environmental Challenges: These encompass environmental impact concerns, social acceptance of renewable energy, lack of public awareness about renewable energy, and challenges in stakeholder engagement.

7.1.2 Challenges in Financing Renewable Energy Projects in Zambia

The major challenges to financing renewable energy projects in Zambia have been identified as high interest rates on loans and limited access to financing sources. Additionally, the study revealed high upfront capital costs, inadequate financial incentives, and difficulty in securing

long-term financing as significant barriers. These financial constraints hinder the ability of the private sector to invest in renewable energy projects, thereby limiting the growth and development of the sector.

7.1.3 Technical, Social, and Environmental Challenges Constraining Private Sector Involvement in the Development of Renewable Energy Projects in Zambia

Technical challenges that constrain the private sector in the development of renewable energy projects include the lack of expertise in the field of renewable energy, inadequate infrastructure to support the development of renewable energy projects, and insufficient training and capacity building in the renewable energy field. Social and environmental challenges have been indicated to constrain the private sector through environmental impact concerns and challenges in stakeholder engagements. These challenges highlight the need for capacity building, infrastructure development, and effective stakeholder engagement to support the growth of renewable energy projects.

7.1.4 Challenges in the Existing Institutional, Policy, and Regulatory Frameworks Constraining the Private Sector in the Development of Renewable Energy Projects in Zambia

The existing institutional, policy, and regulatory framework challenges that are constraining the private sector in the development of renewable energy have been identified as corruption, poor governance structures, bureaucratic inefficiencies, unclear regulations and guidelines, and inconsistent regulatory policies. These challenges play a major role in hindering private sector investment. Effective frameworks in the renewable energy sector are essential to foster private sector investment and promote the development of renewable energy projects.

7.1.5 Importance of the Study and Its Contribution to the Body of Knowledge

This study is significant as it provides a comprehensive analysis of the factors constraining private sector participation in the development of renewable energy projects in Zambia. By categorizing these factors into regulatory and legislative, financial, technical, institutional, and social and environmental challenges, the study offers a structured understanding of the barriers faced by the private sector.

Further, the study provides a valuable body of knowledge for future researchers, policymakers, and stakeholders seeking to enhance private sector participation in the development of renewable energy projects in Zambia.

7.2 Recommendations

Based on the above discussions and conclusions, the following measures have been recommended:

Regulatory and Legislative Measures: The Ministry of Energy (MOE) needs to undertake sensitization and public awareness campaigns on existing and new regulations, legislation, and policies in the renewable energy sector to mitigate regulatory and legislative challenges. Additionally, the MOE should implement new regulations that promote private sector development of renewable energy projects in Zambia.

Financial Measures: The MOE, in collaboration with the Ministry of Finance and National Planning and the Ministry of Lands, should develop mechanisms to minimize the cost of developing renewable energy projects, such as tax breaks, providing land, and conducting feasibility studies to improve financing for renewable energy projects in Zambia.

Technical Measures: The MOE, working with the Ministry of Education, should encourage training institutions to introduce training programs in renewable energy development to mitigate technical challenges. The MOE can also lobby cooperating partners to provide training to the private sector in renewable energy project development.

Institutional Measures: The government should establish adequate and effective governance structures and strengthen the fight against corruption in government institutions to eliminate institutional challenges.

Social and Environmental Measures: The MOE, in collaboration with the Zambia Environmental Management Agency (ZEMA), should conduct a Sustainable Environmental Assessment (SEA) for the renewable energy sector and establish streamlined processes for undertaking environmental assessments for renewable energy project development to mitigate social and environmental challenges.

7.3 Chapter Summary

This chapter has discussed the findings on the major factors that constrain private sector involvement in the development of renewable energy projects in Zambia. From the discussions, the chapter has drawn recommendations aimed at mitigating the challenges of private sector involvement in the development of renewable energy projects in Zambia. It is envisaged that this study will provide a valuable body of knowledge for future researchers on the subject matter.

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APPENDICES

Appendix 1: Introductory Letter from University of Lusaka

UNIVERSITY *of* LUSAKA
Passion for Quality Education: Our Driving Force

Plot No. 37413, Off Alick Nkhata Mass Media, P.O. Box 36711, Lusaka, Zambia.
Phone: **+260211258505 / +26021126994** | Email: **info@unilus.ac.zm** | Website: **www.unilus.ac.zm**

All correspondence should be addressed to the Vice Chancellor

Friday, November 15, 2024.

To whom it may concern,

Dear Sir/Madam,

RE: DATA COLLECTION-MISHECK MUBITA MUBUYAETA

This serves to confirm that **Mr. Misheck Mubita Mubuyaeta** student number **MSCPM23119185** is a registered student of the University of Lusaka pursuing a **Master of Science in Project Management** two Year Master's program currently in his **4th year 2nd semester** of study.

The student is seeking data to enable him write a mandatory dissertation for the award of his degree. Kindly assist with the data he needs in line with his research title to enable him finish in time for submission. A copy of the full dissertation can be availed to you at your request.

Any assistance rendered to him will be highly appreciated.
Yours faithfully,

Mwamba Chanda (Mr.)

DEPUTY REGISTRAR

UNIVERSITY OF LUSAKA
REGISTRAR POSTGRADUATE
15 NOV 2024
P.O. BOX 36711,
LUSAKA.

Appendix 2: Sample Questionnaire

Data collection tool

SCHOOL OF POSTGRADUATE STUDIES

Dear respondent,

My name is **Misheck M. Mubuyaeta**, a final year student at UNILUS pursuing a Master of Science of Project Management Degree. As a requirement for the award of the degree, the school mandates that students carryout a study in relation to their programs of study and as such, I am conducting a study entitled: A***ssessment of Challenges of Private Sector Involvement in the Development of Renewable Energy Projects in Zambia***.

Kindly assist to answer this study questionnaire to the best of your knowledge and be rest assured that all the information given to me will be used for academic purposes only.

For more information or clarifications, you can reach out to me on the following details.

Phone: +260979002299
Email: mishmmubuyaeta@gmail.com

SECTION A: DEMOGRAPHIC INFORMATION

1. What is your gender ……..

Male [ ]
Female [ ]

2. Name of Organization ……..

3. Position in Organization ……

4. Type of Organization

   Private Company [ ]
   Government [ ]
   Non-Governmental Organisation [ ]

5. Years of Operation:

   Less than one year [ ]
   1 – 5 years [ ]
   6 – 10 years [ ]
   More than 10 years [ ]

6. Size of Organisation:

   Small (1 – 50 employees) [ ]
   Medium (51 – 200 employees) [ ]
   Large (More than 200) [ ]

SECTION B: Regulatory and Legislative Challenges

7. To what extent do the following regulatory and legislative factors constrain the private sector in the development of renewable energy projects? Given a scale of 1-5 (where

1=not at all; 2=To a small extent; 3=To a moderate extent; 4=To a large extent; 5=to a very large extent)

Factor Scale	1	2	3	4	5
Inconsistent regulatory policies					
Lengthy approval processes					
High regulatory fees					
Unclear regulations and guidelines					
Lack of supportive policies for renewable energy development					

SECTION C: Financial Challenges

8. To what extent do the financial factors constrain the private sector in the development of renewable energy projects? Given a scale of 1-5 (where 1=not at all; 2=To a small extent; 3=To a moderate extent; 4=To a large extent; 5=to a very large extent)

Factor Scale	1	2	3	4	5
Limited access to finance					
High interest rates on loans					
Inadequate financial incentives (e.g. subsidies)					
High upfront capital costs					
Difficulty in securing long-term investments					

SECTION D: Technical Challenges

9. To what extent do the following technical factors constrain the private sector in the development of renewable energy projects? Given a scale of 1-5 (where 1=not at all;

2=To a small extent; 3=To a moderate extent; 4=To a large extent; 5=to a very large extent)

Factor Scale	1	2	3	4	5
Lack of technical expertise					
Inadequate infrastructure					
Technological challenges					
Insufficient training and capacity building					

SECTION E: Institutional Challenges

10. To what extent do the following institutional factors constrain the private sector in the development of renewable energy projects? Given a scale of 1-5 (where 1=not at all; 2=To a small extent; 3=To a moderate extent; 4=To a large extent; 5=to a very large extent)

Factor Scale	1	2	3	4	5
Political stability					
Corruption					
Bureaucratic inefficiency					
Poor governance structures					
Inadequate institutional support					

SECTION F: Social and Environmental Challenges

11. To what extent do the following social and environmental factors constrain the private sector in the development of renewable energy projects? Given a scale of 1-5 (where 1=not at all; 2=To a small extent; 3=To a moderate extent; 4=To a large extent; 5=to a very large extent)

Factor Scale	1	2	3	4	5

Environmental impact concerns					
Social acceptance of renewable energy					
Lack of public awareness about renewable energy					
Challenges in stakeholder engagement					

SECTION H: Additional Comment

12. Provide any additional comments or suggestions regarding the challenges and potential solutions for enhancing private sector involvement in the development of renewable energy projects?

    ……..

THANK YOU FOR YOUR TIME

Link for questionnaire:

https://forms.gle/gmVgBgTNwZG39HGj8

Appendix 3: Letter from Ministry of Energy on Data Collection

All Communications should be addressed to the
Permanent Secretary
Telephone: (260-211) 230840
Facsimile 230468

In reply please quote
MOE/OPPPI/101/10/20
No:.....

REPUBLIC OF ZAMBIA

MINISTRY OF ENERGY

OFFICE OF THE PERMANENT SECRETARY
P.O. BOX 36079
LUSAKA
ZAMBIA

20th November 2024

Mr. Misheck M. Mubuyaeta
Student
University of Lusaka
LUSAKA

REQUEST FOR CONTACT DETAILS OF PRIVATE SECTOR INSTITUTIONS DEVELOPING RENEWABLE ENERGY PROJECTS IN ZAMBIA

Reference is made to your letter dated 19th November 2024 in which you requested for contact details of private sector institutions developing renewable energy power projects in Zambia.

Kindly find attached a list of contact details for the renewable energy power projects developers at different stages of projects development in the country.

For further clarifications you may contact the Manager – Office for Promoting Private Power Investment (OPPPI) via email: clement.chiwele@moe.gov.zm or Tel: 0979 413853.

Dr. Chisangano Francesca Zyambo
Permanent Secretary – Administration
MINISTRY OF ENERGY

Appendix 4: Plagiarism Checker Report